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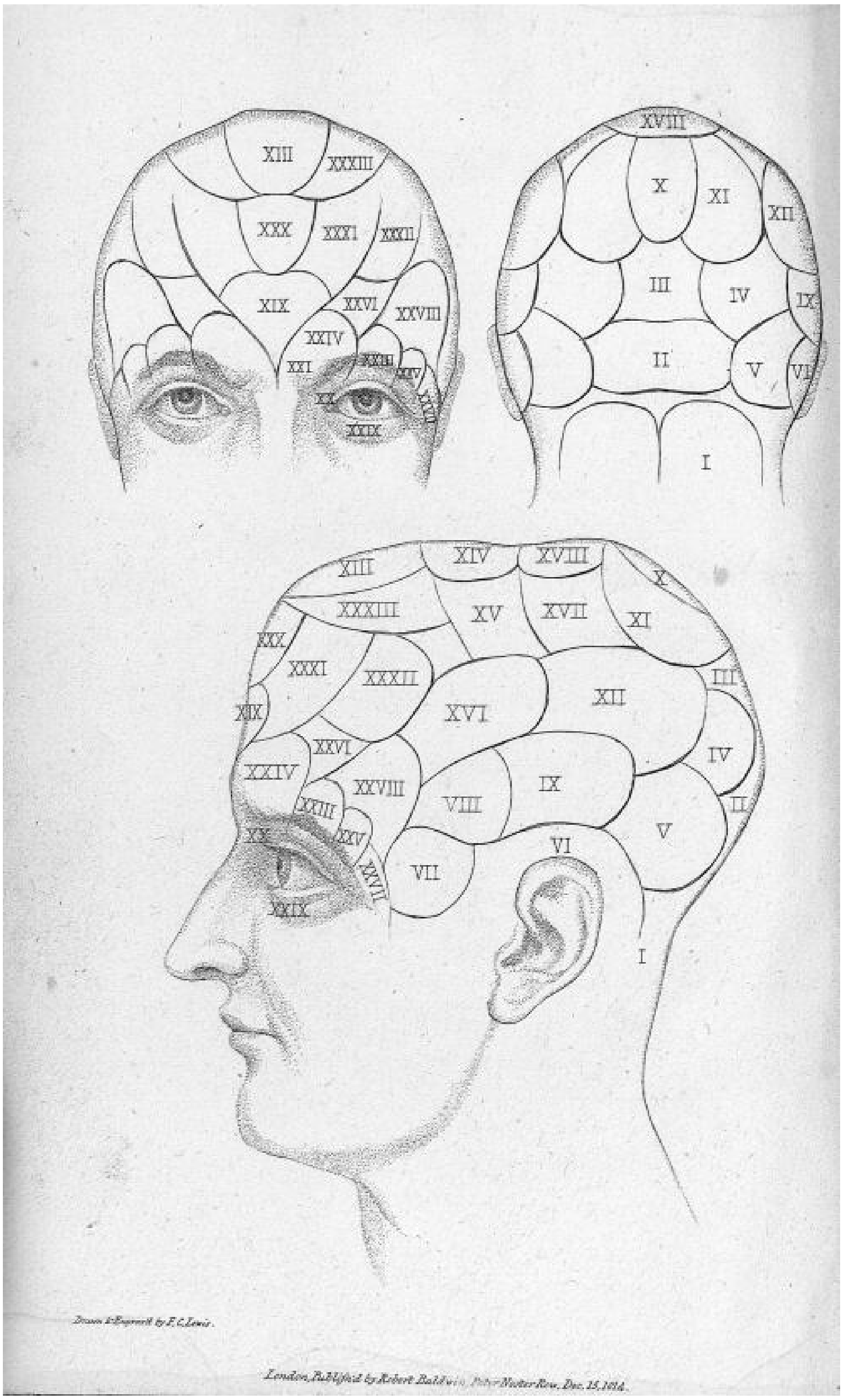

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THE

PHYSIOGNOMICAL SYSTEM

OF

DRS. GALL AND SPURZHEIM;

FOUNDED ON

AN ANATOMICAL AND PHYSIOLOGICAL EXAMINATION

OF THE

NERVOUS SYSTEM IN GENERAL,

AND OF THE

BRAIN IN PARTICULAR;

AND INDICATING THE

DISPOSITIONS AND MANIFESTATIONS OF THE MIND.

BY J. G. SPURZHEIM, M. D.

Being at the same Time a Book of Reference for Dr. Spurzheim's Demonstrative Lectures.

ILLUSTRATED WITH NINETEEN COPPER-PLATES.

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PREFACE

VERY few readers condescend to peruse a preface, especially if it be long. The present therefore shall be very short. I need allude only to two things, the *object* of our inquiries, and the reason why I call them *ours*. Our inquiries may be divided into three kinds; anatomical, physiological, and physiognomical. At first, Dr. Gall's chief intention was to point out the functions of the brain. Now, an exact knowledge of the functions of any organic part requires an examination of its structure; for physiology without anatomy is unfounded, while anatomy without physiology is useless. We therefore never separate anatomy and physiology from each other. Moreover, anatomical and physiological inquiries as to the brain have led us to those of the five external senses, and of the nervous system in general. —The third kind of investigation is the result of the other two. It indicates the possibility of distinguishing, by external signs, the different degrees of perfection in the nervous parts necessary to the manifestations of the special faculties of the mind, and to the activity of these faculties: these investigations are termed physiognomical. Hence, all the functions of man which take place with consciousness, the external signs of these functions, and the structure of their respective organs—undoubtedly the most important part of anthropology—are the object of our investigations.

It is acknowledged that Dr. Gall has the merit of having first begun these inquiries. He had pointed out many relations which exist between various ACTIONS of man and animals, and certain cerebral parts, before I was so happy as to become acquainted with him. As, however, I have been associated in these examinations during many years, and have been especially charged with the prosecution of the anatomical part; as I have not a little contributed, and still continue to extend, to perfect, and to establish the new doctrine, Dr. Gall himself thinks it just to speak of OUR inquiries, and for several years past he has held this language. Hence the Memoir to the national Institute of France, and the Large Work on the Anatomy &c. of the Brain, have been published under our joint names. This book itself will show how much I have improved our doctrine in the last few years, during which nothing else has been pub-

6

lished on the subject. I am now led to think, that the objects which are still to be added to our larger work must assume a more scientific arrangement, and be considered in a more philosophical manner, than Dr. Gall has been accustomed to do in his lectures.

I now confine myself to the publication of outlines of our investigations, in order to give the English reader a correct view of our doctrine, and to enable him to judge of its solidity and importance. The large work, entitled, *Anatomie et Physiologie du Systême Nerveux en général, et du Cerveau en particulier, par Gall et Spurzheim, Paris,* of which the first volume and half of the second have been published, contains many more *anatomical* details elucidated by a greater number of plates than I had the intention of introducing here.

Being aware that neither English philologists nor the English public like to admit new words, I must apologise for my daring to introduce new names. I foresee that the reviewers may blame them. I therefore beg leave to observe, that while I do not wish to dispute respecting words, I shall be obliged for every observation which may improve our knowledge of human nature, or rectify the nomenclature of our philosophical ideas; but that I shall pay no attention to any observation which indicates any other intention than scientific examinations require, or which may originate in individual motives. Let us never forget: *Nihil aliud natura, nihil aliud sapientia dicet.*

Having however formed new names it is my duty to state my reasons for so doing. The English language presents very few single words which express my conceptions of the peculiar faculties of the mind. Hence I was obliged either to speak by circumlocution or to make new names. Now I think with Locke, that, in this respect, we have the same right as our predecessors, and I therefore propose new single names, which I have formed, as much as possible, conformably to the spirit of the language. Having established different propensities as peculiar faculties of the mind, in order to designate propensity I have taken the termination IVE as indicating the quality of producing, and NESS as indicating the abstract state; I have therefore joined IVENESS to different roots, among which I have given the preference to English words generally admitted. When I could not find any such, I chose Latin participles, which, in English, are so common even in expressions which denote a meaning similar to that which I look for, as destructiveness, productiveness &c.

I have further to make a few particular observations. In the nomenclature of the PRO-

PENSITIES, I dislike the name physical love, because this propensity is neither more nor less physical than attachment, or any other inclination common to man and animals; and I could not admit some other expressions in order to denote this propensity, because I want names which indicate the faculty, and not at all any determinate action, whether in its use or its abuse. I have therefore adopted amativeness, like destructiveness.—It was difficult to make a name for the second organ, because there is no single word which indicates the love of offspring. Hence I took two Greek roots. I am aware that the name is long, but I could not say philogenitiveness, because the name ought to indicate love of producing offspring. As however progeny means offspring, and philoprogeny love of offspring, and philoprogenitiveness the faculty of producing love of offspring, I have adopted that term.—Inhabitiveness is composed of the English word inhabit, and the termination iveness.—It is true that adhesiveness is generally used merely in a physical sense, but was not this originally the case with many other words which bear now a mental signification? Attachment indicates only the effect of this faculty, and I require a name to express the faculty of producing such effect. It was naturally my desire to give the same termination to all the names which denote any propensity; and it seems to me that the sound attachiveness would be infinitely more disagreeable than adhesiveness, the signification of which only remains to be determined.—Combativeness is the propensity to combat.—Destructiveness is admitted in the language.—Constructiveness is, in our doctrine, the producing of construction.—I know that covetiveness is a pléonasm, but this fault is observed in many other words. Covet itself indicates propensity or wishing for; and I have added *iveness* solely for the sake of uniformity: otherwise I should have said covetingness.—Secretiveness is the propensity to secrete or conceal.

The termination ous indicates a SENTIMENT, as anxious, cautious, pious, conscientious &c., and I should have been very glad of finding similar adjectives for every primitive sentiment of the mind. When that has been the case, I have added NESS in order to express the abstract state, as cautiousness, righteousness, or conscientiousness.

The names of the INTELLECTUAL FACULTIES are easily understood, and do not require any particular explanation.

If, under any head of this nomenclature, there be any better name, or one which indicates more exactly any determinate faculty, but no determinate action or effect of the faculty, I shall be anxious to make use of it; for I am always disposed to acknowledge truth and every real improvement.

As to style, my work of course presented, in the first instance, many Germanisms and Gallicisms; and it probably still presents some of them. I am however indebted to my friend Alexander Walker, Esq. late Lecturer at Edinburgh, for bestowing upon its revisal such time as he could spare from other avocations.

J. G. SPURZHEIM, M.D.

11, Rathbone Place, London,
Dec. 1814.

CONTENTS.

ANATOMICAL PART.

PHYSIOLOGICAL PART.

CHAPTER I.

INNATENESS OF THE FACULTIES.

CHAPTER II.

THE MANIFESTATIONS OF ALL FACULTIES OF THE MIND DEPEND ON ORGANIC CONDITIONS.

CHAPTER III.

EXAMINATION OF THE MATERIAL CONDITIONS NECESSARY TO THE MANIFESTATIONS OF THE MIND.

CHAPTER IV.

PLURALITY OF THE CEREBRAL ORGANS.

CHAPTER V.

MEANS OF POINTING OUT THE ORGANS OF THE MANIFESTATIONS OF THE MIND.

CHAPTER VI.

POSSIBILITY OF DISTINGUISHING THE DEVELOPEMENT OF THE BRAIN IN GENERAL, AND ITS PARTS IN PARTICULAR.

CHAPTER VII.

CHAPTER VIII.

PARTICULAR ORGANS OF THE MANIFESTATIONS OF THE MIND.

CHAPTER IX.

DIFFERENT MODES OF ACTION OF THE SPECIAL FACULTIES OF THE MIND.

CHAPTER X.

MUTUAL INFLUENCE OF THE FACULTIES OF THE MIND IN RESPECT TO THE MORALITY OF OUR ACTIONS.

CHAPTER XI.

CHAPTER XII.

CHAPTER XIII.

CHAPTER XIV.

CHAPTER XV.

CHAPTER XVI.

CHAPTER XVII.

THE

PHYSIOGNOMICAL SYSTEM

OF

DRS. GALL AND SPURZHEIM.

INTRODUCTION.

THIS system is commonly considered as one according to which it is possible to discover the individual actions of every one; it is treated as an art of prognostication. Such, however, was never the aim of our inquiries: we never treat of determinate actions; we consider only the faculties man is endowed with, the organic parts by means of which these faculties are manifested, and the general indications which they present. The object of this new psychological system, therefore, is to examine the structure and the functions of the nervous system in general, and of the brain in particular. Thus does this science particularly contribute to the knowledge of human nature.

It is sometimes asked, if such inquiries be useful. Every one will agree, that the knowledge of man is of the greatest interest; that the brain and nerves are the most important of the animal organs; and that the greatest ignorance exists concerning these parts. Hence, inquiries of this kind cannot be unimportant. We examine all the beings around us: we divide and subdivide the different objects which nature presents to us: we study mineralogy, botany, zoology: why should we not study man, who manifests the greatest number of faculties, and who is lord of the terrestrial creation? Man, if considered merely as the most important being of creation, ought chiefly to interest every thinking person. As moreover we ourselves belong to this kind of being, it must be of the utmost importance to know his nature. Among the Greeks the divine precept written upon the temple of Delphos was Γνῶθι σεαυτὸν—Know thyself. Our interest in being acquainted with human nature increases in proportion as we live with men; as it is necessary that we should influence them; as we wish to direct them. All institutions must be calculated upon a knowledge of human nature; otherwise they cannot be permanent. Than this, indeed, it seems impossible to point out an object more interesting to natural philosophers, anatomists, physiologists, physicians, teachers, moralists, and legislators.

I do not pretend that the study of man has been neglected. On the contrary, reflecting people of all ages have thought it especially worthy of their attention. They have taken notice of the actions of the most remarkable individuals, as well as of mankind in general; they have inquired into the number and the nature of the faculties of man; and they have invented many systems in respect to the causes of his actions. But though men of almost all professions have thus endeavoured to elucidate human nature, it must be allowed that our knowledge of mankind is still extremely defective; and when we consider, that so many great men have investigated this subject, it is astonishing that so little progress has been made in it.

It would, indeed, be difficult to imagine this slow and limited improvement, if the manifold obstacles to scientific inquiries in general, and to anatomy and physiology in particular were unknown. Among these general obstacles, we may reckon the religious respect which men have for ancient opinions, and their aversion to new ones;—the obligation and the ease of maintaining adopted opinions;—our inaptness to think for ourselves;—the want of clearness and precision in our ideas and expressions;—the mania of forming systems upon a few solitary facts and hasty conceptions;—the jealousy, the envy, the falsehoods of opponents;—and their malice in drawing dangerous consequences from the most innocent statements.

The particular causes of ignorance in psychology may be divided into natural and artificial. Among the natural, the most important is the difficulty which the examination of mankind presents. It may be observed in general, that our knowledge is less advanced the more difficult the object to be examined. It is easy to describe minerals, their volume, figure, weight, density, colour, and other physical qualities. This may also be done at leisure. Hence mineralogy is eminently advanced. Inquiries belonging to botany and zoology are more difficult; and these sciences are consequently less improved. On the same account we are, even as to plants and animals, more acquainted with their physical qualities, than with their vital functions. Anatomy, being easier than physiology, is also more advanced. We may at our leisure describe and make drawings of animals; we may anatomize and preserve them with safety and ease; but it is not so easy to observe the facts concerning the life of animals, to inquire into their instinctive labours, their propensities, and their faculties. Of the many books which treat on human nature, anatomical descriptions form the greatest portion. In anatomy the parts, in physiology the functions, the most easy to be examined, are also the best known. It is infinitely easier to examine the muscles and bones, than the nervous system: the anatomical and physiological knowledge of the nervous system and of the brain has, therefore, made the slowest progress. Till our days only the external forms of the brain were known, and the internal structure of its parts was quite overlooked. The brain was pretty generally considered as the source of the medulla oblongata, of the spinal marrow, and of all the nerves. Indeed the physiology of the nervous system, and of the brain, shows only a succession of error, ever conformable to the prevailing philosophical system.

To anatomy there is a natural obstacle in the repugnance which men have, at all times, had against the dissection of the dead. The ancient Egyptians embalmed them; and the Greeks, Romans, Jews, Arabs, and Chinese, were prohibited by religious opinions from dissecting and examining dead bodies. Hence Hippocrates often betrayed his ignorance of anatomy. Aristotle and the Roman anatomists were confined to the dissection of animals. Galen considered himself as having been very fortunate, in seeing two human skeletons at Alexandria; and he recommended all those who intended to study osteology on the skeleton, to go there. In ancient times, the dissection of human bodies was permitted or encouraged, only by the Ptolemies. Protected by these governors, Herophilus, Erasistratus, and Eudemus, made several important discoveries, which were however neglected or overlooked by their successors. The empirics entirely neglected anatomy. For that reason it was, in the year 1315, very remarkable, that Mondini de Luzzi, a professor at Bologna, publicly dissected two dead bodies. Montagna, a professor at Padua, acquired even in the 15th century great reputation by having dissected 14 bodies; an evident proof that the improvement of anatomy was very slow, even after the restoration of letters, in the century which preceded. Even at the present day few permit the opening of a deceased relation; and physicians too much neglect such means of instruction. Thus if we consider the want of the opportunity of dissecting, and especially the difficulty of dissecting the nervous system, we may conceive why the anatomy of that system has made so slow a progress. Moreover, in dissecting the brain, anatomists employ a method which is very bad. They cut the brain horizontally, vertically, or obliquely, from above or from below, and remove it by slices. In this manner they only destroy the organic parts, and their various and interesting connexions. Unacquainted with the origin of the nerves, and that of the brain; destitute of every physiological principle capable of guiding them; and neglecting the comparative anatomy of these parts, they have hitherto proceeded without any system. It was even impossible thus to acquire any idea of the natural order of the parts.

Physiology presents a still greater number of obstacles. Besides the natural difficulty of inquiring into the causes of the functions, there are many artificial obstacles.—The metaphysical notions of the schools have greatly impeded the improvement of psychology. By substituting on all occasions such metaphysical opinions for data furnished by the observation of nature, physiologists and even anatomists, have regarded these opinions as sacred. The schoolmen, for example, say, the soul is simple, and therefore its material residence must be simple also, and all the nerves must end in one point; in other words, the nerves can have only one origin, because each individual has but one soul. Bonnet, Haller, and others, having extended its seat to the whole substance of the brain, were contradicted by the metaphysicians, who did not reflect, that a little more or less of room could not enable them to explain the nature of the soul any better; nor that, according to the remark of Van Swieten, Tiedemann, and others, a material point, in which all ideas and sensations should centre, is inconceivable, in consequence of the confusion and disorder which would result from such an arrangement. It appears indeed ridiculous, that the naturalist, to whom all nature is open, should direct his researches and inductions by the guidance of such frivolous speculation. If, on the contrary, metaphysicians would observe the facts, and ascertain the conditions on which they depend, their notions would no longer be at variance with the inferences of anatomy and physiology; and one science would not arrogate the right of setting bounds to the progress of another. The doctrine of a single origin, and of a central point for all the nerves, is neither true nor possible; and this can be verified by examination. If, after this, the metaphysician cannot comprehend the unity of his individual consciousness, we ask him, if he understand, in automatic life, how such different apparatus concur by their varied functions in forming one whole?—if he can reconcile, in animal life, the circumstance of double organs with unity of function, and simplicity of consciousness?—if he can comprehend any single power in the material world?

The principal artificial impediment to the improvement of psychology was the blameable method which had been employed for the study of human nature. All phenomena were explained by the imagination alone or by hypotheses. There exist, even at this day, philosophers, who maintain that man is not at all subjected to the laws of nature, that he can begin a series of actions independently of all causes and motives, and that his functions do not admit of any explanation. According to this hypothesis, man is separated from all other beings; he is considered as a being entirely regulated by laws peculiar to himself. These schoolmen attribute all the operations of man to his soul: several of them even give to it an unbounded power over the body. This neglect to compare man with other beings was a great obstacle to the progress of psychology.—Moreover, the various branches of anthropology, instead of being united, are cultivated separately. The useful example of the Greek philosophers is neglected. Anatomy, physiology, medicine, philosophy, education, religion, and legislation, instead of uniting their mutual influence, constitute so many particular doctrines or sciences.

Man must be considered as a being of creation; and the study of his nature requires the same method as the examination of every other natural being. Every class of living beings presents two parts for investigation: the bodily structure, which is the object of anatomy, and the functions, which are the objects of physiology. Thus it is necessary to study in man—1st, The structure of the whole body, and that of each part in particular. 2d, The functions in general, and those of every part in particular. 3d, The mutual influence of the different parts, and their functions; and 4th, The relations between man and all the beings around him, whether inanimate or animate, even the relation to his Creator.

The knowledge of mankind may farther be divided into two parts: into the knowledge of the healthy, and into that of the diseased state. We may now ask, To what profession does the examination of human nature especially belong? Several persons cannot conceive why a physician should speak continually of the knowledge of human nature; but no profession is more interested in nor more fit for such examination. It is indeed the particular duty of the physician to consider the diseased state of man; but it is evident that a knowledge of the healthy state must be the foundation of a knowledge of the diseased state: that is, pathology must be founded upon physiology. It is impossible to understand any derangement of the functions if we are not acquainted with their regular state. Hence all physiological inquiries are most intimately connected with medicine.

It cannot be doubted that, considered even in itself, the most important part of man is the nervous system; and with relation to other parts, our inquiries in respect to that system in general, and to the brain in particular, must also be the more important, the greater influence these parts exert upon all the operations of the animal economy. Now in man, and the more perfect animals, the manifestations of all the faculties are more or less subordinate to the influence of the nervous system. The functions of digestion, nutrition, circulation, respiration, secretion, and excretion, are deranged or annihilated, when the nerves, which co-operate in the performance of these functions, are compressed, wounded, or destroyed. The chemical changes in the alimentary canal during digestion are the more sensible the less the nervous power is active. The nerves distributed to the organs of sense, and to the muscles, are indispensable to the performance of their functions. The impressions made on parts below the division of a nerve are no more perceived, and the principle of motion can no more be directed towards the muscles with which it is naturally connected. We shall also see that, besides the functions of the five external senses, all the instincts, propensities, sentiments, and intellectual faculties, all affections and passions, all the characteristics of humanity, are manifested only by means of the nervous system. Hence we are obliged to acknowledge, that without the physiology of the nervous system, there would be neither psychology nor any species of philosophy; and that it is impossible to find any object of greater importance than this, or of more durable interest for philosophers, physicians, moralists, teachers, judges, and legislators.

Hence it is obvious, that physicians, who study the influence of the nervous system, are especially interested to contribute to the knowledge of man; nor does the practice of any profession make us feel so intimately the necessity of knowing both his physical and his moral state, in consequence of the influence of affections upon the functions. Who, for instance, has not observed that grief, jealousy, envy, hopeless love, and similar painful affections, consume the principle of life? Moreover, the examination of the nervous system, and of its influence, interests physicians, chiefly because all the alienations of the mind have their primitive cause in the mediate or immediate derangement of the nerves, and of the brain; and in pointing out the conditions necessary to the manifestations of the moral sentiments and intellectual faculties in the healthy state, we contribute also to the elucidation of mental diseases. Thus no one is more interested than the physician in discovering the nature of man.

Fortunately no profession is more prepared than that of the physician to investigate these subjects by accessary knowledge, and by the study of nature in general; nor is any one so frequently, and so seriously, admonished by nature to revise opinions, and to forsake hypothetical reasoning, in order to follow the simple methods of experience. No philosopher is more intimately convinced, that all our knowledge ought to be reduced to a rational mode of judging from experiment and observation. The physician, moreover, is placed in circumstances the most conducive to a profound and certain knowledge of man. No one has such facility of observing men at all times, and in all situations, when liberated from, when incapable of, habitual restraint and ceremony. The physician alone has an opportunity of being, during the night or the day, witness of the most intimate relations, and the most secret events in families. Good and bad men, when sick, with difficulty conceal from him their true sentiments. Who does not wish for the friendship of the man whom he trusts with his own life, with that of his wife, or of his children? To such a man, supposed to know all that belongs to our nature, we unfold the most secret thoughts, we acknowledge our frailties and our errors, in order to guide his judgment concerning our situations. There is consequently no profession more entitled to study mankind, than that of medicine.

PART I.

ANATOMY OF THE NERVOUS SYSTEM.

THE first part of our inquiry relates to the anatomy of the nervous system in general, and that of the brain in particular.—I have already mentioned the slow progress of the anatomical knowledge of these parts, though, from the earliest antiquity, anatomists, convinced of their importance, have inquired into their structure. I have also pointed out the reasons of this. I now continue the elucidation of the subject.

In examining the structure of the nervous system, our whole procedure differs from that of other anatomists. The method of demonstrating the brain, commonly employed in anatomical schools, is defective in every sense. No idea could be formed of the structure of any organic part, if its dissection were performed by slicing, as is done with the brain. Who could understand the structure of the muscles by a demonstration of their transverse sections? Guided always by physiological and pathological views, we begin the examination of every cerebral part at its origin, and by scraping aside the nervous substance, we follow the course and direction of the fibres. In this way, we easily perceive their successive increase, the addition of new parts, and their various connexions. We also discover the form, consistency, and colour of the nervous parts with more facility than by cutting and slicing them. This method, therefore, is preferable even for those anatomists whose aim is only the mechanical form of the organization. It is of indispensable necessity to our considerations, which are not confined to mechanical form, but connected with physiological and pathological views.

In our anatomical inquiries, the origin of the nervous system is the first consideration. Is there one common origin of all nerves, or are there various origins?—Anatomists and physiologists generally speak of a common origin of the nervous system: they consider the brain as the origin of the spinal marrow and of the nerves, and all these parts as one homogeneous mass. We are of opinion, that the nervous system must be divided and subdivided, and that each part of these divisions and subdivisions has its particular origin.—Anatomists speak commonly of four parts of the nervous system: of the great sympathic or intercostal nerve, of the spinal marrow, of the cerebral nerves, and of the brain itself. Several anatomists, as Winslow, Soemmerring, and Cuvier, have remarked the impropriety of deriving the great sympathic nerve from the brain and the spinal marrow; they have considered this nervous apparatus as existing by itself. Bichat even maintained, that the intercostal nerve is not one, but that it must be considered as composed of various parts which take their separate origins from the different ganglia dispersed through the abdomen and thorax: he mentions the differences which may be observed between the great sympathetic, and the other nerves of the body. The fibres of the former are greyer, thinner, softer, and more numerous, while the fibres of the other nerves are whiter, thicker, more solid, and less numerous. Comparative anatomy indeed clearly proves, that the nerves of the abdomen and thorax are not the continuation of the spinal marrow and the brain. For, while no nerves have been detected in zoophytes, nerves exist in animals which have distinct vessels, and an intestinal canal, and there take their origin from various ganglia; and, as these animals are destitute of a spinal marrow and brain, the nerves cannot arise from them. Now as the nervous systems of the viscera of the lower classes of animals are analogous to similar systems in higher classes, which perform similar functions; that is, as the nerves of these animals correspond to the nervous plexus of the abdomen and thorax, and to the series, more or less interrupted, of the ganglia of the sympathic nerve in the higher animals, it is demonstrated that this apparatus exists independently and of itself. Thus we consider the intercostal nerve as composed of different parts which have their separate origins, and are in communication with each other, with the spinal marrow, and with the brain.

Even the spinal marrow, and the pretended cerebral nerves, are not continuations of the brain, nor is one part of them the continuation of another; but the spinal marrow, every pair of its nerves, and every pair of the pretended cerebral nerves, have their peculiar origin. For the brain is in proportion neither to the spinal marrow nor to the pretended cerebral nerves, which ought to be the case if they were continuations one of another. The brain of a horse, ox, or stag, is smaller than that of man, while their spinal marrow and nerves are far larger than the same parts of man. Hence the brain is the origin neither of the spinal marrow nor of the nerves. Certain monsters of the human species, and of the perfect animals, are born without head, and are yet provided with nerves, and a spinal marrow. Sometimes the head, the upper parts of the body, and the thorax, are wanting, and yet the inferior parts have nerves. Even a leg, if it be born alone, is provided with them. Hence the brain cannot be their origin.

Certain authors support their opinion relative to the origin of the nerves from the brain, by saying with Morgagni, Haller, and Sandifort, that a dropsy of the brain, after having destroyed that mass with its membranes and bony coverings, is the cause of the dissolution and absorption of all the parts which are wanting. But no acephalous fœtus, either incomplete or complete, that is, either where the basis of the skull, the inferior parts of the brain, and the nerves exist, or where the whole head is wanting, shows, at birth, any traces of such destruction. Instead of observing any erosion, the edges of the bones are smooth, and thicker than in the perfect fœtus. Besides, if the water, whether that of the amnios or that which is accumulated in the brain, can dissolve membranes and bones, why do the soft nerves of smelling, seeing, and hearing, resist this destructive power? Moreover, when it is admitted that other parts of the body, as legs, hands, arms, &c. are wanting by a primitive defect of organization, why should it be necessary to make an exception in respect to acephali, and to have recourse to dropsy in order to explain the deficiency of the brain and the skull?

Other persons, who maintain that the brain is the origin of the nerves, explain the existence of acephali by a stronger pressure, whereby the compressed parts are absorbed. It may indeed happen, that a strong pressure hinders the nutrition of any part, and the deposition of new matter, while the absorption continues; consequently in this manner a compressed part may diminish, and even disappear; but who shall determine the duration necessary to produce this effect? Moreover, I do not understand how the uterus can produce a pressure upon the head without a counter pressure upon the opposite parts, and yet these parts are not absorbed at the same time. In the same way it is inconceivable, how the pressure could act only upon the arms, legs, or upon any other part alone. How shall we find in pressure, an explanation of the want of interior parts, while the whole surface of the body is entire? Finally, while the fœtus swims in the water of the amnios, it is quite impossible that any pressure should take place. Hence, accephali must be considered as the result of an organization originally defective.

The direction of the fibres of the spinal marrow, and of the pretended cerebral nerves, clearly proves that they are not prolongations of the brain; and that one pair of nerves is not a prolongation of another. The direction of the pretended cerebral nerves is evidently from below upward. (*Pl.* I. *fig.* i. 10, 12. 13, 15, 20, 23.) Every pair of the spinal nerves is composed of different bundles, several of which, in animals, have their direction from below, upward and outward; others from above, downward and outward. Hence, the nervous bundles come neither from the superior nor inferior extremities of the spinal marrow; but every pair of nerves takes its origin at the place, whence the nervous bundles go off. This is also evident by the size of the different parts of the spinal marrow, which are not in proportion one to another. The spinal marrow is large or small, in proportion to the size of the nerves which arise at different parts of it; for instance, it is larger at the places where the nerves of the arms and legs take their origin; and is smaller at the places where the nerves of the back go off. Therefore, the number of pairs of the spinal marrow varies extremely, not only considered collectively, but also the particular number of the vertical, dorsal, and lumbar pairs.

This consideration relative to the origin of the nervous substance must also be applied to the various parts of the brain. Thus the different parts of the brain, of the spinal marrow, the pretended cerebral nerves, and the nerves of the abdomen and thorax, have no common origin; but every part has its separate origin. The various parts are brought only into communication with each other.

It is natural that the form of the whole nervous system should be different in different animals, and conformable to the form of their different bodies. If an animal have a round form, the arrangement of its nervous system must be different from that of an animal which is long.

The nervous system in general, and the brain in particular, consist of two kinds of substance; namely, of a cineritious, and of a white substance. The cineritious or grey substance is pulpy, gelatinous, sometimes softer, sometimes harder, more or less whitish, yellowish, reddish, or blackish, and without apparent organization. It contains a very great number of blood vessels, so that certain anatomists have considered it as a tissue of very small blood vessels; but Albinus, and after him, Soemmerring, proved by injections, that there is yet another substance, which is probably secreted by the blood vessels. Other anatomists supposed that it is destined to secrete a nervous fluid. We consider the grey substance as the matrix of the nervous fibres.

It is objected, that all organic parts are produced and nourished from the blood. This is true; but it does not always happen immediately, but also mediately. We may therefore state, that various organic parts immediately take origin from a soft greyish substance, and only mediately from the circulating fluids. Plants spring from a soft substance. In trees, wherever a branch originates, it first happens that a certain quantity of greyish substance is deposited from the sap, and then from this substance fibres arise. These fibres next are on one side brought in communication with the trunk, and by means of this with the roots; and on the other side they form the branch. The new branch, therefore, is not the continuation of the inferior ligneous fibres, or of the roots; it is only brought into communication with them. This is also evident from the consideration, that all the branches together make up a larger quantity than the trunk or the roots do. The mutual influence of the roots and branches is sufficiently explained by the communication of these parts; and therefore it is, that the injuries of the roots do harm to the branches, and *vice versâ.*

The bones have their origin in a similar way. The cartilaginous mass precedes the bony substance, and this latter is deposited in the former. In the nervous system also, the grey matter acts sooner than the white fibrous substance. At first, in the fœtus, the whole brain consists of a cineritious mass, and by degrees only it is that the fibres appear; and then at certain places sooner than at others, the nervous fibres always going off from the grey substance. There is even a uniform proportion between the grey substance and the nervous fibres which are derived from it. In worms, insects, and crustaceous animals, the ganglia, wherein nervous fibres arise, contain a proportionate quantity of greyish substance. This substance is sometimes accumulated at particular places, and sometimes it accompanies the nervous fibres in their course. It is the same in the cerebellum and in the brain. Every nervous part has its origin in a proportionate quantity of cineritious matter. From these considerations we infer, that the nervous filaments are originally produced in the cineritious substance.

The opinions of anatomists, concerning the structure of the white substance, are also very various. Some have taught that it is solid; others maintain that it is hollow: some, that it is absolutely destitute of vessels; others, that it is entirely composed of them: a great number think it resembles marrow; very few anatomists know that it is fibrous, and this is in fact its structure.

The objection, which is opposed to the fibrous structure of the brain, is, that we do not see the fibres when we cut the mass. Sometimes, according to their expression, it *seems* fibrous; but this is, say they, the effect of drawing and pulling this coriaceous mass; and though filaments were also observed by other processes, this happened, continue they, in consequence of a chemical preparation, or of an alteration after death. This assertion is quite unfounded. In the first place, it is quite impossible to discover the true and fibrous structure of an exceeding fine and soft mass by cutting it. Proceeding in this way, we fail to discover this structure even in those cerebral parts which are manifestly fibrous; for instance in the pyramidal bundles and in the great commissure. The fibrous structure may however be proved by other means. In dropsy of the brain, the fibres are very distinct. If we direct a stream of water by means of a syringe, on a convolution, and separate its two layers one from another, we may see their fibres throughout their whole expansion. The same result follows if the convolutions of the brain be boiled in oil, or macerated in nitric or muriatic acid diluted with alcohol. Moreover, when we scrape the white substance in the direction of the fibres, we can follow them with the naked eye into the grey substance of the convolutions; but when we scrape cross-ways or side-ways, the fibres are brought out of their natural direction, and visibly break off. If then the fibres were the product of coagulation after death, how should it happen that agents so opposite as the water of the dropsy, alcohol, vinegar, mineral acids, boiling oil, and even intense cold, act in a uniform manner upon it. Why, in the convolutions, is the white substance coagulated in fibres which run perpendicularly from the basis upward? Why in other parts is it in horizontal, circular, crossed, interlaced, or diverging fibres? Why do the fibres always take the same form in the same parts? The only rational answer is, that the white substance is fibrous, and that these are its natural directions.

For this reason the name medullary substance is false. This expression excludes the idea of fibres; and the functions of the nervous fibres have no analogy with those of the medulla. Therefore, we always say, nervous mass or nerves, and name them according to the parts they belong to: for example, instead of spinal marrow, we say the nerves of the spine, as we say, nerves of the stomach, of the lungs, &c.

I shall now describe the most remarkable parts of the nervous system.—The nerves in general may be divided in the same way as their functions. I shall afterwards demonstrate that certain functions must be considered as the result of the organization alone; and that others take place with consciousness, and are the effect of the mind. The former class of functions constitute organic or automatic life; the latter animal life.

The nerves of automatic life consist in the nerves of the abdomen and thorax, into the particular description of which I shall not enter. I have proved that they exist by themselves. I only add that they are brought into communication with all the nerves of animal life. The nerves of animal life may be subdivided into four orders; into the nerves of voluntary motion, those of the five senses, those of the propensities and sentiments, and those of the intellectual faculties. Till the present time, the difference between the nerves necessary to voluntary motion and to the sense of feeling has not been demonstrated; but, by several anatomical, physiological, and pathological proofs, I am convinced of its existence. This difference has been sought for from ancient times. Herophilus was the first who spoke of it. Reil thought that the medulla of the nerves produces sensation, and their investment motion; but entire nerves—nerves consisting of both these parts—are distributed to the muscles or to the skin.

I admit a difference in the nerves of motion, and those of feeling; because the same nervous fibres do not go to the muscles and to the skin, and each of these parts perform peculiar functions. The nerves necessary to motion cannot propagate the impressions of the sentient nerves, nor these the impressions of the nerves of motion. These latter produce only the feeling of pain, as the nerves of automatic life do. Muscles do not feel temperature nor moisture, but muscles feel fatigue. There is no proportion between being fatigued and feeling: it is possible to be fatigued and to have an acute feeling. Muscles receive their impressions from within, and nerves of feeling from without. Moreover, there is no proportion between the size of muscles, and the sense of feeling. The nerves of feeling are only assisted by the nerves of motion, in the same way as the nerves of all other senses. That is, if internal faculties act upon internal impressions by means of the five senses, they make use of the organs of motion. Is not the tongue, for this reason, provided with three kinds of nerves, *viz.* with nerves of motion, of feeling, and of taste? The diseased state proves also the difference between the nerves of motion and those of feeling. Voluntary motion sometimes is impossible, while feeling is preserved or even increased; and sometimes feeling is lost, while voluntary motion continues. From these observations I infer that the nerves of motion and feeling are different.

It may be replied, that the nerves of motion and feeling arise from the same pair, consequently that they are not different. This conclusion is erroneous; and the contrary is evident by the fifth pair, the various fibres of which perform different functions, *viz.* motion and taste. The other spinal nerves are also composed of different original bundles, the functions of which may be different. According to this view, the spinal marrow consists of nerves of motion and of feeling; and the greater number of the pretended cerebral nerves belongs to the nerves of motion or of feeling.

In respect to the nerves of motion, and of the five external senses, I have already proved that these nervous fibres exist by themselves, and cannot be considered as the continuation of the white substance of the brain and cerebellum. I shall only add some considerations relative to their particular structure.

ON THE SPINAL NERVES.

The term spinal marrow has been used in a vague manner by different authors. The natural limit of this nervous mass appears to be the edge of the foramen magnum, at the lower extremity of the pyramidal bundles. (*Pl.* I. *fig.* i. *i.*) It must be considered as a series of enlargements, in which arise the different pairs of nerves. There is in this respect an analogy throughout all classes of animals, whose nervous system presents in general a longitudinal arrangement. In the worms and caterpillars there are as many origins of nerves or ganglions, as there are superficial rings or segments. These ganglions or knots are joined to each other by nervous branches, and form a cord with small tumours of various forms and sizes. The number and size of the nervous threads arising from these swellings are always proportionate to the size of the swellings themselves. In fishes, amphibia, and birds, there is no essential difference; only the ganglions are in general closer to each other, forming, with their uniting bands, a cord nearly equal in size; but swelling in distinct knots wherever large nerves go off. The same law is preserved in mammalia and in man, although in man the swellings are not so immediately evident. But even in him, these alternate swellings, corresponding to the origin of the nerves, may be seen by removing the spinal marrow, detaching the arachnoid coat, and observing the profile when held against the light. The largest swellings are where the nerves of the extremities go off; but they are sufficiently visible throughout, the line being every where more or less undulatory.

The interior structure of the spinal marrow is not well understood. There are evidently two fissures, one in the midst of the anterior, and another in the midst of the posterior side, but there are no lateral fissures. The anterior fissure is wider and more visible; the posterior penetrates more deeply. The anterior fissure has also the peculiarity of being interrupted by the decussation of the pyramidal bodies. The two halves of the spinal marrow are united at the bottom of each fissure by a nervous layer, the fibres in the anterior being transverse, and in the posterior, longitudinal. The nerves of the spinal marrow originate in the cineritious substance, found in the interior of each side of the cord, forming two arcs which pass towards the anterior and posterior surface. The nervous fibres follow the course of these arcs from within, to the surface throughout the whole length of the spinal marrow; so that we have on each side two rows of nerves, an anterior and a posterior. The posterior ones are more considerable, and therefore it is that the posterior fissure penetrates more deeply.

ON THE PRETENDED NERVES OF THE BRAIN.

There can be no dispute about the origins of the accessory (*Pl.* I. *fig.* i. 2—3), hypoglossal (*Pl.* I. *fig.* i. 4), vocal (6), and glossopharyngeal (7) nerves. They bear a close resemblance to the nerves of the spine. The others have this particularity, that their filaments unite into one band before they quit the mass, which band evidently runs directly upward, sometimes more, sometimes less visibly, according as it is more or less covered by neighbouring bundles. However we must not in these nerves confound the point of origin, with the point of departure from the mass.

The abductor nerve (*Pl.* I. *fig.* i. 10) is seen clearly, in herbivorous animals, arising, at some distance behind the pons Varolii (*Pl.* I. *fig.* i. *b b*), from a small band which ascends between the corpora pyramidalia (*i*—*c*) and olivaria (*a*). It is only on account of the greater breadth of the pons in man, that this nerve approaches to its posterior edge.

The facial nerve (*Pl.* I. *fig.* i. 11) goes off at the angle formed between the pons Varolii, and the corpus retiforme (*e*—*e*). In herbivorous animals, the roots of this nerve may, according to Mr. Walker's observations, be deeply traced as two strong and glistening cords passing through the whole thickness of the medulla oblongata.

The auditory nerve (*Pl.* I. *fig.* i. 9) comes from the medullary streaks on the surface of the fourth ventricle, increases into a small grey and slightly prominent band placed transversally upon the corpus retiforme. This band is proportionate to the size of the auditory nerve, and the acuteness of hearing in different animals.

The roots of the par trigeminum (*Pl.* I. *fig.* i. 12) may be traced to above the corpora olivaria (*a*). This fact has been observed by Santorini, but overlooked by modern anatomists. The breadth and thickness of the pons in man were the obstacles to its being discovered sooner. But as this part is much smaller in animals, the roots of the fifth pair are easily traced. In fishes, amphibia, and birds, it is quite detached from the cerebral parts.

The optic nerves (*Pl.* I. *fig.* i. 20) have a very different origin from that which is commonly assigned to them. The greater number of anatomists derive them from the thalami, although Santorini, and, among the moderns, Hildebrand, Soemmerring, and Boyer, stated that they arise, in a great measure, from the nates. It is very evident in brutes, particularly in the horse, the calf, and sheep, that the anterior pair of the tubercula quadrigemina gives origin to a broad band of nervous fibres, which bends round the outside of the thalami, and appears to receive a small addition from the corpus geniculatum externum, where it ceases to adhere, except at its external edge. It proceeds toward the forehead, and is closely attached to a layer of grey matter, called by some tuber cinereum, receiving from it several new filaments. Here it meets the nerve of the opposite side, and decussates that nerve, according to the opinion of the most enlightened anatomists, although this decussation is denied by others, who allege reasons which are of less force. We have seen in different animals, that, after blindness which lasted for many years, the nerve of the affected side diminished in size as far as the union, that the change has continued from this point along the nerve of the opposite side, and that the nates of this same side has also been considerably diminished. It is evident that the thalami are not the origin of the optic nerves. There is no proportion between the size of the optic nerves and of the thalami. The latter are much smaller in the horse, cow, and stag, than in man, though the optic nerves of these animals are much larger; but the proportion between the optic nerves and the nates is always preserved. It may be clearly shown from the brain of birds, that the thalami do not belong to the optic nerves. Anatomists have strangely confounded, in fishes and birds, two round tubercles with the thalami in mammalia, though the hemispheres in fishes and birds contain the same parts as in mammalia. In these only one band of superficial fibres, on their outside, contributes to the formation of the optic nerves. All the rest belongs to the brain, particularly to the organs of propensities and sentiments. Anatomical inquiries clearly prove this organization. At Paris I have examined a brain in which the thalami were destroyed by suppuration, but the optic nerve preserved its natural size proportionate to its fellow of the other side.

The origin of the olfactory nerve (*Pl.* I. *fig.* i. 23) is not yet demonstrated. There are three roots (18, 19, 21) in different directions, but I have not been able to observe its primary origin. It is certain that neither the testes nor the corpora striata are its origin, because the brains of the cetacea, destitute of this nerve, have testes and corpora striata. It is also an error to suppose that the relative magnitude of the nates is larger in herbivorous, and that of the testes more considerable in carnivorous animals.

CEREBRAL MASS.

Natural order now leads us to the examination of the cerebellum and the brain. The ideas which have prevailed, on what may properly be called the brain, have been, till the present time, very indeterminate. Certain anatomists confine the idea of brain to the convolutions and hemispheres. Others extend it to the whole nervous mass contained in the skull. Others still suppose that even the medulla oblongata and spinal marrow are prolongations of the brain and cerebellum, and give to all these parts the common name encephalic mass (from the Greek ἐν, *in*, and κεφαλὴ, *head*). In order to fix the meaning of our terms, and to avoid all confusion, we call cerebral all the nervous mass which is joined to the nervous systems, performing voluntary motion, and the functions of the five senses.

The cerebral mass is commonly divided into two principal parts; namely, the superior, composed of the two hemispheres, and called the brain; and the inferior, which, being in general much smaller than the superior, is called cerebellum or little brain. The cerebral mass may also be divided, according to its functions, into two parts: into the organs of propensities and sentiments, and into those of the intellectual faculties.

Anatomists have observed in the medulla oblongata three eminences: the corpora pyramidalia (*Pl.* I. *fig.* i. *i—c*), olivaria (*a*), and retiformia (*e—e*); or the pyramidal eminences, olivary tubercles, and retiform bodies, naming them according to their mechanical form. But the medulla oblongata contains different bundles which are composed of fibres. These bundles are augmented by new fibres, which arise from a grey substance, and are joined to the inferior nerves; that is, the original fasciculi of the cerebellum and of the brain are put in communication and reciprocal action with the nervous system below them.

The mode of this communication is not the same in all these original parts of the cerebral mass. Except the anterior pyramidal eminences, all the other fasciculi of the brain, as well as of the cerebellum, arise on the same side, of which they become cerebral parts, and they communicate with the nervous systems of the same side of the body; but it is quite different with the anterior pyramidal eminences. The fibres of these eminences cross or decussate each other, each going to the side opposite to that from which it originates. Just at the spot where the medulla oblongata, or the great occipital enlargement, begins to swell at its lower part, at one inch and a few lines below the pons Varolii (*Pl.* I. *fig.* i. *i*), let the arachnoid and vascular coats be divided by a superficial incision, not extending into the subjacent parts, and then be carefully removed. If then the edges of the groove, which runs in the middle, be gently separated, there are seen three, four, or five threads crossing each other, coming obliquely from below upward, and occupying a space of about three or four lines in length. The nervous threads, arising in the cortical substance on each side, pass respectively to the opposite side, so as to produce a decussation of the pyramids. These primitive threads of the pyramids vary in number and size: there are five, four, or three; and sometimes the primitive fibres, instead of forming an intertexture of this kind, present bands which pass obliquely to the side opposite to that from which each comes. The decussation is constant, but the form and size of the crossing fibres vary.

This structure of the pyramids was known to some of the ancient anatomists, as to Mistichelli, Pourfour du Petit, and Santorini; but it has been overlooked or denied by modern anatomists. It explains why injuries of the head influence the opposite side of the body; and as only a part of the brain, namely the continuation of the anterior pyramids, is in communication by decussation with the nervous mass of the body, it is evident and easily understood, why palsy of the body, or convulsions, produced by injuries of the head, are observed sometimes on the opposite, and sometimes on the same side.

CEREBELLUM.

The lowest part of the cerebral mass is the cerebellum (*Pl.* I. *fig.* 2. I). It follows immediately after the spinal nerves. In animals of the lower orders, and also in birds, the cerebellum is single, but always composed of two distinct halves. In fishes and reptiles no division of it is perceived; and if, in them, it be cut perpendicularly, it does not present the arbor vitæ. In birds, the external surface of the cerebellum presents semicircular rings and ridges, and if in them the cerebellum be cut perpendicularly, the arbor vitæ is visible. In viviparous animals, the cerebellum is no longer single; lateral parts are added, and the first part becomes the middle portion, as Reil calls it. This denomination however seems less adapted to it than that of fundamental portion, because this portion exists in all animals, even in fishes and reptiles, where there are no lateral parts.

Nature observes always the same model in the formation of the cerebellum. The cerebellum of man, therefore, although complicated and perfect, presents the common elementary form. The first visible roots of the cerebellum spring out of the grey substance, placed in the interior of the large occipital swelling (medulla oblongata). These roots form on each side of this swelling a fibrous cord more or less considerable. This string thickens continually as it ascends (*Pl.* III. *fig.* 1 & 2. *e e*). Near the cerebellum it is covered by the auditory nerve and by its ganglion, called by certain anatomists the grey band. After having taken away with precaution, by scraping or by the handle of the scalpel, the auditory nerve and ganglion, we see on each side, in following the direction of the fibres, the whole cord enter into the interior of each hemisphere of the cerebellum. It has scarcely advanced a few lines, when it meets an accumulation of grey substance, and forms with it a somewhat dense tissue, so that it is impossible to pursue in it the direction of the nervous filaments (*Pl.* III. *fig.* 1 & 2. S). This tissue, offering an indented and irregular figure, is named by anatomists, corpus dentatum, ciliare, rhomboideum, or zig-zag. Other anatomists, considering this part as the re-union of all the white substance of the cerebellum, gave it the name *nucleus*. The cineritious substance, contained in this body, is a preparatory apparatus, destined to increase the nervous filaments that enter into it by new fibres: consequently it is a large point of increase for the cerebellum. Accordingly several new nervous bundles arise in it, continue their course, ramify into branches, layers, and multiplied subdivisions. In every point from which a principal branch goes off, there is an increased quantity of grey substance. Thus results a number of fringes, or denticulations, of this substance equal to the number of the principal branches. The original bundle, the ganglion, the divisions, and subdivisions are, as to their dimensions, in direct proportion to one another. The greater number of viviparous animals, having the cerebellum smaller than man, have also a smaller, and scarcely visible, ganglion (corpus ciliare.) Therefore anatomists thought that animals were destitute of it.

In man, one principal branch goes toward the middle line, and contributes with its fellow of the opposite side to make the fundamental portion of the cerebellum; namely, the vermiform process, which is ordinarily subdivided into seven principal branches (*Pl.* II. *fig.* 2. 62). The other branches, which go off from the corpus ciliare, are directed upward, downward, and outward, and are expanded in slender layers horizontally disposed (*Pl.* I. *fig.* 2. I). Those of the middle line are the longest; the others are the shorter as they are nearer to the place where the original cord enters into the corpus ciliare. The nervous fibres of all the divisions and subdivisions are covered with grey substance at their peripheral extremity (*Pl.* II. *fig.* 2; *Pl.* III. *fig.* 1 & 2. 47, 48.)

If the cerebellum be cut vertically through the middle of this ganglion, we commonly find eleven principal branches, but the number of the divisions varies, according as the cut is directed farther from or nearer to the middle of the cerebellum. The fibrous layers expanded into large branches and leaves, when vertically cut, present a figure which, on account of its resemblance to the leaf of a thuya, or tree of life, bears the name, arbor vitæ. But horizontal or transverse cuts of these branches and leaves present only a white substance. Therefore anatomists are wrong in maintaining that the quantity of the cineritious mass is more considerable in the cerebellum than in the brain. The contrary will appear if the brain and the cerebellum be cut vertically.

BRAIN.

I shall now examine the organization of the brain. Immediately before their entrance into the pons Varolii, the pyramids are a little contracted (*Pl.* I. *fig.* 1; & *Pl.* III. *fig.* 2. *c*); but as soon as they enter this mass, they are divided into many bundles, which spring out of the large mass of grey substance, contained in the pons Varolii (*Pl.* III. *fig.* 2. *f*). These longitudinal bundles are covered by a thick layer of transverse cords (*Pl.* III. *fig.* i. *b*), coming from the cerebellum, which I shall describe hereafter. Some longitudinal bundles are disposed in layers; others are interwoven with transverse cords. They ascend and are successively enlarged, so as to form, at their exit forward and outward, at least two thirds of the crura cerebri. Thus the anterior and external bundles of the crura cerebri (*Pl.* III.

fig. i. *g*) are the continuation and successive completion of the primitive pyramidal bundles: they contain internally, through their whole course, a great quantity of grey substance, by which they are continually increased, and always multiplied by new fibres which are joined to former ones. At their upper extremity, where the optic nerve bends round their outside, or at the exterior part of the corpora striata (*Pl.* III. *fig*. i. 34—38), they receive the greatest additions. There is there a large mass of grey substance, wherein an infinite quantity of fibres are produced. At last, at the external margin or edge of the optic nerve, the nervous bundles of the crura cerebri assume a diverging direction, and form expansions folded in various ways, called convolutions of the brain. In this way the pyramidal eminences, being successively increased and completely developed, form the inferior, anterior, and exterior convolutions of the anterior and middle lobes (*Pl.* III. *fig*. 1).

It remains to show how the posterior lobe and the convolutions at the superior margin of every hemisphere, or toward the middle line, are formed. The bundle which comes from the olivary tubercle (*Pl.* III. *fig*. 2. *a a*), and some other posterior bundles (*Pl.* III. *fig*. 2. 70), ascend like the pyramids through the transverse cords of the commissure of the cerebellum or pons Varolii. In this way they receive some additions, but less considerable than that of the pyramidal eminences, and they form the posterior and interior part of the crura cerebri. Here they receive the greatest additions from the thick mass of grey substance contained in the crura, which gives origin to many fibres, and forms a hard ganglion flat in the middle, and unequal superiorly and posteriorly (*Pl.* II. *fig* 2. *p*). This ganglion was hitherto known under the name, optic thalamus; but I have already proved that the broad band of nervous fibres, which forms the optic nerve, is only attached to the posterior external surface of this ganglion; that there is no proportion between the size of the thalami and the optic nerves, but that the thalami are proportionate to the convolutions which arise from them; finally that, by examining the interior of this ganglion, a great number of fine fibres is detected, which ascend in a diverging direction, and which at their exit, namely at the superior margin of this ganglion, form large bundles. The anterior bundles of the thalamus penetrate a large mass of grey substance, *viz.* that part of the corpora striata which is situated in the great cavities, and receive from it a considerable addition. All the bundles of this ganglion form the posterior lobes and the superior convolutions toward the mesial line of the head (*Pl.* III. *fig*. 2).

Thus we consider the thalami and corpora striata as apparatus of increase, in which many new fibres arise and join the others. In this way the different cerebral parts are added to the other nervous systems, just as many branches might be engrafted upon the stock of a tree. So far I have described the diverging fibres of the cerebellum and brain. I have followed these fibres from their origin to the bottom of the convolutions into which they enter;

but before I speak of the particular structure of the convolutions, I shall consider another order of fibres which come out of the convolutions, pass in the intervals of the fibres first described, and cross them, always converging toward the middle line, becoming thicker and forming commissures or unions.

ON COMMISSURES.

All the nerves necessary to the manifestations of animal life are double, but they all unite in the middle line with their fellows of the opposite side. For a long time past anatomists have given the name of commissures to different parts of the brain. They have mentioned the anterior, middle, posterior, and great commissure. But they never thought of the relation between these commissures and their respective parts; they never examined whence the commissures are derived; nor whether every cerebral part is united in the same manner, nor why the unions are so different in different kinds of animals. They had no knowledge of the law of this arrangement. We have established, in this respect, the strictest and exactest elucidation. We do not employ the expressions of anterior, middle, posterior, and great commissures; we endeavour to settle to what parts the unions belong, and name every commissure according to the parts it serves to unite.

I have spoken of a transverse nervous layer at the bottom of the anterior fissure of the spinal marrow. By means of this apparatus the two halves of it communicate with and act upon each other; and any part of one side participates in the state of the corresponding part of the other side.

COMMISSURES OF THE CEREBELLUM.

The double parts of the cerebellum are also united. In the cerebellum there exists a kind of nervous fibres, which are not immediately in connexion either with the original band, or with the apparatus of increase. These fibres come out of the grey substance at the surface, pursue various directions through the diverging fibres, always converging toward the anterior external margin of the cerebellum, where they form a large and thick fibrous layer. The anterior ones converging lie in front: the middle and posterior ones pass transversally through the longitudinal bands, which go to diverge in the hemispheres of the brain. They all unite in the middle line with their fellows of the opposite side, thereby joining the two hemispheres of the cerebellum. This part, now known under the name pons Varolii, or tuberculum annulare, is then really the great commissure of the cerebellum. It is always in a direct proportion to the lateral parts of the cerebellum. Therefore the mammalia, having smaller cerebella, have also this commissure smaller. In man, in whom the cerebellum is so large, the commissure is particularly broad, covering the origins of many of the nerves which are exposed in other animals. This commissure does not exist in fishes, reptiles, and birds, because these animals have no lateral parts to their cerebellum. But all animals have a commissure of the part which I have called fundamental portion, independent of the commissure of the lateral parts. This commissure is formed by the soft and fine fibrous layers from the superior and inferior parts of the fundamental portion, commonly called the superior and inferior valves.

COMMISSURES OF THE BASIS OF THE BRAIN.

The uniting fibres of the inferior convolutions of the posterior lobe, and those of the posterior convolutions of the middle lobe, bend behind the crura of the brain, and behind the pretended optic thalami, go from every side toward the middle line in an oblique direction, and are joined together. The internal convolutions of the posterior lobe give off the uniting fibres, which are named the posterior fold of the corpus callosum, the other uniting fibres of these convolutions form the fornix with its lyra or psalterium, which, according to anatomists, is composed of both the lateral parts of its lower surface. The uniting fibres of the anterior convolutions of the middle lobe form the nervous cord which passes through the corpora striata without being adherent, and both sides present, in man, the figure of a bow, the convex part of which is directed forward. The direction of this bow is quite opposite in animals; in them the convex part is directed backward. Anatomists called this cord commissura anterior (*Pl.* II. *fig.* 2. 61). The inferior convolutions of the anterior lobes have their commissures in what is called the anterior fold of the corpus callosum. The anterior and posterior folds of the corpus callosum are adapted to the cavities which extend between the inferior and superior convolutions of the posterior and anterior lobes.

COMMISSURES OF THE SUPERIOR CONVOLUTIONS OF THE BRAIN.

All the superior convolutions of both hemispheres of the brain have their uniting fibres in the great commissure or in the corpus callosum (*Pl.* II. *fig.* 2. λ μ λ). This commissure, as well as all the rest, must be proportionate to the size of the parts from which it is produced. Therefore it is much smaller in sheep, dogs, oxen, &c. than in man. As both hemispheres of the brain are separated both behind and before, the uniting fibres of the convolutions, between these separations, cannot join in a transverse direction, but the uniting fibres of the posterior convolutions run forward and inward, and those of the anterior convolutions run backward and inward. On this account also, the uniting fibres are more numerous at both extremities of the corpus callosum; and, as the posterior separation of the hemispheres is more considerable than the anterior, the posterior extremity of the corpus callosum is also thicker. In the middle region, however, of the corpus callosum, the direction of the uniting fibres is transverse.

Anatomists are wrong in maintaining that birds are destitute of the corpus callosum and of certain commissures. The cause of their error is the smallness of the commissures in birds. The commissures however are proportionate to their respective parts, and the same principle exists in all animals. All double nervous parts are united, and only the form, size, and direction of the uniting fibres offer various modifications.

CONVOLUTIONS.

We have seen that the bundles of the corpora striata and thalami pursue every variety of direction, that is to say, toward the fore and lateral, the back and upper parts. At the bottom of the convolutions, the radiating or diverging and converging filaments cross one another and form a tissue, from which they are afterward disengaged. Beyond this tissue, each duplication may be easily separated into two layers (*Pl.* III. *fig.* 1. II. 1—2. 2, 1—3), and as this may be done in all the convolutions, it follows, that if the tissue be destroyed by a rude kind of manipulation, or extended by a gentle action of a constant force, as in hydrocephalus, all the duplicatures will be transformed into a kind of membranous expansion, covered externally by grey substance. A person affected with hydrocephalus, of 54 years of age, first excited us to examine the structure of the brain in general, and of the convolutions in particular. It is a common opinion, that in hydrocephalic persons, the brain is disorganized or even annihilated. But this hydrocephalic patient manifested her faculties in a pretty high degree; and several similar examples are recorded. The conclusion, that the brain is by no means destroyed in those hydrocephalic persons, who manifest their moral sentiments and intellectual faculties, is unavoidable.

Now in a large hydrocephalus, the upper convolutions do not appear: a membrane only is discovered, the fibres of which are horizontal, while the fibres of the convolutions in the natural state keep a vertical position from the basis to the top. It unavoidably follows, that in hydrocephalus the convolutions are separated into two parts. This is more probable, because the membrane of the cerebral mass is very thin, and covered on the external surface with grey substance. Nay, it is possible to imitate the extension or unfolding of the convolutions, by taking away the arachnoid and vascular coats, by introducing the fingers into the great cavities, and by pressing against the convolutions. At first a little resistance is felt on account of the tissue above mentioned; but beyond this tissue the two layers of the convolutions are easily separated from each other. This unfolding of the convolutions has been very strongly contested. The French Institute stated, that their reporters found that the convolutions would separate into two lateral portions, as easily on one side of the middle line of each convolution, as in the middle line itself.

This is incorrect, and the contrary is easy of proof. Vertical slices of the convolutions, macerated in nitric acid diluted with rectified alcohol, or in pure alcohol, become hard, and are more easily divided at the middle line. The separation into two layers is exhibited, when the convolutions are boiled for 12 or 15 minutes in oil. When we blow on such a slice, or direct a small stream of water on it with a syringe, the separation may be made very easily in the middle; but not at all at the sides, without obviously destroying the structure of the fibres. In the two latter cases especially, the two surfaces which are separated remain smooth, there is no division of vessels, nor any traces of fibres passing from one side to the other. Consequently the existence of the two layers of the convolutions must be admitted. However, it may be that between them there exists an adhesion of contiguity, maintained perhaps by a fine cellular substance, but by no means a connexion of continuity, produced by an intermixture and confusion of substance. The junction of the two layers may be denominated agglutination, but not concretion.

INTERMEDIAL LAYERS OF THE COMMISSURES.

There are different objects which belong to the structure of the brain, but the uses of which are unknown. We have seen that all the nerves of both sides are united, but it is not certain that the similar parts of both cerebral hemispheres are in immediate contiguity; for there is, in the middle line of all commissures, a layer of transverse fibres, which are accompanied in the same direction by blood-vessels. Bonhomme, Tarin, Vicq d'Azyr, and Soemmerring, have demonstrated this structure in the corpus callosum. I find that the direction of these intermedial fibres is always opposite to that of the fibres which seem to be separated. It is transverse between the ascending bundles (*Pl.* II. *fig.* 2. 86, 87, 88, 90) in the midst of the corpus callosum; between its horizontal fibres it is vertical (*Pl.* II. *fig.* 2. μ); and, in the anterior and posterior parts of the corpus callosum, it is divergent in radii. (λ λ) These intermedial fibres produce what is called the raphe of the corpus callosum.

SEPTUM LUCIDUM.

The septum lucidum may be considered as the continuation and expansion of a fibrous bundle, like a band between the anterior and middle lobes (*Pl.* I. *fig.* 1. 63). It is in communication with the intermedial fibres of the corpus callosum (*Pl.* II. *fig.* 2. 57, 58, 59).

TRANSVERSE BANDS.

In plants there exist transverse layers of fibres, at different places where they are increased. This arrangement is very evident in straw. There are rings and transverse fibres, which however do not interrupt the communication of the superior and inferior parts. A similar arrangement is also observed in the structure of the brain. At every point of considerable increase there is a transverse band, for instance, at the lower end of the corpora olivaria;—in the midst of the crura cerebri (*Pl.* III. *fig.* 1. 34);—at the external margin of the optic nerve (35);—between the thalami and corpora striata (37);—and at the external margin of the corpora striata (38).

CORPORA CANDICANTIA.

The corpora mammillaria, or candicantia, are separated one from another in man (*Pl.* I. *fig.* 1. *Pl.* II. *fig.* 2. 16); in animals they adhere one to another, and seem to form only a single tubercle. Every corpus mammillare contains three cords, two internal and one external. This latter is joined to the transverse band under the optic nerve; the internal anterior cord is in connexion with the anterior crus of the fornix; the internal posterior sinks into the interior of the thalamus, and is united to another transverse band.

PINEAL GLAND.

The pineal gland (*Pl.* II. *fig.* 2. E.) bears a name which is acknowledgedly inaccurate. It is not a gland, but composed of grey and white substance. Four nervous threads are produced in it. Its name pineal results from its mechanical form, which somewhat resembles a cone of a pine or fir.

CAVITIES OF THE BRAIN.

The cerebral parts are separated one from another at different places. These intervals are called cavities or ventricles. Anatomists speak of five ventricles; but the fifth has no analogy to the others. It consists of the interval between the two layers of the septum lucidum. Every anfractuosity, the interval between the two hemispheres, and that between the anterior and middle lobe, would, as well as it, deserve the name of ventricles. The four other cavities are in communication one with another; therefore they cannot be considered as separate cavities. We neglect their numerical order as first, second, third, and fourth, and call them according to their situation. The fourth ventricle of anatomists is the interval between the fundamental portion of the cerebellum and the medulla oblongata (*Pl.* II. *fig.* 2. *m m*). By means of the canal before the fourfold tubercles, called the aqueduct of Sylvius (*Pl.* II. *fig.* 2. φ), it communicates with the third ventricle, that is, the interval between the thalami (M M). The lateral or great cavities are in the interior of the hemispheres forward, backward, and in the middle lobe, consequently in the interior of the lobes.

COMMUNICATIONS.

Besides the separate and independent origin of every nervous part, and the commissures or unions of every nervous part which is double, there is to be considered another nervous apparatus, which I call communicating branches, or nervous apparatus of communication. By this means particular nervous parts are brought in communication, and therefore placed under mutual influence. In the lower classes of animals, the different ganglia are joined to each other by particular nervous cords. In the higher classes of animals, it is the same with the different ganglia and plexus of the nerves of the abdomen and thorax. These nervous systems communicate with every pair of spinal nerves, with the five senses, and with the cerebral parts. The various pairs of spinal nerves adhere one to another; and they are all concatenated by a longitudinal cord, visible at the bottom of the posterior fissure, throughout the whole length of the spinal marrow. The nerves necessary to motion are brought in communication with the nerves of the five senses, and both these kinds with the cerebral parts. This communication of the different nervous parts is always adapted to their mutual influence. The five senses and all the cerebral parts are in communication with the nerves necessary to motion. The five senses communicate also with certain cerebral parts more than with others; for instance, the nerve of taste is in nearest communication with the nerves of mastication, deglutition, and respiration. The auditory nerve is in more intimate connexion with the nerves of hunger and thirst, of the voice, of taste, and with the organs of propensities and sentiments, than with the organs of the intellectual faculties. The optic nerve, on the contrary, has the greatest communication with the organs of the intellectual faculties. Finally, all the cerebral parts adhere one to another; but certain parts are connected more intimately than others. These considerations will be better understood, if the different faculties of the mind and their respective organs be demonstrated. Then they are of the greatest necessity for the elucidation of the mutual influence of the different faculties.*

RECAPITULATION.

In this chapter I have developed our method of examining the structure of the nervous system; I have demonstrated the necessity of admitting as many origins as there are various nervous masses; I have pointed out the proportion of the grey and white substance in the nervous system, and their relation. Moreover, I have considered the different structure of the nervous parts of the abdomen and thorax, of the spine, of the five senses, of the cerebellum and brain; I have shown the general principle of commissures or unions of all nervous parts which are double; and I have proved the communication of the different nervous parts one with another, and especially of those which exert the

* Those who make a study of anatomy, and want more details, will find them in the first volume of our large work, entitled, "Anatomie et Physiologie du Système nerveux en général et du Cerveau en particulier." There they will find also every particularity exhibited, by plates, in their natural size.

greatest influence upon each other. It follows that all nervous parts are formed and perfected in the same manner; that our considerations are general and simple; and that this conformity of all the established principles bears the character of truth.

PART II.

PHYSIOLOGY OF THE NERVOUS SYSTEM.

CHAPTER I.

INNATENESS OF FACULTIES.

THE first question perhaps in Anthropology is, Whence has man his faculties? Is man born indifferent; or does he come into the world endowed with determinate faculties? Before I answer this question, I shall make some general observations.

From the remotest antiquity, philosophical inquirers have divided beings into creative and created. These last were subdivided into spirit or soul, and matter. The word spirit was given to every being that did not fall immediately under the senses; namely, which was not palpable, tangible, measurable, or visible. Every thing, on the contrary, which possessed these qualities was called matter. Thus this division into spirit and matter was founded on the density of beings. Several beings therefore, which formerly passed for spirits, must actually be considered as matter.

According to the definition of spirit, it is evident that we never can have the least notion or conception of its nature; and we are therefore obliged to content ourselves with the knowledge of material beings. We are acquainted with the existence of spirits, only in as far as their phenomena or manifestations fall under our senses.

Material beings offer to our consideration matter itself and phenomena. Now it is not easier to acquire any knowledge of the nature of matter itself than of spirit. Thus we can only inquire into phenomena. In ancient times, all phenomena were considered as effects of the operation of spirits or souls. All motions and actions of stars, plants, and animals, were thought to be produced by them: hence, their multitude according to Thales, Pythagoras, and others. Matter, according to this system, was considered as inert.

The philosophers who treat of spirits may be ranged into two classes: into those who consider them as material, for instance, Zeno and the Stoics; and into those who admit an immaterial principle. These latter admit in man either several principles, or one single soul; yet it is to be observed, that in man never more than one principle was considered as immaterial. Pythagoras, Alcmeon, Plato, and others, speak of one rational soul, and of one irrational soul, in man. Aristotle, Galen, and their disciples as far down as the 17th century, attributed to the soul all the operations of life. Thomas Aquinas attributed to it an unbounded power over the body. Borelli, Robinson, Cheyne, Mead, Porterfield, and others, considered the soul as the efficient cause of the organization. Swammerdam, Perrault, and Stahl, honoured the soul as the guardian of health, or the cause of disease.

On the other hand, it is also an ancient doctrine, that every atom is endowed with a primitive property. Philo the Jew taught this doctrine. Several other philosophers considered all phenomena as produced by the form and mixture of the bodily organization. This opinion was openly maintained by Democritus, Heraclides, Epicurus, Asclepiades, Hippocrates, Erasistratus, and others. The expressions of Thales, Pythagoras, Empedocles, and Heraclitus, are not distinct and determinate enough to enable us to decide whether they believed in an immaterial soul or not.

The doctrine, that every thing is provided with its own properties, was from time to time checked by metaphysicians and scholastic divines; but by degrees it gained ground, and the maxim that matter is inert, was entirely refuted. Natural philosophers discovered corporeal properties, the laws of attraction and repulsion, of chemical affinity, of fermentation, and even of organization. They considered the phenomena of vegetables as the production of material qualities—as properties of matter. Glisson attributed to matter a particular activity, and to the animal fibre a specific irritability. De Gorter acknowledged in vegetable life something more than pure mechanism. Winter and Zups proved that the phenomena of vegetable life ought to be ascribed only to irritability. Of this, several phenomena of flowers and leaves indicate a great degree. The hop and French bean twine round rods which are planted near them. The tendrils of vines curl round poles or the branches of neighbouring trees. The ivy climbs the oak, and adheres to its sides, &c.

Now it would be absurd to pretend that the organization of animals is entirely destitute of properties: therefore Friederick Hoffmann took it for the basis of his system, that the human body, like all other bodies, is endowed with material properties. Whytt, Sauvage, Hartley, Unzer, Charles Bonnet, and others, maintained that all automatic functions are produced without consciousness, and that in this sense the seat or residence of the soul is extended over the whole body. The writings of Isenflamm, Cullen, Musgrave, De la Roche, Thaer, Schaeffer, and many others, present similar considerations.

It follows that the functions of man must be divided into two classes: into those which are produced by means of the organization alone without consciousness—*automatic life;* and into functions which take place with consciousness, and which are the effect of the soul—*animal life.*

Now may we answer the question, whether man is born indifferent, or whether his nature is determinate. First, the faculties of automatic life, being considered as the effects of the organization, must be innate and determinate, because the organization itself is innate. These faculties being common to man and animals must be innate in man as well as in animals. In general, man, participating in the nature of all other beings, of minerals, plants, and animals, and being therefore a microcosm, must possess all the properties common to him and to other beings. The body of man consists of matter: hence it is subjected to all the laws of matter. It is attracted towards the centre of the earth, and if it be not supported, it falls as every inanimate body does. It is impenetrable, and is crushed by violent pressure like matter in general. It has figure and extension; it possesses all the other physical and chemical qualities; and in order to explain a great number of the functions of man, it is necessary to know the laws of physics, mechanics, and chemistry. Moreover, the organic life of man, and that of plants, is supported by the same circumstances, namely, by the influence of caloric, air, light, food, &c. Plants are produced from germs, which formerly made part of a similar being; they take food, convert it into their proper substance, increase, decrease, and die. This comparison of man with plants takes place not only in respect to the healthy state, but even to the state of disease. It is certain that various diseases in man are explicable by certain laws of nutrition, which are observed in plants. If too much food be given to a peach-tree, its bark bursts, grows rough, and secretes gum. In the same manner, a person who is too well nourished has a red countenance, pimples, boils, and various eruptions on the skin. Wounds heal in man as in plants. Strip off the bark of a branch; it falls down, as a bone deprived of its periosteum. A smooth circular cut in a plant heals sooner and better than a lacerated wound. The healing of wounds begins from the margin both in man and in plants, &c. In the same way all the organic laws of animals are preserved in man; and the constituent parts of animals are much more analogous, than the parts of plants, to those of man. Their bones, muscles, viscera, arteries, veins, and nerves, perform the same functions. Hence, all the faculties of man, which contribute to the production and reproduction of the organization, namely, all the faculties of automatic or organic life, are innate.

In former times there were philosophers who thought that the soul forms its own body; but, if this be the case, an ill formed body never could be endowed with a good soul. All the natural influence of generation, nutrition, climate, education, &c. would therefore be inexplicable. Hence, it is much more reasonable to think that the soul, in this life, is only confined in the body, and makes use of its respective instruments, which entirely depend on the laws of the organization. In blindness, the soul is not mutilated, but it cannot perceive light without eyes, &c.

Let us now examine whether the faculties of animal life, *viz.* those which act consciously, are also innate? These faculties may be subdivided into four orders: into voluntary motion; into the five external senses; into propensities and sentiments; and into the faculties of the understanding. According to the principle above mentioned, that when animal life presents any point of contact between man and animals these common faculties are innate, it is evident that voluntary motion must be considered as innate or given by nature. The five external senses are also inherent in the nature of man and animals; and these senses exert essentially the same functions in man and animals. No one will endeavour to prove that the five senses are the production of our will: their laws are determined by nature. Therefore as soon as an animal meets with the food destined for it, its smell and taste declare in favour of it. Thus it is not astonishing that a kid, taken from the uterus of its mother, preferred broom-tops to other vegetables which were presented to it. And Richerand is wrong in saying, "If such a fact have any reality, we should be forced to admit that an animal may possess a foreknowledge of what is proper for it; and that, independently of any impressions which may be afterwards received by the senses, it is capable, from the moment of birth, of choosing, that is, of comparing and judging of what is presented to it." The hog likewise eats the acorn the first time he finds it. Animals however have, on that account, no need of any previous exercise, of any innate idea, of any comparison or reflexion. The relations between the external world and the five senses are determined by creation. We cannot see as red that which is yellow, nor as great that which is little, &c. How should animals have any idea of what they have not felt?

It results from these considerations, that the comparison of man with other beings (not merely with animals, but also with plants and minerals) must be admitted, and cannot be repugnant to our feelings, because he participates of their properties. He, who thinks that such comparisons degrade mankind, should be aware that the greatest natural philosophers, moralists, and divines, have maintained the same opinion; as St. Gregorius Nyssenus, St. Augustin, Bonnet, Pascal, Condillac, and others. Herder was right in saying "that it is incontestable that all living beings are created conformably to certain laws of analogy."* It is only to be considered that the inferior properties are preserved in the beings of a higher order, modified only by superior faculties. In this manner man unites all physical, chemical, vegetable, and animal laws; and it is only by particular faculties that he acquires the character of humanity.

I have still to examine the origin of the propensities, sentiments, and intellectual faculties. There are three modes of explaining this matter: Man and animals acquire their propensities, sentiments, and intellectual faculties, either by external impressions, or by internal causes. In this latter respect, either one or several general faculties produce all particular faculties; or each special faculty is determinate, and given by creation. I shall first demonstrate that external influences are not the cause of the internal faculties of the mind.

* Ideen zur Geschichte der Philosophie der Menschheit. T. II. p. 126.

On external Influences considered as the cause of the Faculties of the Mind.

EXTERNAL CIRCUMSTANCES.

There are a great number of authors who maintain that the faculties of the mind, instead of being innate, result from external circumstances and accidental events. "Demosthenes," says Helvetius, "became eloquent because he heard Callistratus speak, whose eloquence made so deep an impression upon his mind that he aspired only to this talent." According to the same author, "Vaucanson became famous in mechanics, because, when yet a child and being obliged to stay alone in the waiting-room of his mother's confessor, he found there a clock, examined its wheels, and by means of a bad knife endeavoured to make a similar machine of wood. He succeeded, and therefore he constructed such surprising machines as his automatons. Milton would not have composed his poem of Paradise Lost, had he not lost his place of secretary to Cromwell. Shakspeare composed his tragedies because he was an actor; and he became an actor because he was forced to leave his native county on account of some juvenile errors. Corneille fell in love and made verses for the object of his passion, and therefore he became famous in poetry. Newton saw an apple falling, and this fall revealed to him the law of gravitation. It is daily observed that revolutions produce great men, &c."

In this manner of reasoning the origin of the faculties is confounded either with the opportunity necessary for their activity, or with some external excitement. It is certain that external circumstances must be presented, otherwise internal faculties cannot act; but opportunities do not produce faculties. Without food I cannot eat; but I am not hungry because there is food. A dog cannot hunt if it be shut up, but its desire of hunting is not produced by leading it into the fields. The same circumstances are often presented to many millions, and perhaps one single individual alone makes use of them. Revolutions make great men known, not because they produce the faculties, but because they offer opportunities and subjects necessary to the faculties. Circumstances are often very favourable to the attainment of distinction and the acquisition of celebrity, but we do not see that every individual attains an honourable place. It is certainly not sufficient to be an actor in order to compose tragedies like Shakspeare. How many children are exposed to the same influences without manifesting the same energy of faculties. Several individuals, on the contrary, not only make use of the present circumstances, but they prepare and produce events which admit a still greater activity of their faculties.

On the other hand, it is true that our faculties are often excited by external events, and that without this external excitement our faculties would remain inactive. However useful therefore may be the consideration of great models, I am still convinced that in every science, in every art, in every occupation, the principles of each are easily conceived by those who possess the corresponding faculties in a high degree. This is the case even with moral principles and with religion. These superior sentiments are easily excited if the innate dispositions be conformable.

SOCIETY.

A great number of works treat of the natural state of man in opposition to his state of society, and of many qualities which are considered as the result of social life. According to this hypothesis, man is made for solitude, and the social state is in opposition to his nature. It is added, that many virtues and vices of man would never have existed, had he not abandoned his natural state of isolation. Excepting certain idiots however, where, and at what time, has man lived a solitary being? According to history, man lived always in society, at least in families; and the families, though scattered in woods, formed communities. Thus, as we find mankind every where united in society, is it not natural to conclude that man is a social being? It is necessary to know that, in this respect, there are two kinds of animals: several species are destined to live in society, as sheep, monkies, dogs, hogs, geese, crows, &c.; others to live solitary, as the fox, hare, magpie, &c. Man belongs to the social class. Now it is certainly conceivable that the social animals are endowed with faculties destined for society, and that these faculties can never act without society; for every individual is upon the whole calculated for society, and all the faculties must be appropriated to this end. Bustards and cranes place sentinels; a flock of wild geese form a triangle in flying; a flock of chamois is led by a female; the honey-bees act in concert, &c.: and all these properties are given to animals at the same time with the social instinct. Consequently society itself is a natural institution established by creation, and the faculties, which are observed in social animals, are not at all the result of society. This assertion is also proved by the observation that social animals have quite different faculties; but if society produced any number of the faculties of man and animals, every kind of social animal ought to possess them.

WANTS.

Wants, that is, disagreeable impressions, misery, poverty, painful situations, are often considered as the source of the instincts, propensities, sentiments, and intellectual faculties of man and animals. It is certain that external wants, in this signification, excite the internal faculties, but it is not true that these external wants produce them. For, according to this supposition, the same external wants ought to produce the same faculties in animals and in man. But we observe that not merely every kind of animal, but even every individual, acts and conducts itself differently against external impressions, and always according to its internal faculties. The partridge dies from hunger and cold during sharp winters, and benumbed sparrows fall from the top of the house, while the nightingale and quail have gone into temperate climates before the season of hunger and thirst has arrived. The cuckow wants a nest to lay its eggs in as well as the wagtail or the redbreast, yet it builds none. The idiot makes no effort in order to prevent the injuries of the air and to preserve himself, while the reasonable man covers himself with cloathing. Moreover, the faculties are active in animals and man without any external necessity. The beaver, although shut up and defended against the injuries of the weather, builds its cottage. The weaver bird, though in a cage, makes its tissue. It consequently follows that external wants only excite the activity of the internal faculties, but do not produce them; and in this respect their influence is important. The faculties of poor persons, for instance, are more active than the faculties of those who live in plenty; but if the faculties have not been given by nature, external wants cannot excite them.

The expression *want* has still another sense, that of propensity or inclination. Want, in this signification, is evidently the effect and not the cause of the internal faculties; and, in this sense, there are as many wants as there are different faculties themselves. These wants are also proportionate to the activity of the faculties.

CLIMATE AND MODE OF LIVING.

Several philosophers have advanced that climate, manner of living, and even the nurse's milk, might be the cause of our faculties. According to this manner of thinking, the modifications of our faculties are confounded with their primitive origin. These external influences can neither produce nor annihilate determinate faculties: the special faculties are given by creation. This opinion must however be considered. It proves only that the manifestations of our faculties depend on our organization; for climate, eating, drinking, &c. have a powerful influence over the organization. Instead therefore of denying the influence of climate, food, air, light &c. we consider it as very important, but only in respect to the activity of the faculties. The milk of nurses contributes certainly to the increase and organic constitution of children, and consequently to the manifestations of the moral and intellectual faculties, in as far as the body is necessary to these manifestations, but all these external influences cannot produce any faculty. If parents were right in attributing the inferior propensities of their children to nourishment, why might not grown-up persons, who live upon beef, veal, mutton, pork &c. accuse the ox, the calf, the sheep, or the pig, for their own want of intelligence, and for their peculiar character? Dietetics must be still improved. They ought to determine the influence of external impressions upon the organization, according to the different constitutions or temperaments, which it affects; and they ought to point out what external influences—what food, climate, &c. act more upon the nervous than upon other systems. The activity of our faculties varies according to the modifications of the organization, in the same way that the milk and butter of cows vary according to the food they live on; or as the flesh and fat of fowls, and other animals, are modified according to the food by means of which they are fattened. The activity of men fed on game differs much from that of those who live upon potatoes and vegetables. It seems moreover possible to show the greater influence of different aliments upon certain systems in the healthy state, just as we may show that some medicaments act more upon one system than upon another. By the same reason we may also conceive why certain rules of fasting are useful in order to subdue the sensual appetites. Certain degrees of excitement suppress the activity of certain faculties while they increase that of others.

Climate has certainly a great influence upon the organization, and it seems natural that certain climates contribute more than others to the developement of certain faculties. Its influence however does not seem so powerful in mankind as in animals. Man by his intellectual faculties opposes its influence. Of this the Jews are an evident proof. This people is dispersed over the whole world, and yet their primitive and characteristic organization is preserved in all countries. The effect of innateness and propagation from parents to children is much stronger than that of external influence. In determining therefore, that, according to climate and nourishment, the faculties are more or less active, the primitive origin of the faculties, and their greater or less activity, must not be confounded.

EDUCATION IN GENERAL.

Finally, education has been particularly considered as a cause of the faculties of the mind. According to this opinion, not only man but also animals are born without determinate faculties—indifferent—as tabulæ rasæ or blank paper. All the instincts and aptitudes of animals, from the insect to the dog and elephant, are the effects of instruction. Foxes hunt because they learn it from their parents; birds learn to sing; and man becomes man by education. It must be answered that neither in animals nor in man does education produce any faculty whatever.

CONSTANCY OF ANIMALS AND MEN.

If animals be susceptible of all impressions around them, so that these impressions determine their character and nature, why does every kind of animal always preserve the same nature? Why does not the hen learn to coo when she is brought up with pigeons? Why does not the female nightingale learn to sing like the male? Why do birds hatched by those of different species imitate the habits and instincts of their parents? Why does the young duck, hatched by a hen, run towards the water? Why does not the cuckoo sing like the bird that hatched and nourished it? When young squirrels and rabbits are pursued, why do squirrels climb upon trees and rabbits hide themselves in burrows? Why are dogs attached to their masters notwithstanding the blows they receive, and which ought to produce the contrary effect? &c. It is true that the actions of animals are not confined solely to what their preservation requires. They are susceptible of several modifications: they modify their manners according to the position wherein they live; they are susceptible of an education beyond their wants. Hence horses, monkies, dogs, cats, rats, harts &c. can be instructed to play various tricks. Still however this power of modifying their manners is not unbounded, but conformable to their nature. Pigeons and roes never can be made to hunt like falcons and dogs.

It is the same with man. If human faculties be the result of external influences and education, why does not man imitate the nature of different animals? Why does he preserve, at all times and in all climates, his characteristic nature, and his primitive qualities? Young children pass the most of their time with their mothers and nurses, and consequently with women; yet boys and girls show, from the earliest infancy, their distinctive character. And this difference between the sexes continues for life.

GENIUSES AMONG ANIMALS AND MEN.

If animals and men learn all functions from other individuals, why do several individuals excel others which have absolutely the same manner of living, and the same instruction? Why does one nightingale sing better and more constantly than another in the same wood? Why, amongst a drove of cows, oxen, or horses, is one individual good-natured and meek, and another ill-natured and furious? M. Dupont de Nemours had a cow which alone understood to open the enclosure of a field: none of its companions learned to imitate its manner of proceeding; but being near the entrance waited with impatience for the arrival of their leader. A hunting dog, when he was hindered from taking a good place near the fire, from his companions occupying every surrounding place, went out into the yard and barked: immediately all the other dogs did the same; and then he ran in and took the best place near the fire. Though he often deceived his companions, none of them was capable of imitating his stratagem. A little dog, when he was eating with several large dogs, behaved himself in the same manner, in order to secure his portion, or to catch some good bits. Such genius is not the result of instruction.

Children sometimes show particular dispositions and faculties before they have received any kind of instruction. Almost every great man shows in his infancy the character of future greatness. Achilles, hidden in Pyrrha's clothes, took the sword from among the presents of Ulysses. Themistocles, when still a child, said that he could increase a state and render it powerful. Alexander would not dispute any prize at the Olympic games, unless his rivals were kings. At fourteen years of age, Cato of Utica manifested the greatest aversion from tyranny. Nero was cruel from the cradle. Pascal, when twelve years old, published his treatise on conic sections. Voltaire made verses when only seven years of age. The number of such examples is very great: it is not necessary to multiply them, as they must be within the scope of every one's knowledge.

INDIVIDUALITY.

All individual animals of the same kind show something particular. Every young bird of the same brood does not learn to sing with the same facility. One horse is more fit for the race than another. Sportsmen know very well that there is a great difference among dogs, &c. It is the same with mankind. Children of the same parents are entirely different, though their education is uniform. How could the same education produce all the particularities of different children. I shall afterwards prove that education has a great influence upon the majority of persons whose faculties are middling, who have no determinate vocation, and who repeat what they hear, and do what they see done by others. Yet notwithstanding the same education, every individual preserves some peculiarity in his character, in his manner of feeling and thinking: so many men, so many minds. Moreover, if education could produce faculties, why have instructors not yet found the means of conferring understanding, judgment, and good qualities in general? Why are we not all men of genius? Why are we obliged to lament so many errors and crimes? Why cannot moral and satirical discourses prevent the abuses of our faculties.

Objection.

In order to prove that man acquires all his moral and intellectual faculties by education, it is asserted that savages who are found in woods, destitute of all human faculties, are like beasts, only because they have not received any education. This objection is refuted, as soon as the condition and state of these pretended savages are known. These unfortunate creatures may be referred to two classes. Ordinarily they are wretched persons of a defective organization, with heads too large, being increased in size by dropsy of the brain; or they have heads too small and deformed. These individuals have almost always scrofula, hanging lips, a thick tongue, a swollen neck, a bad constitution in general, a wavering and unsteady gait; they are more or less completely idiots. They generally consist of persons who have been exposed and given up to the care of Providence, because they were burdensome to their parents. In certain countries, the lower classes of people consider such unhappy creatures as bewitched, and take no care of them. Often these idiots have a determinate propensity to live alone in woods, and they consequently escape. At Haina near Marbourg, where there is a great hospital, we were told that several idiots had escaped, and on sending people in order to seek and catch them, other idiots who had escaped from other places were found. In a castle near Augsburgh, we saw a mad woman who had been found in a wood. At Brunswick we saw a woman, who was found lying on her side in a forest, but was incapable of pronouncing a single word. The pretended savage of Aveyron, who is kept in the Institution of Deaf and Dumb at Paris, is an idiot in a high degree. His forehead is very small and much compressed in the superior region: the eyes are little, and lay deep in the orbits. We could not convince ourselves that he hears; for it was impossible to make him attentive to our calling him, or to the sound of a glass struck behind him! His attitude and manner of sitting are decent, but his head and body are incessantly in motion from side to side. He knows several written signs and words, and points out the objects noted by them. The most remarkable instinct in him is, the love of order. As soon as any object is displaced, he puts it in order.

Such unfortunate creatures therefore are idiots, not because they have not received any education, but because they cannot be educated on account of their imbecility. It is difficult to conceive that in our populous countries, a well organised person should long wander about like a savage, without being discovered. However, if a well organised individual, who has escaped in his infancy, be discovered in a forest, though he cannot be acquainted with our manners and determinate education, yet he will manifest the essential and characteristic faculties of mankind; and such an individual, living in society, will soon imitate the manners and receive the instruction of others. The girl of Champaigne proves this assertion.

Thus education produces no faculty either in man or in animals: but let us not draw the conclusion, that education is superfluous. After having considered all the innate faculties of the mind, I shall examine what education does; and I shall prove its importance. It is certain that education cannot produce any faculty. It only excites, exercises, guides and determines the uses, and prevents the abuses of the different faculties. In this respect, education is of the highest importance. It is evident in countrymen and peasants, who are confined to their occupations. They are ignorant; yet many of them might surpass many citizens in every kind of aptness and science, had they received a good education.

It results from all these considerations relative to external influence, that the internal faculties are not produced by them, but that the doctrine of external impressions as causing the faculties of the mind, may be reduced to two propositions. Either the external impressions present some opportunity for the activity of the faculties, or they excite and guide the faculties; but in no way do they produce them.

The second way of explaining the origin of the faculties of man and animals is to admit an internal cause. The meaning however of these authors must be subdivided, because several authors admit one or more primitive faculties, which they say produce all the special faculties. Others maintain that every special faculty is innate. Let us first consider the doctrine, that one or several general faculties produce all other special faculties.

ATTENTION.

Attention is commonly considered as the cause of all internal faculties. Helvetius even said, that each well organised person might exercise his faculties by means of his attention, with so great a success, as to arrive to the first rank. By the expression, well organised person, can only be understood those who are not born idiots; consequently according to this opinion, the first and most important faculty, *viz.* attention, on which all other faculties depend, depends itself on the organization.

The word attention has two acceptations. It denotes consciousness in general, and in this sense attention accompanies the activity of every faculty. Thus may it be explained why one animal or man pays great attention to one object, and very little or none to another. Sheep will never pay attention to philosophy nor theology. The squirrel and pigeon perceive a hare pass with indifference, while the fox and eagle watch for it. Different individuals are attentive to different objects, even according to their sex and age. Among children, girls prefer dolls, ribands &c.; boys take horses, whips and drums. Among adults, one is pleased with philosophical discourses, another with witty replies; one with events which touch the heart, another with sanguinary battles. Attention in this sense is also proportionate to the activity of the respective faculty. If therefore the five senses be not exercised, much greater impressions are necessary to excite their attention. The attention of every faculty may be cultivated and improved by the exercise of the particular faculty; but by one particular faculty general attention cannot be exercised.

Attention denotes also a distinct consciousness, a reflection on our sensations and actions. The aptitudes and instincts of animals, however, are certainly not the effect of this kind of attention. Nobody will maintain, that the rabbit, badger, mole, marmot, or hamster, make burrows because they have examined with attention the advantages of them; or that the beaver builds a cottage because it has studied the laws of mechanics. Among men, geniuses burst forth before they are conscious of their talent. This kind of attention may excite the particular faculties, but it never produces them.

PAIN AND PLEASURE.

There is an ancient doctrine which teaches that pain and pleasure, desire and aversion, are not only the source of all actions, but also of all faculties. Let us briefly examine it. Pain and pleasure, desire and aversion, are general expressions, and belong to all faculties. Every faculty, being active, desires; and man and animals desire the objects relative to their faculties. The dog has the desire of hunting, the beaver that of building. Hence the desires are as different as the faculties, and the energy and number of desires are proportionate to the activity and number of the faculties. It is the same with pain and pleasure. Every faculty being satisfied perceives pleasure; and every faculty being disagreeably affected feels pain: consequently the kinds of pain and pleasure are as numerous as the faculties. One individual delights in generously pardoning offences, another in taking revenge. One is happy in the possession of riches, another glories in disdaining the vanity of mankind. It follows that pain and pleasure are the result, and not the cause, of the particular faculties.

PASSIONS.

Helvetius and several others consider the passions, principally the love of glory or ambition, as the source of faculties. Let us examine their doctrine. The expression, *passion*, has different significations: sometimes *passion* is confounded with the affections in general; or it signifies the highest degree of activity, or it denotes any special faculty. *Passions* in the sense of affections, as anger, envy, shame, affliction, joy &c. are only modifications of the sensations, and cannot produce the faculties whose modified actions they are. *Passions,* as the highest degree of activity of any faculty, produce evidently great phenomena. Every faculty which is extremely active, whether by its own power and internal energy, or by external excitement, will perform actions which are impossible in the ordinary state of activity; but it follows also, that the faculties are not the effect, but the cause of the passions. Finally, *passions* as particular faculties, for example, love, glory, pride &c. may excite the other faculties, but they never can produce them. Many individuals have emulation, but they do not therefore excel in any particular talent. This point will be better understood when I speak of the mutual influence of the faculties. Here I shall make two secondary observations in respect to the passions. The factitious passions spoken of in different books do not exist. All faculties are innate; their highest degree of activity ought to be called passion; and every passion presupposes a primitive faculty: therefore the passions are as different as the faculties.

Locke and many modern writers maintain that children are destitute of passions. It is true there is one passion in adults which is not observed in children, the passion of love. There have been, however, some individuals who at three or four years of age have felt passionately this propensity; but in general the greater number of inclinations manifest themselves with energetic activity in children. The opponents of our doctrine, for the most part, confound the objects upon which the particular faculties act at different ages, with the inclinations themselves. Children it is true, have no inclination to defraud the orphan of his inheritance, or to conquer kingdoms; but they will deceive one another for a bird's-nest; they will fight for play-things, and they are proud to occupy the first place at school: young boys are even more grieved by the loss of a bird, than when grown up they are sorry for that of a horse. Some qualities are even more active in children than in adults, while other faculties are more energetic in adults than in children. Hence passion, in the signification of the highest degree of activity, in general takes place in children, and but very few faculties are quite inactive in them. This is also the case with other faculties in adults. Thus it is necessary to speak more precisely, and to indicate the faculties which do not act passionately at different ages; but it is false to say generally, that children have no passions. Children have also passions in the sense of affections. Who has not observed in them anger, jealousy, envy, shame, affliction, joy &c. Hence, children have passions as well as adults.

It results from these considerations, that one or several general faculties are not sufficient to produce all particular faculties. Thus we may conclude, from all preceding negative proofs, that every special faculty of the mind or understanding is innate, and given by creation. There are also many positive and direct proofs of the innateness of every faculty.

ANALOGY.

The first of them may be drawn from analogy. By examining nature we perceive that every kind of earth, every salt, every metal, has its determinate qualities, which distinguish one species from another; for instance, the figure of crystallization, the weight, affinity, and other physical and chemical properties, are determinate and permanent. It is the same with plants. Their general laws are fixed, and every plant has its own character. A pear-tree never bears apples, nor an apple-tree pears. We never gather figs upon a vine, nor grapes upon a thorn-bush. The plastic power of vegetables, by which they have their increase, fructification, and all relations to external beings, is determinate. Every species of animal presents a specific character. The structure of their bodies, and all their manifestations, afford characteristics to distinguish one from another. We can never change a cat into a dog, nor a tiger into a lamb, &c. Hence we must say with Moses, "God created all beings, earths, plants, fishes, birds, and all animals, each according to its kind."* Why then should man be excepted?

The faculties of man may be divided into those which are common to man and animals, and those which are proper to man. As long as we consider faculties which are common to animals and man, it is evident that these faculties are innate. Now it is beyond doubt, that all the instinctive aptitudes and inclinations of animals are innate. Is it not evident that the faculties by which the spider makes its web, the honey-bee its cell, the beaver its hut, the bird its nest, &c. are inherent in the nature of these animals. When the young duck, or tortoise, runs towards the water as soon as hatched,

* Gen. i. 22, 24.

when the bird brushes the worm with his bill; when the monkey, before he eats the may-bug, bites off its head, &c. all these and similar dispositions are conducive to the preservation of animals, but they are not at all acquired. According to the same law, the hamster gathers corn and grains, the dog hides its superfluous food, the falcon kills the hare by driving his beak into its neck, &c.

In the same way, all instinctive manifestations of man must be innate. The new-born child sucks the fingers and seeks the breast, as the puppy and calf seek the dug. I have mentioned above, that voluntary motion and the five external senses, common to man and animals, are innate. Moreover, if man and animals feel certain propensities and sentiments, with clear and distinct consciousness, we must consider these faculties as innate. Thus, if in animals we find examples of mutual inclination between the sexes, of maternal care for the young, of attachment, of mutual assistance, of sociableness, of union for life, of peaceableness, of desire to fight, of propensity to destroy, of circumspection, of slyness, of love of flattery, of obstinacy, &c. all these faculties must be considered as innate. Let all these faculties be ennobled in man: let animal instinct of propagation be changed into moral love; the inclination of animals for their young into the virtue of maternal care for children; animal attachment into friendship; animal susceptibility of flattery into love of glory and ambition; the nightingale's melody into harmony; the bird's nest, and the beaver's hut into palaces and temples, &c.: these faculties are still of the same nature, and all these phenomena are produced by faculties common to man and animals. They are only modified and ennobled in man by the influence of superior qualities, which give another direction to the inferior ones.

Many modifications of sentiments, known by the name *affections*, as pain, pleasure, fear, anxiety, anger, envy, jealousy, hatred &c. are common to man and animals, and are not voluntarily produced either by man or by animals. Both are struck with affections before they thought of them. These affections arise against will and reflection, and they are inherent in the nature of man and animals. Therefore when the sentiments and affections are somewhat energetic, they are accompanied with bodily motions, gestures, and sounds, which are as involuntary as the affections themselves, but which tend to the preservation of man and animals. The infant, who has no knowledge of motherly care, weeps and cries when he is hungry and in pain. The puppy, though destitute of the sense of hearing during the first fortnight, and unaware of its complaining being heard, whines and invites the assistance of its mother. Threatened by any danger, we draw back the limbs before we have time to think of it, and of the means to escape. The will has no part in these actions, but man and animals do what nature commands them to do by innate laws.

INNATENESS OF THE HUMAN FACULTIES.

Finally, man is endowed with faculties which are peculiar to him. Now it is to be investigated whether the faculties which distinguish man from animals, and which constitute his human character, are innate. It must be answered, that all the faculties of man are given by creation, and that human nature is as determinate as that of every other being. Thus though we see that *man* compares his sensations and ideas, inquires into the causes of phenomena, draws consequences, and discovers laws and general principles; that he measures distances and times, and crosses the sea from one end to another; that he acknowledges culpability and worthiness; that he bears a monitor in his own breast, and raises his mind to the idea and adoration of God:—yet all these faculties result neither from accidental influence from without, nor from his own will. How indeed could the Creator abandon man in the greatest and most important occupations, and give him up to chance? No. Herein, as every where, he has prescribed to man his sphere of activity, and guarded all his steps. It is only by these means that the same essential faculties always continue in the human kind, faculties the existence of which we could never have conceived unless nature had given them to us.

CONSTANCY OF THE HUMAN CHARACTER.

In order to prove that man does not acquire his faculties by education, I have already mentioned the constancy of the human character. This constancy really proves the innateness of all the faculties with which man is endowed. Mankind are always the same, as far as we know their history, not only in respect to organic, but also in respect to animal life. Ancient mummies present the same parts of the skeleton which we find in man at present, and the history of all times shows virtues and vices essentially the same. Thus mankind has not acquired any faculty, and can never lose any. The special faculties are always the same; the only difference observed, at different times, is that the manifestations of the special faculties are more or less active, and variously modified, in different persons. Here one unjustly seizes a piece of ground, there a place of honour; here the beloved person is celebrated on an oaten-reed, there on a harp. Leaders are decorated, some with feathers, others with purple, &c. but all these modifications are grounded upon primitive faculties essentially the same.

UNIFORMITY OF MANKIND.

The uniformity of mankind in respect to the essential faculties, notwithstanding all the exterior influence of society, climate, modes of living, laws, religion, education and accidental events, affords a great proof that nothing can change the laws of nature. We every where find the same species; whether man stain his skin or powder his hair; whether he dance to the sound of a drum or to the music of a concert; whether he adore the stars, the sun, the moon, or the God of Christians. The special faculties are every where the same.

GENIUSES.

I have also spoken of genius, in order to prove that education does not produce our faculties. Indeed children, endowed with particular dispositions, show their peculiar faculties before they have received any kind of instruction. Shakspeare, when he was a boy, exercised the trade of his father, who was a butcher; but when he killed a calf he would do it in a high style and make a speech. External circumstances are sometimes very adverse to the exercise of genius; but individuals, endowed with energy of disposition, only wait for opportunities; they often leave their parents and their profession, and follow their natural inclination. Moses, David, Tamerlane, and Pope Sixtus the Fifth, were shepherds; Socrates, Pythagoras, Theophrastus, Demosthenes, Molière, and Rousseau, were the sons of artificers. Such individuals are sometimes obliged to surmount great obstacles, but they vanquish all impediments; their character prevails, and their talents assume their natural place. Sometimes such individuals, hindered by circumstances from following their inclinations, find their favourite occupation, and their most agreeable recreations, in the exercise of their most powerful dispositions. Therefore peasants, shepherds, and artisans, become astronomers, poets, philosophers &c.: on the other hand, ministers, kings, and emperors, have been known to employ themselves in the mechanical arts. All this proves that the primitive faculties are innate.

Objection.

It is objected that men of genius form a particular class, and that they cannot be compared with persons whose faculties are middling. This is the same as to say, that hunger and the circulation of the blood do not depend on the organization, because all men have not an immoderate hunger, famine, or the fever; or that the mole does not see by means of its eyes, because the stag sees better on account of its larger optic nerves; or that man has no smell, since the smell of the dog is so superior on account of its larger olfactory nerves. We ought to conclude in a quite opposite manner; for, if the organization be the cause of the highest degree of activity of the different faculties, it is evident that on it the lower degree of their activity also depends.

PARTICULARITY OF EVERY GENIUS.

The man of greatest genius in one respect is often very weak in others. William Crotch, at six years of age, astonished all his auditors by his musical talent, but in every other respect he was a child. Cæsar never could have become an Horace or a Virgil, nor Alexander a Homer. Sir Isaac Newton could not be changed into so great a poet as he was an astronomer; nor Milton into so great an astronomer as he was a poet. Nay, Michael Angelo could not have composed the paintings of Raphael, nor Albano those of Titian, &c.

PARTICULARITY OF EVERY SEX.

Both sexes manifest essentially the same moral and intellectual faculties, but there is a great difference between their modifications. Several faculties are more energetic in women; others more in men. In general the feelings are stronger in women, and the intellectual faculties more energetic in men. These modifications then are inherent by nature, and it is impossible to change one sex into another.

INDIVIDUALITY OF EVERY PERSON.

In all nations, notwithstanding the uniformity of opinions, customs, professions and arts, sciences, laws, religion, and whatever relates to positive institutions, every individual differs from another by his peculiar character. Every one has more capacity and more propensity for one than for another object. Every child manifests his own manner of thinking and feeling. It is a fact generally known, that every one excuses his frailties by saying, It is my nature; it is stronger than I am; I cannot help it, &c. Brothers and sisters often differ extremely from each other, though their education is uniform. The cause must be internal.

RELATION BETWEEN THE MANIFESTATIONS OF THE FACULTIES AND THEIR RESPECTIVE ORGANIZATION.

It is also necessary to admit the innateness of the faculties, because there is a direct relation between the manifestations of the moral sentiments, and the faculties of the understanding, and their respective organizations. I here take this for granted: its particular elucidation must be demonstrated afterwards. I mention this proof only for the sake of connexion.

MAN HAS BEEN CREATED.

Finally, man has been created as well as every other being; consequently it is rational to think that his faculties are determinate, and ordered by creation. We consequently maintain that every faculty of man is innate.

In respect to innateness it is important to consider an observation of Locke. In order to demonstrate that the ideas are not innate, Locke stated that children do not manifest certain qualities, and that different nations have quite different, nay, opposite principles of morality. This assertion of Locke, in respect to the innateness of ideas and moral principles, must not be confounded with the innateness of the faculties. No sensation, no idea, no principle, is innate. Our sensations and ideas of external objects result from external impressions. These impressions are accidental, consequently the ideas of them are not innate; but the faculties which perceive the impressions, and conceive the ideas, are innate; for instance, the ideas of a stone, plant, animal, are not innate; but these objects make impressions on our senses, and these impressions produce sensations or ideas in our minds. The five senses however, and the faculties of our mind, are innate. In the same manner the sensations and ideas of external and accidental events are nowise innate. In general no determinate action of any faculty, but the faculty itself, is innate. The propensity to love, not the subject of love; the faculty of speaking, not the peculiar language; the faculty of comparing and judging, not the determinate judgment; the faculty of poetry, not the particular poem, &c. are innate. Thus there is a great difference between innate faculties and innate ideas and sensations.

It is true that children do not manifest all faculties, but we cannot from this draw the conclusion that the faculties are not innate. For birds do not make their nests, the hamster and marmot do not collect provisions, the swallow does not migrate into foreign countries, immediately after their birth. Animals do not propagate, females and women do not give suck, immediately on coming into the world. All these qualities however are innate. This difficulty is easily explained. Every faculty is confined to its own organ, and its manifestations are proportionate to the developement of the organ. Several organs are very little developed in children, but very much in adults; while others are proportionately larger in children than in grown-up persons: other organs are greatly developed in children as well as in adults. The manifestations of the faculties then being always proportionate to the developement of the organs, it is evident why certain faculties do not manifest themselves in infancy.

It is also obvious why the moral principles are different in different nations. We agree with Locke that these principles are not innate, but we maintain that the faculties which form these principles are innate. I shall afterwards show that only some faculties make laws, and that the moral principles vary in different nations because the principles do not result from one organ but from the different combinations of various organs; consequently that the justice of a libertine without benevolence and veneration must be quite different from that of a charitable and modest person without the love of venery. We every where see the same fundamental faculties, but the manifestations are greatly modified. Men every where adore a Supreme Being; they every where have marks of honour and of infamy; there are every where masters and servants; all nations make war, whether with spears and arrows, or with muskets and artillery. Every where dead friends are lamented, whether their remembrance be honoured by embalming their bodies, or by putting their ashes into an urn, or by depositing them in sepulchres. Hence though the functions in general of all faculties are modified in different nations, and consequently also the functions of those faculties which determine all laws and principles, yet the same primitive faculties are observed in the customs, manners, and laws of all nations.

The innateness of the faculties is too evident to escape the penetration of profound thinkers. Many ancient and modern philosophers, both profane and religious, were convinced of this. Plato (in his Republic VI.) considers philosophical and mathematical talents, memory, the sentiments of pride, ambition, courage, sensuality &c. as innate. Hippocrates, in treating of the qualities necessary for a physician, speaks of natural and innate dispositions. Quintilian said, If precepts could produce eloquence, who would not be eloquent? Cicero, Seneca &c. were of opinion that religion is innate; so thought also Lavater. Herder * considered the sociability of man, his benevolence, his inclination to venerate a superior being, his love of religion, &c. as innate. Condillac † says, Man does not know what he can do, till experience has shown what he is capable of doing by the force of nature alone; therefore he never does any thing purposely till he has once done it instinctively. I think this observation will be found to be permanent and general. I think also that, if it had been considered, philosophers would have reasoned better than they have done. Man makes analyses only after having observed that he has analyzed. He makes a language

* Th. 1. S. 252.

† Œuv. Compl. 8vo. T. III. p. 115.

after having observed that he had been understood. In this manner poets and orators began before they thought of their peculiar talents. In one word, all that man does he did at first from nature alone. Nature commences, and always commences well. This is a truth that cannot be repeated too frequently.

"When the laws," says he in another passage,* "are conventions, they are arbitrary." This may be the case; and indeed there are too many arbitrary laws; but those which determine the morality of our actions cannot be arbitrary. They are our work as far as they are our conventions; but we did not make them alone; nature dictated them to us, and it was not in our power to make them otherwise than they are. The wants and faculties of man being given, laws are given also; and, though we make them, God, who created us with such wants and such faculties, is in fact our sole legislator. In following these laws conformably to nature we obey God; and this is the completion of the morality of our actions.

Innateness was so evident to ancient philosophers that they thought that even sensations and ideas were *innate*. I have mentioned above that this assertion is incorrect, and that only the faculties of acquiring these sensations and ideas are innate. The religion of Christ also admits the innateness of the faculties. According to it all is given from above. "A man can receive nothing, except it be given to

* Loc. cit. p. 55.

him from heaven." *—" No man can come unto me, except it were given to him of my Father."†—" Who has ears to hear, let him ear."‡—" The disciples said, Why speakest thou in parables? Christ answered, Because it is given unto you to know the mysteries of the kingdom of heaven, but to them it is not given."§—" All men cannot receive this saying, save they to whom it is given."‖—" St. Paul says: " When the Gentiles which have not the law do by nature the things contained in the law, these, having not the law, are a law unto themselves: which show the work of the law written in their hearts, their conscience also bearing witness, and their thoughts the mean while accusing, or else excusing one another."¶

RECAPITULATION.

I have considered as the basis of anthropology this truth, that the nature of man is determinate, and that all his faculties are innate. For this purpose I have first refuted all opinions, according to which the faculties of man and animals originate from external impressions, or from certain particular faculties which are said to produce all special faculties. Then I have mentioned direct proofs, as the analogy throughout all nature: minerals, plants, and animals, have their peculiar and determinate nature, and why should not man? In conformity

* John iii. 27. † John vi. 65. ‡ Matt. xiii. 9.
§ Matt. xiii. 10, 11. ‖ Matt. xix. 11. ¶ Rom. ii. 14, 15.

with this consideration, I have demonstrated that the faculties which are common to man with minerals, plants, and animals in general, must be innate in man as well as in other beings. Moreover, I have proved the innateness of the merely human faculties by the constancy of the human character; by the uniformity of the nature of man at all times and in all countries; by the tendency of natural genius; by the peculiarity of every genius; by the determinate character of each of the sexes; by the peculiarities of every individual; by the relation between the organization and the manifestations of the respective faculties; finally, by the circumstance that man is a created being. As long therefore as all these proofs are not refuted, our first principle of anthropology stands unshaken.

Objection against the Innateness of the Faculties.

FATALISM.

It is proved by incontestable facts, that the moral sentiments and intellectual faculties are innate; but ignorance often, and hypocrisy and envy sometimes, take part in the discussion. The basis of the doctrine is no longer attacked: it seems more convenient to blame its consequences, and, without knowing why or explaining how, to cry out that it is dangerous. This, in all ages, has been the fate of every discovery and invention. The disciples of the different philosophical schools of Greece inveighed against each other, and made reciprocal accusations of impiety and perjury. The people, in their turn, detested the philosophers, and accused those who investigated the causes of things of presumptuously invading the rights of the Divinity. Pythagoras was driven from Athens on account of his novel opinions. For the same reason Anaxagoras was confined in prison: Democrites was treated as a fool by the Abderites for endeavouring to find out the cause of madness by dissections; and Socrates, for having demonstrated the unity of God, was forced to drink the juice of hemlock. Several of those who excelled in physics in the fourteenth century were punished with death as sorcerers or magicians. Galilei, when seventy years of age, was shut up in prison for having proved the motion of the earth. Vesalius, Varolius, and Harvey, were persecuted on account of their discoveries. Those who maintained, at first, the influence of climate upon the intellectual faculties of man were suspected of materialism. The pious philosopher Bonnet, Linnæus, Buffon, the virtuous Lavater, and many others, have been treated as materialists and fatalists.

The example of Aristotle and Descartes may be quoted to show the good and bad fortune of new doctrines. The ancient antagonists of Aristotle caused his books to be burned; and in the time of Francis I. the writings of Ramus against Aristotle were similarly destroyed, his adversaries were declared heretics, and under pain of being sent to the galleys philosophers were prohibited from combating his opinions. At the present time, the philosophy of Aristotle is no longer spoken of. Descartes was persecuted for teaching the doctrine of innate ideas; he was accused of atheism though he had written on the existence of God; and his books were burnt by order of the university of Paris. A short time after, the same university adopted the doctrine of innate ideas, and when Locke and Condillac attacked it, there was a general cry of materialism and fatalism. Thus the same opinions were considered at one time as dangerous because they were new, and at another as useful because they were ancient. What is to be inferred from this but that man deserves pity; that the opinions of contemporaries, in respect to the truth or falsehood, and the good or bad consequences imputed to a new doctrine, are quite suspicious; and that the only object of an author ought to be that of pointing out the truth. Ancillon is therefore right in saying with Bonnet, Reason does not know any useless or dangerous truth. That which is, is. This is the only answer to be given to those who, valuing things only by the advantage they may produce, incessantly ask, *Cui bono—what is this good for?* and at the same time to those who anxiously ask, *To what does it lead?* Jesus the son of Sirach long ago said, "We ought not to demand what is this good for; the usefulness of every thing will be known in its due time."

We are far from thinking that ignorance and knavery will not attack our doctrine with abuse, but what does not man abuse? Tell him that he ought to expiate his crimes, in his superstition he will immolate his children. Have not Lucretius and his disciples employed all their genius and talents to demonstrate, that the belief in the immortality of the soul maintains the fear of death, and poisons all the enjoyments of life; whereas Christians consider this belief as the basis of order and happiness, of morality and of the most efficacious comfort during the calamities of life? To establish hospitals for innoculation or for vaccination, and to fix upon edifices a conductor for lightning, is, in the opinion of some persons, of the greatest service to humanity; but, in the eyes of others, it is an offence to Divine Providence. In one word, man finds in all things some cause of complaint; but we may say with St. Bernard, "we ought to judge in a different manner the complaints of the ignorant and those of the hypocritical." The former complain from ignorance, the latter from malice; the first because they do not know the truth, the second because they hate it.

Malebranche has very well painted the enemies of new truths. "Persons of solid and true piety," says he, "do not condemn what they do not understand; but the ignorant, the superstitious, and hypocritical, do." The superstitious by a slavish fear become fierce, when they see an ingenious and penetrating man. If he assign the natural causes of thunder and its effects, they deem him an atheist. Hypocrites on the contrary, though led by particular motives, make use of truths generally venerated; and they combat new truths under the mask of some other truth: sometimes they deride secretly what every one respects, and produce in the minds of others a reputation which is the more to be feared, in proportion as the things which they abuse are more sacred.

As we maintain that all faculties are innate, it is also said that this doctrine leads to fatalism. But what is the meaning of this objection? The expression, *fatalism*, has different significations. Certain writers understand by fatalism, that all in the world, and the world itself, exist by necessity; but that all events are the result of chance, and not at all the effect of any supreme intelligence. This fatalism resembles atheism; but such fatalism is quite different from the doctrine, that man has received all his faculties by creation, and that his nature is determined by it. Another kind of fatalism teaches that all physical and moral laws are created and fixed; that there is no liberty in our actions; that man does good or evil according to his faculties; that he cannot change his character; that his actions are irresistible; consequently that he cannot be rewarded or punished for them.

Here we must make a distinction. It is certain that not only the faculties of mankind and the laws to which they are subjected, but that the laws of nature in general are fixed by creation. All faculties are given, and their laws are determinate in automatic and in animal life. Who for example has called himself to life? Does it depend on the will of any one to be born in such or such a country? from such or such parents? under this or that government, or religion? Who has determined his sex? Who can say: I am the eldest or youngest because it has been my choice? Who can determine the accidents which affect him, the capacities of his teachers, and of all those around him from the earliest infancy? Who can prepare and produce all external circumstances acccording to his will? The organs of automatic life perform their functions without our will, the liver never can perform digestion; the kidneys never can secrete bile; and what is poison can never be changed into food, &c.

It is the same with animal life. The existence and the laws of the five external senses are an effect of creation. It does not depend on our will to have the power of seeing, hearing, feeling, smelling and tasting; we can never hear or see by the fingers, nor smell by the lips &c. It is impossible to see as red that which is blue, or to see as great that which is little. The determination of these faculties is doubtless fatalism. We, in the same manner, maintain, that all propensities, all sentiments and intellectual faculties, are innate and determined by creation. But there is a great difference between the innateness of the faculties and the irresistibility of their actions. The faculties are given, and without innate faculties no action is possible; but is there no liberty in our actions? This question cannot be perfectly understood before I have treated of the particular faculties, and of their mutual influence and subordination. I shall then elucidate in a clearer manner what moral liberty consists in. Meanwhile I appeal to experience. Are the actions of the faculties in man and animals irresistible?

Neither in animals nor in man are all the faculties active at the same moment, and with irresistible force. It often happens in animals, that whilst one faculty is active the others are quiescent. Animals perform rather one action than another. If this were not the case in animals, it would be cruel to punish them in order to prevent certain actions. If a dog who is hungry be punished for having eate, do we not often observe that he will leave the food presented to him? And is it not the same with man? Man has a great number of faculties, but are they always active and irresistible? We can walk, dance, sing, but are we forced to do so? Who does not feel within himself, that he sometimes wishes for something, or inclines to perform some action, while he combats this inclination by other motives? Hence it is indubitable that the actions neither in animals nor in man are irresistible. The muscular system and the moving powers are given and innate, but we are not forced to move our limbs incessantly. And in the same way we shall see, that the greatest number of our faculties are subordinate to the will.

It is true that the faculties of the will, and the motives which determine the will, are given and innate. This kind of fatalism must be admitted not only in man, but even in God; for perfection and all good powers are inherent in the nature of God. He cannot wish for evil. So also the superior faculties of man, called the divine part of his nature, must desire the real good of man. Hence a certain fatalism has its foundation in nature; and therefore the philosophers of China, Hindostan, Greece, the eastern and western Christians, and the followers of Mahomet, have blended a certain fatalism with their religious opinions. Indeed, it cannot be dangerous to teach such a fatalism in as far as it exists; for Christ, his apostles, and the fathers of the church have done so. A proverb of Solomon was, "The Lord gives wisdom;"—Christ said, "The tree is known by its fruit;" *—"O generation of vipers, how can ye, being evil, speak good things? for out of the abundance of the heart the mouth speaketh." †—St. Paul says, "And we know that all things work together for good to them that love God, to them who are the called according to his purpose.

* Matt. xii. 33. † Matt. xii. 34.

For whom he did foreknow, he also did predestinate to be conformed to the image of his Son; that he might be the first-born among many brethren. Moreover whom he did predestinate, them he also called: and whom he called, them he also justified: and whom he justified, them he also glorified." *—The same: "Who maketh thee to differ from another? and what hast thou that thou didst not receive?" † St. Augustine taught openly and distinctly our dependance on God, and he commanded to preach this truth. "As no one," says he, "can give to himself his life, so nobody can give to himself understanding." ‡ He calls gifts of God, all good qualities, as the fear of God, charity, faith, obedience, justice, veracity.—He says, § that God has not distributed in an equal manner noble sentiments any more than temporal good, as health, strength, riches, honours, the gifts of arts and sciences. It is then positive that the faculties are innate; but we must also say with St. Augustine, ‖ God in giving the power does not inflict the necessity. I now continue to investigate the knowledge of mankind; nor need I fear that the innateness of the faculties can produce irresistibility in our actions, or in general that any physical truth is dangerous. We admit one sole Creator, who certainly has rendered consistent all physical and moral truth.

* Rom. viii, 28—30.
† 1 Cor. iv. 7.
‡ Lib. de Fide, c. 1.
§ Lib. de Coreptione et Gratia.
‖ Lib. de Litera et Spiritu. c. 31.

CHAPTER II.

THE MANIFESTATIONS OF ALL FACULTIES OF THE MIND DEPEND ON ORGANIC CONDITIONS.

THERE is no doubt that the functions of automatic life depend on organization, because they absolutely are results of it. It is also allowed in respect to a great number of the functions of animal life, that they cannot take place without organization, voluntary motion for instance, and the five external senses. We maintain, that the manifestations of every moral sentiment and every intellectual faculty depend on the organization. But in saying, that the manifestations of the moral sentiments and intellectual faculties depend on the organization, we do not assert that the faculties are the result of the organization. We never venture beyond experience. We only consider the faculties of the mind or understanding, in as far as they become apparent to us by the organization. We neither deny nor affirm any thing which cannot be verified by experiment. We neither make researches upon the dead body nor upon the soul alone, but upon man as he appears in life. We never question what the moral and intellectual faculties may be in themselves. We do not attempt to explain how the body and soul are joined together and exercise a mutual influence. We do not examine what the soul can do without the body. Souls may be united to bodies at the moment of conception or afterwards; they may be different in all individuals, or of the same kind in every one; they may be emanations from God, or something else. Whatever metaphysicians and theologians may decide in respect to all these points, our assertion, that the manifestations of all the faculties of the mind depend, in this life, on the organization, cannot be shaken. Let us now consider the proofs of this second principle of psychology.

DIFFERENCE OF THE SEXES.

The manifestations of the faculties of the mind are modified in both sexes. Some faculties are more energetic in men, others in women. Do the souls of women therefore differ from those of men, or is it more probable, that the manifestations of the faculties are modified because the organs or instruments vary? Malebranche * deduces the different manner of thinking and feeling in men and women from the delicacy of the cerebral fibres. According to our doctrine of the brain, certain parts of the brain are more developed in men, others more in women; and in that way is the difference of the manifestations of their faculties

* T. I. 5me. Edit. p. 155.

perfectly explicable. There are doubtless a great number of exceptions, so that the intellectual faculties of some women are like those of men, and *vice versâ.* This idea will be perfectly understood after I have demonstrated that the manifestations of every faculty depend on some particular organization, and that they are more energetic in proportion to the size of the respective organs. It follows that the difference of the manifestations in men and women depends on the organization, either of the whole body or of its particular parts.

In respect to the heads of women, it must be observed that the head of the Venus de Medici is too small, and that such a head is only compatible with imbecility. The head of a gladiator would as little suit this figure as the head of an idiot. Intellectual gifts certainly heighten and adorn the charms of a beautiful figure, consequently the fairest woman ought to have a head which admits at least the manifestations of the intellectual faculties.

INDIVIDUALITY OF EVERY PERSON.

The manifestations of the faculties of the mind and understanding are modified in every individual. Now is it not probable that the soul of each individual differs?—On the contrary, it is said that all mankind has descended from the same original parents; and all the modifications of our faculties are easily explained by the difference of their respective organs. All animals of the same species, and all men, have essentially the same corporeal parts. There is only some difference of proportion and developement in the different parts of the organization. These differences of the organs then produce differences in the manifestations of the respective faculties.

AGES.

The manifestations of the faculties are modified in different ages. The soul cannot change, but the organization—the instruments of the soul change. This law exists in respect to automatic and animal life. Certain faculties manifest themselves earlier, others later, according to the developement of their respective organs. The nervous systems of the abdominal and thoracic viscera are almost perfect, while the brain seems to be only a pulpy mass. The nerves of taste and smell are earlier developed than those of hearing and seeing. Therefore their respective functions manifest themselves earlier. This is obvious principally in those animals which are born blind and deaf.

It is the same with the moral sentiments and intellectual faculties. Their manifestations are not simultaneous. Several faculties manifest themselves from infancy, others appear later: in the same manner several faculties disappear earlier, and others last till the end of life. Now as we see that the manifestations are always according to the state of the organic conditions, it is impossible to deny that the manifestations of these faculties depend on the organization.

RELATION BETWEEN THE ORGANIZATION AND THE MANIFESTATION OF THE FACULTIES.

Moreover it can be demonstrated, that the manifestations of the faculties exactly correspond to the developement of the organs. The faculties of the mind manifest themselves, increase and diminish, in the same proportion as their respective organs are developed, increase and decrease. In new-born children, the brain shows scarcely any appearance of fibres. The fibres are sooner visible in the posterior and middle lobes, than in the anterior. The cerebellum increases very late in life. The brain increases by degrees, and it attains its perfection between 30 and 40 years. At this time, it seems to undergo very little change for several years; but in proportion as the individual advances in age, the cerebral fibres become firm; the whole brain diminishes; the convolutions, which in their maturity of age are plump, become flabby. Thus the brain undergoes the same organic changes as every other corporeal part.

According to this successive growth, stationary state, and decrease of the brain, the relative functions manifest themselves. In new-born children, animal life is confined to spontaneous motions, to the perception of hunger and thirst, to some obscure sensation of pain and pleasure, and to the external senses. Even these functions are very imperfect. By degrees inclinations and propensities become more numerous and more energetic; children acquire some determinate ideas of external objects; they become acquainted with them. The child advances to boyhood, adolescence and manhood. Then all these faculties manifest the greatest energy. By degrees they begin to decrease; and in the decrepitude of old age, the sensations are blunted, the sentiments weak, and the intellectual faculties almost or entirely suppressed. Now the organization of the brain is innate; hence, as the manifestations of the faculties of the mind and understanding are proportionate to the organization, it is evident that they depend on it.

If the organs of the faculties do not follow the natural order of increase, if their developement be too rapid or too tardy, then the respective functions undergo the same change in their manifestations. In rickets, the intellectual faculties act often with greater energy than the age of such children requires. Then their brain is also extraordinarily developed or irritable. It sometimes happens even without this disease, that some part of the brain is too soon unfolded, and then its functions are equally premature. We have seen several children from three to four years of age, whose cerebellum had acquired an extraordinary growth. These individuals manifested also a particular desire for sexual intercourse. There are similar instances in respect to every particular faculty and every respective organ.

On the other hand, several parts of the brain, or the whole brain, sometimes arrive very late at the state of maturity. Such children retain their childishness, and are sometimes half stupid till about 10 or 12 years of age, so that their parents despair of their rationality. At this age the organs sometimes acquire a particular developement, and the manifestations of their faculties are simultaneous. One of the most distinguished physicians at Berlin, when 10 years of age, could not yet make use of his organs of speech. Gessner at the same age had improved so little that his preceptor declared him half an idiot; yet it is known how famous he afterwards became.

If the growth of the organs be incomplete, the manifestations of the faculties are equally defective. It is impossible to determine with exactness the degree of cerebral developement, necessary to the regular manifestation of the intellectual faculties; for these manifestations depend not only on the size of the organs, but also on their internal constitution. A brain too small, however, is always accompanied with imbecility. Willis described the brain of one who was an idiot from birth. It was not more than half the size of an ordinary brain. Professor Bonn of Amsterdam possesses two such sculls, and the brain of one who was an idiot from birth, and who lived till the age of 24 (*Pl.* IV. *fig.* 1). This individual was born at Amsterdam, where he was shown for money as an African savage. We have seen several such heads in different collections. Pinel has one; Gall has two.

It is to be observed that, in general, the heads of idiots are either too small or too large, increased in size by hydrocephalus, or water collected in the cavities of the brain. But in proportion as the organization of the brain becomes more perfect, the faculties of the mind manifest themselves more distinctly. The inclinations of such individuals are subordinate; their ideas become clearer; and their manners more significant. In respect to idiots it must be observed, that imbecility sometimes is not general, but only partial. Parents often, and even physicians, cannot conceive how a child should be declared an idiot, though he answers reasonably and executes correctly several things relative to household affairs. We saw at Hamburgh a young man 16 years of age, the inferior parts of whose brain were favourably developed, but whose forehead was scarcely an inch in height, and consequently the improvement of the superior parts of the brain was impeded. He had indeed only the functions of the inferior parts: he recollected names, numbers, chronology and historical facts; he repeated them in a mechanical manner. But the functions of the superior parts of the brain, as comparison, reflection, judgment, sagacity, penetration &c. were utterly wanting. Even reasonable and very intelligent persons are sometimes extremely ill provided with this or that particular faculty.

If the organs have acquired a particular developement, the faculties manifest themselves with particular energy. The history of all times, and the languages of all nations, denote great genius by an expansion of the head (*Pl.* IV. *fig.* 2). Several ancient artists have perfectly well imitated this difference of heads. They gave to priests and philosophers, for instance, a head quite different from that of gladiators. But all modern artists are entirely wrong in fancying that the head bears a certain proportion to the rest of the body, and that the Apollo Belvidere ought to be considered the model of wisdom and of human perfection. This beautiful form would not agree with an idiot, but it is quite insufficient for the faculties of a Socrates. Had the ancient artists perfectly understood the laws of the organization, they would not have thought it necessary to hide the head of Pericles with a helmet because it was disproportionate in size with his body.

Children possess sometimes the same organic constitution of the brain as their parents; and such children manifest the moral and intellectual faculties in the same degree. It is observed, that the characteristic form of heads is often transmitted from generation to generation; and then the faculties of the mind and understanding are propagated in such families during as many centuries. It is an acknowledged fact that children, who are like one another or like their parents, manifest similar faculties, as far as the difference of age and sex admits. I have seen two twin-boys so like each other that it was almost impossible to distinguish them. Their inclinations and talents presented also a striking and astonishing similitude. Two others, twin-sisters, are very different: in one the muscular system is the most developed, in the other the nervous. The former is of little understanding, whereas the second is endowed with strong intellectual faculties. It is the same with animal as with automatic life. Dispositions to certain diseases are propagated from generation to generation; as the disposition to gout, consumption, deafness, dropsy &c. In the same manner, certain propensities, sentiments, and intellectual faculties, even certain inferior inclinations, imbecility, and the disposition to mental diseases, are transmitted from parents to children. It is known, that musical talent is sometimes hereditary in certain families, &c. Gaubius relates, that a girl, whose father had killed men in order to eat them, and who was separated from her father in her infancy and carefully educated, committed the same crime. Gaubius drew from this fact the consequence, that the faculties are propagated with the organization. It would be of the highest importance to know the laws according to which the different dispositions and faculties are propagated from parents to children, and why the same parents occasionally beget quite different children. But our knowledge, in this respect, is very defective; and it is impossible to say any thing determinate without multiplying infinitely observations of this kind.

From all these considerations it results, that there is a relation between the manifestations of the faculties and the organization; and hence the manifestations of the faculties must depend on the organization.

The state of watching, sleeping and dreaming, proves also, that the manifestations of the faculties of the mind depend on the organization. Corporeal organs alone can be fatigued and exhausted. Now it is known that the operations of the soul, or of the faculties of the mind, cannot continue incessantly with equal energy. Rest is necessary and unavoidable. This inactive state of the faculties of the mind is *sleep*. During it, new forces are collected; and after awaking, its functions proceed with new energy.

If single organs be excited by any stimulus whatever, and enter into action while other organs are inactive, partial sensations and ideas, or *dreams*, arise. The nature of these dreams is almost always the result of certain material causes, and they are conformable to the age and organic constitution of the body. Men and women, endowed with a very irritable nervous system, find, in their dreams, impediments without end; they feel always pain and anxiety. This relation between our dreams and organization, verified by an infinity of examples, evidently proves that the manifestations of the faculties of the mind and understanding depend on the organization.

EXERCISE.

The possibility of exercising and training the faculties of the mind, or education, proves also the dependence of their manifestations on the organization. For it is inconceivable how an immaterial being can be exercised.

INFLUENCE OF THE PHYSICAL CONDITIONS.

All that disturbs, weakens, or excites the organization, chiefly that of the nervous system, changes also the manifestations of our faculties. It is a general observation, that the organs are weakened if their increase be too rapid; and therefore their functions are less energetic. This is principally to be observed at the climacterical years, or at the periods of increase, which are very important to be known in practical medicine. The body does not grow always in the same proportion. This happens, in the same manner, in plants, animals, and man. It is known that vegetables increase sensibly at two periods; first in the spring, and secondly in the middle of summer. The growth of man is also stronger at certain periods than at others. Now each sudden increase weakens the organs, and consequently their respective functions. This is the case in respect to automatic and animal life. Girls who increase too suddenly grow pale, and undergo chlorosis; young men become consumptive &c. Such individuals, during their periods of growth, are not fit to be employed, or much to exercise their intellectual faculties. Rest is necessary till the organs have acquired a state of maturity. Then the faculties of the mind again operate with great energy. Sometimes the organs are too soon developed or too much exercised, and thence often results an incurable exhaustion: such early genius becomes quite ordinary in men. I have already mentioned also that sometimes weak intellectual faculties, principally in children in whose heads water is collected, become stronger, so that they afterwards show peculiar energy.

In grown-up men and animals, the organs are still subjected to different degrees of excitement according to the seasons, temperature, food, and principally according to particular laws of the organization. Therefore we see appear and disappear in animals, at different periods, their instinctive labours, their inclination or disposition to sing, to build, to gather provisions, to live solitarily or in society, to migrate &c. It is the same in man: the functions of his faculties do not always act with the same energy. Who can mistake the influence of periodical evacuations; for instance, of the catamenia, of hemorrhoides &c.; the influence of pregnancy, of digestion, of fasting, and of all that exhausts the corporeal powers? Who can deny the influence of diseases upon the manifestations of our faculties; that of external and internal excitement, of agreeable sensations, of fine weather, of music, of dancing, and similar circumstances? Now all these influences act only upon the organization, consequently the manifestations of the faculties depend on the organization.

Sometimes very inert and defective manifestations grow very active when excited by external or internal causes. Haller relates, that an idiot, who was wounded on the head, manifested great understanding while the wound lasted; but as soon as the wound was cured fell into his former stupidity. He speaks of another patient whose eye was inflamed, and who saw perfectly well at night during the time of his sickness. Father Mabillon, in his infancy, showed very limited faculties. He got a blow on his head, and from that moment he manifested talents. We have been told, that a boy at fourteen years of age seemed incapable of improvement: he fell down a staircase and got several wounds in his head; and after that period he excelled in his studies. We have seen a girl nine years of age, who had received a blow on the right side of her head, and who afterwards complained of pain on the opposite side: by degrees her right arm grew weak and almost paralytic; her inferior jawbone trembled incessantly; she was often seized with convulsions; but her intellectual faculties had acquired a high degree of energy and perfection, and her manner of behaviour was very imposing. There are many facts of this kind. I shall mention only one other case, inserted in the Edinburgh Review,* and extracted from a description of the Retreat, an institution near York for insane persons of the society of friends, by Samuel Tuke: "A young woman, who was employed as a domestic servant by the father of the relater when he was a boy, became insane, and at length sunk into a state of perfect idiocy. In this condition she remained for many years, when she was attacked by a typhus fever; and my friend, having then practised some time, attended her. He was surprised to observe as the fever advanced a developement of the mental powers.

* N° XLV. April, 1814, p. 197.

During that period of the fever when others are delirious, this patient was entirely rational. She recognized, in the face of her medical attendant, the son of her old master, whom she had known so many years before, and she related many circumstances respecting his family and others, which had happened to herself in her earlier days. But, alas! it was only the gleam of reason: as the fever abated, clouds again enveloped the mind; she sunk into her former deplorable state, and remained in it until her death, which happened a few years afterwards."

These facts are positive, and there cannot be any doubt that similar causes change surprisingly the exercise of the faculties of the mind; yet they act immediately upon the organization alone. Hence we are obliged to conclude, that when these physical and organic causes produce the manifestations of the most impudent lasciviousness, the most arrogant pride, a complete despair which rejects all consolation &c. the cause of these manifestations depends on the organization.

Finally, if it be possible to demonstrate the respective organs of the propensities, sentiments, and intellectual faculties, it will be impossible to deny that their manifestations depend on the organization.

The essential part of this second principle has been known from the remotest antiquity. A great number of ancient and modern, profane and religious, writers taught it. Plato considered the body as a prison for the soul. Seneca, (Epist. 66,) "Corpus hoc animi pœna ac pondus est." Hippocrates and

Galen, and all physicians and physiologists, however different their opinions, make all manifestations of the soul depend on the organization—the intellectual faculties on the brain; and the affections, passions, and moral sentiments on the temperaments. Boerhaave and Van Swieten attribute to the brain not only all ideas with their combinations, and all reasoning, but also the moral character and the essence of man. The Cartesians, by their doctrine of the tracks which they admit in the brain, acknowledge the influence of the brain on the intellectual faculties. Malebranche explains the difference of the faculties of both sexes, the various kinds and particular tastes of different nations and individuals, by the firmness and softness, dryness and moisture, of the cerebral fibres, and he remarks that our time cannot be better employed than in investigating the material causes of human phenomena. Charles Bonnet said, that mankind can only be known and penetrated by their physical nature. St. Thomas * said: "Though the spirit is no corporeal faculty, the spiritual functions, as memory, imagination, cannot take place without the bodily organization. Therefore if the organs cannot exercise their activity, the spiritual functions are disturbed. For the same reason a happy organization of the human body is always accompanied with excellent intellectual faculties." St. Gregorius Nyssenus † compared the body of man to a musical instrument. "It sometimes happens," says he, "that excellent musicians cannot

* Contra Gentiles, c. 84. 12. 9. † De Hominis Officio, c. 12.

show their talent because their instrument is in a bad state. It is the same with the functions of the soul. They are disturbed or suspended according to the changes which take place in the organs; for it is the nature of the spirit that it cannot exercise conveniently its functions but by sound organs." St. Paul: "O wretched man that I am! who shall deliver me from the body of this death?" * and "When I was a child, I spake as a child, I understood as a child, I thought as a child; but when I became a man, I put away childish things." † St. Augustine, ‡ St. Cyprian, § St. Ambrose, ‖ St. Chrysostom, ¶ Eusebius, and others, consider the body as the instrument of the soul, and teach distinctly that the soul is regulated according to the state of the body. Consequently all natural philosophers and physicians, all the fathers of the church, and even the apostles, agree with us in respect to the second principle, that all the manifestations of the mind depend on the organization.

MATERIALISM.

After these considerations it is easy to answer the following objection made against the physiology of the brain. It is said that, if the manifestations of the faculties of the mind depend on the organization, materialism will thereby be established. It

* Romans vii. 24. † 1 Cor. xiii. 11. ‡ De Lib. Arb.
§ De Operibus Christi. ‖ De Off.
¶ Hom. II. III. super Epist. ad Heb.

must however be remembered that the expression materialism has two different significations. One class of materialists maintain, that there is no Creator; that matter has always existed; and that all phenomena in the world are the effects of matter. The ancient Roman church attached this signification to the expression materialism. It is still often the case at the present day, that materialism is employed as synonymous with atheism. But our assertion, that the manifestations of the mind depend on the organization, is far from this sort of materialism. A natural philosopher, who inquires into the laws of phenomena, cannot be an atheist. He cannot consider the admirable and wise concatenation of all nature, the mutual relation between all things, as without a primitive cause. He is obliged, according to the laws of thinking, to admit such a cause, a supreme understanding, an all-wise Creator.

Another kind of materialism is taught by those who admit a Creator, but who maintain that man does not consist of two different substances—of the body and soul; and that all the phenomena, ordinarily attributed to the soul, result only from the forms and mixture of matter. The soul, in their opinion, is a fluid of extreme tenuity, distributed over all things, and enlivening the whole organization. Our doctrine of the physiology of the brain and nervous system has nothing in common with this opinion. We never endeavour to explain final causes. We have always declared, and we every where declare, that we do not make any inquiry into the nature of the soul, nor into that of the body. We are led only by experiment. Now we see that every faculty manifests itself by means of the organization. But when our antagonists maintain that we are materialists, they ought to prove that we teach that there is nothing but matter. The falsehood of this accusation is very obvious by the following considerations. The expression *organ* designs an instrument by means of which some faculty manifests itself; the muscles, for example, are the organs of voluntary motion, but the muscles are not the moving power. The eyes are the organ of sight, but the eyes are not the faculty of seeing. We separate the faculties of the soul or of the mind from the organs, and we consider the cerebral parts as the organs of these faculties, *viz.* as the instruments by means of which these faculties manifest themselves. Even the adversaries of our doctrine must so far admit the dependence of the soul on the body. Professor Walter, of Berlin, imputed materialism to our doctrine; but in the same passage he says, In children the brain is pulpy, in decrepid old age it is hard. It must have a certain degree of firmness and elasticity, that the soul may manifest itself with great splendour. But this consideration does not lead to materialism, it shows only the mutual union of the body and soul.

It results from what I have just said of our manner of teaching, that we are no more materialists than our predecessors, whether anatomists, physiologists, physicians, or than a great number of philosophers and moralists, *viz.* all those who admit the dependance of the soul on the body. For it is essentially the same, whether the faculties of the mind depend on the whole body, or on the whole brain, or whether every special faculty depends on a particular part of the brain: the manifestations of the faculties depend always on the organization.

It is also objected, that the faculties of the mind cannot depend on the organization, because man in his healthy state does not feel their dependance. Man does not feel the performance of digestion, circulation, nutrition in general, and of the different secretions; but do not these functions depend on the organization? We think with Herder, that the vulgar understanding is to be pardoned, when it considers reason, or the rationality of man, as an absolute faculty which is independent of the senses and of all organization. But the natural philosopher, who knows human nature by experiments, and who observes the scale of perfectibility from the lowest animal to man, is incessantly warned and informed of the influence of the organization. Every thing shows him that man is not the creator of his intellectual faculties, any more than of his organic life. Thus, though we do not feel the functions of the faculties of the mind, their dependance on the organization is not less certain.

There are persons who maintain that, in the highest degree of magnetic influence, the manifestations of the soul are independent of the organization. If this be the case they ought to demonstrate that, in this state, the body has no influence upon the soul, and that the soul is utterly separated from the body. In this supposition, why do not these persons produce the same phenomena when they act upon children, fools, and idiots, as when they magnetise very weak, delicate, and irritable individuals? Why do magnetised persons know only what is known? Why do they not make any discovery in anatomy, physiology, medicine, or in any art or science? While there are in these subjects so many points to be elucidated, why cannot these persons make them out? Hence, as long as all the phenomena produced by magnetism denote only a greater irritation and a greater energy of the faculties, and not at all a different state, we must conclude that the soul manifests itself only by the organization. We do not deny the existence of some animal fluid, called magnetic fluid; on the contrary we admit it. This fluid may have the greatest affinity to the nervous system: its accumulation may increase the activity of the nerves, so that magnetised persons may have more acute feelings and judge better, than they can do in the ordinary state of irritation. But I wish to know if it be possible to communicate this fluid by the will, and what phenomena this fluid can produce? I fancy that this fluid only excites the different organs, and produces phenomena relative to every organ: consequently magnetism is only a state of particular excitement.

RECAPITULATION.

According to our second principle, all manifestations of the faculties of the mind depend on the organization. In order to support this assertion, we demonstrate that the manifestations are different according to the sexes;—that they are modified in every individual;—and that they do neither appear nor disappear simultaneously:—besides, we show that sometimes one faculty manifests itself weakly, whilst the other faculties are very energetic, and that sometimes one faculty is very energetic, whilst the others are very defective. Moreover, we state that children inherit the moral character and intellectual faculties of their parents, when similar organization is propagated from parents to children. We prove also our assertion by the state of watching, sleeping, and dreaming; by the possibility of education; and by the observation that every thing that changes, weakens, or excites the organization, especially of the nervous system, changes the manifestations of animal life. Finally, the proportion between the manifestations and the respective organs does not permit us to doubt of the dependance of the moral sentiments and intellectual faculties on the organization.

CHAPTER III.

ON WHAT ORGANIZATION DO THE MANIFESTATIONS OF ANIMAL LIFE DEPEND.

AFTER having demonstrated that the manifestations of the moral sentiments and intellectual faculties depend on the organization, it is important to determine on what organization animal life, in general, and its particular functions depend. Before we enter into this consideration, let us examine the difference between the expressions, seat and organ of the soul. Formerly the seat of the soul, and the mutual influence of the soul upon the body, and of the body upon the soul, were much spoken of; but these two problems seem to us to be beyond the reach of natural philosophy. It is absurd to assign a material seat to an immaterial being; and the action of an immaterial being upon the body, and that of the body upon an immaterial being, are also quite inconceivable. I shall mention only a few of the opinions which have been entertained on this matter. Physiologists and philosophers according to their opinions respecting the soul, assign to it a different seat, and a different manner of acting upon the body. From ancient times down to the present day, the moral sentiments have been attributed to the different viscera. The sentient soul, or intellectual faculties, on the contrary, was placed in the brain according to Pythagoras, Plato, Galen, Haller, and the greater number of physiologists. Aristotle placed the sentient soul in the heart. Des Cartes and his followers confined it to the pineal gland (*Pl.* II. *fig.* 2. ε). Erasistratus placed it in the cerebral membranes; Herophilus in the cavities of the brain; Serveto in the aqueduct of Sylvius (*Pl.* II. *fig.* 2. φ); Van Helmont in the stomach; Wharton and Schellhammer in the commencement of the spinal marrow; Drelincourt and others in the cerebellum (*Pl.* I. *fig.* 2. I.); Bontekoe, Laneisi, and Lapeyronie in the great commissure of the brain; Willis in the corpora striata; Vieussens in the centrum ovale of the medullary substance; Soemmering in the vapour of the cerebral cavities &c. But it is said that each of these parts has been found wounded, diseased, and entirely disorganised without any alteration of the intellectual faculties. Hence it results, say they, that these parts are not the seat of the soul.

In order to explain the mutual influence of the soul and body on each other, the most extravagant opinions have been formed. Some authors, with Malebranche, consider God as the immediate agent between the soul and the body:—others on the contrary deny the existence of two different substances, and consider all faculties as properties of the body which are propagated with the semen, and produced by the developement of the organization. A third class of writers endeavours to find out means to reconcile all the differences of opinion, by the intervention of some medium or middle substance. Hence the great number of vapours, fluids, pneumata, and vital spirits: hence the introduction of caloric, and the electric, galvanic, and magnetic, fluids. We shall always adhere to our first declaration—that we make no inquiries into the nature of the soul; we observe only its manifestations, and the organic conditions by means of which its manifestations take place; and in speaking of organs, we speak only of the organic parts by means of which the faculties of the soul become apparent.

We have now to examine if animal life depend on the whole body, *or* on one particular system: on the nervous system for example; or only on one part of this system, for instance, on the brain. Animal life begins with consciousness or the power of perceiving any impression, and its action I call *sensation*. We never confound the functions of irritability with those of sensibility. As long as the functions take place without consciousness, we consider them as the effect of the organization or of irritability, as digestion, circulation, and nutrition. No motion is spontaneous or the result of sensibility, but that which is accompanied with consciousness. The same organ may be moved either by irritability or by sensibility. It seems however to me that a particular arrangement of this organ renders possible the manifestations of consciousness, and another organic peculiarity produces the phenomena of irritability. This idea will afterwards be more fully explained. Thus it is to be examined whether the whole body, or the brain alone, is the organ of consciousness.

Many physiologists and philosophers speak a great deal of unity, both in inorganic and organic nature; they maintain that the whole contributes to the performance of every function, and that no part in an isolated state can perform its function. This manner of speaking is not sufficiently distinct. It is true that no part can perform its function if its organization be not in a healthy and perfect state: thus the organization of the eyes must be perfect, otherwise the eyes cannot see, &c. Consequently all parts which contribute to the reproduction and nutrition of the organs contribute mediately to the function of every part; in this manner, the stomach and alimentary canal contribute to the functions of the brain, but peculiar functions are performed by peculiar organizations. Now it is evident that all those parts which are insensible cannot be considered as organs of sensibility. It is even generally admitted that the functions of animal life are confined to the nervous system. It is only undecided, whether the whole nervous system, or only one part of it, is the organ of animal life.

I have said that animal life begins with consciousness. I now consequently ask, Is consciousness manifested by the whole nervous system, or is it confined to certain parts of that system? The opinions of physiologists are different in this respect. The greatest number consider the brain without the spinal marrow and the nerves of the five external senses, as the organ of all consciousness. They quote the following proofs: a nerve that is divided can no more produce either sensation or voluntary motion, however the nerve may be irritated. Hence, the sentient principle does not reside in the nerves, or at the place where the impression is made, but only in the brain. If the origin or continuation of any nerve be compressed or tied, its function is suspended, but after the pressure is removed, sensation returns. Hence, the consciousness of all impressions must reside in the brain. When the brain is compressed by any fluid, by a long excrescence, by turgid blood-vessels, or by a violent concussion, all sensation is interrupted and it is restored in proportion as the compression is removed. Sometimes in convulsive fits, pains are felt as if they were ascending along the nerves to the brain; and such pains are often cured by dividing or by tying the nerves. After the amputation of a limb, some individuals, though perfectly cured, fancy that they feel pains in the amputated limb. Thus this pain cannot have its seat but in the brain. Finally, all volition comes from the brain: consequently the first cause of all voluntary motion resides in it. The opinion that all consciousness resides in the brain was formerly supported by the assertion that all nerves are continuations of the brain, and that they have a central point in it. But this proof can no longer be admitted, because we have demonstrated that neither the nerves of the external senses, nor the spinal marrow, are prolongations of the cerebral mass, nor are the nervous fibres concentrated in one spot; but that every nervous system has its own origin, and that the different nervous systems are only brought into communication by nervous branches, and exert thereby a mutual influence.

RECOLLECTION.

On the other hand, arguments of different degrees of validity may be employed, in order to prove that the brain is not exclusively the organ of sensation and voluntary motion. Dumas thinks that those who have lost a limb, and imagine that they feel pain in it, do so by their power of recollection. If that be the case, Dumas ought to prove that the power of recollection is different from that of consciousness, before he can conclude that that power may exist in the brain, and consciousness everywhere. Besides, why is it absolutely impossible to produce an equal degree of other agreeable or disagreeable sensations by means of the power of recollection? Moreover, after amputations, why are pains particularly excited by wet, stormy, and changeable weather? Hence, the assertion of Dumas is far from refuting the positive proofs, that all consciousness belongs to the brain.

THE BRAIN IS INSENSIBLE.

The same physiologist thinks that the brain can neither be the seat nor the organ of sensation, because it is insensible. It is true that the convolutions of the brain, when wounded or mutilated, do not produce the same pains as the sensitive nerves do when they are injured. Yet in certain diseases the brain becomes very painful, as is the case with different other parts which do not manifest any sensibility in the healthy state. Besides, nobody says that the pains which we feel in our limbs exist in the brain. This organ has only the consciousness of them. The pains exist in the part where the impressions are made. Moreover, we must consider that the sensations of different parts are quite different, and that although one part does not produce the sensations of another it cannot on that account be called insensible. The nerves of hunger and thirst cannot perceive the sensations of pride or compassion; the olfactory nerve cannot perceive the impressions of light &c. Every particular sensation is manifested by means of a particular organization. Now thinking and willing certainly are sensations, and nobody can or will deny that these two functions are confined to the brain: consequently it can only be said, that the brain does not manifest all sorts of sensation. The assertion however, that all consciousness resides in the brain, is not yet refuted. It may still be maintained that the nerves produce the impressions, but that the brain perceives them and alone has consciousness.

MONSTERS.

It is also objected that sometimes acephali, who are entirely destitute of cerebral substance, live, suck, and make various motions; consequently that the brain is not the only organ of sensation. In this objection, automatic motions are evidently confounded with consciousness. This is also the case, when they say, with Gautier, that a beheaded cock struggles in order to fight and to defend itself. All similar phenomena, which may be observed in insects, fishes, reptiles, birds, quadrupeds, and even in man, are the result of irritability without consciousness. Such motions seem to be accompanied with sensation and will, only because, according to the organic structure and mechanical arrangement of the parts, the motions take place in the same way as they ought to do if they were determined by the will and with consciousness. There are many phenomena which happen according to determinate laws without consciousness, reflection, or will. In the same way, the motions of the muscles are determined, whether they are the effect of the will or of any other irritation. All automatic motions take place without brain, and neither the energy nor the length of automatic life is in proportion to the quantity of brain. During sleep and before birth, automatic motions existed in sufficient perfection, while the animal functions were inactive.

It is even to be determined whether crying and sucking are always accompanied with consciousness, or whether these phenomena may belong to automatic life. It seems to me that they are sometimes automatic and at other times animal, just as motions in general are. Consequently it must be considered that certain parts of the body can produce only automatic motions; and that other parts are subjected to the will, but that they are capable of producing motions which are not the result of the will, but which are nevertheless conformable to the structure of the muscles.

MUTILATIONS.

Duverney is said to have taken out all the brain from some pigeons, which, however, continued to perform all their animal functions. Similar experiments made upon turtles are mentioned by several authors, but their knowledge of these facts is derived merely from hearsay. It is evident to us that the whole brain cannot be taken off without destroying at the same time the nerves of the external senses and the animals themselves. Besides it is generally known that sportsmen kill wounded birds by driving a feather into their neck. In order to be absolutely certain, I have made several experiments. I cut off the greatest portion of the hemispheres of the brain of some hens and pigeons, even the great commissure, and down to the lateral or rather the great ventricles; and these animals manifested distinctly their sense of seeing and hearing. They did not take the food presented to them, but they swallowed bread and seed introduced into their bills.

Rabbits, mutilated in the same manner, walked, saw and heard; they even took food spontaneously. Consequently it is certain that the destruction of all the superior parts of the brain does not destroy the functions of the five senses and the muscular motion. But it is impossible to take out all the cerebral mass without killing the animals. As soon as the corpora striata and optic thalami were wounded, convulsions and death succeeded. Consequently we declare the experiments made by Duverney entirely false. All that can be concluded from these experiments is, that the whole brain is not necessary to the functions of the five senses; but it cannot be concluded that no cerebral part is absolutely necessary to the functions of the five senses, because it is impossible to separate the brain from the nerves of the five senses without killing the animals.

There are other arguments which give room to suppose that the external senses have perception and a kind of judgment. There are animals to which it is impossible to refuse feeling and taste, although they present nothing which may be compared to any portion of the brain. Every nerve destined to a particular function has its own origin, its gradual enlargement, its proper expansion, its particular form, and it makes a whole in respect to its structure: why relatively to its function should it not make a whole? The functions of the nervous systems of the five senses are in proportion to the perfection of their particular organization, and by no means to the quantity of the brain. Several insects, notwithstanding the extreme smallness of their brain, are endowed with an extraordinary fine feeling, taste, and smell. Eagles, with their little brain, see much better than dogs whose brain is much larger; and the smell of dogs is more acute than that of man, whose brain is very considerable. It has been observed that when not only the external apparatus, but also the internal organization of a sense is destroyed, all ideas which belong to this sense are lost or annihilated. All these arguments however are not sufficient to explain why, in perfect animals, every nerve which is pressed, tied, or divided, loses sensation. Perhaps, in perfect animals, the inferior parts of the brain are as necessary to consciousness as the heart is necessary to the circulation of the blood; while in lower animals a kind of obscure consciousness exists independent of the brain, as in them, and even in plants, circulation takes place without the heart.

After every consideration it remains undecided, at least in perfect animals, in what respect the brain is necessary to the passive consciousness of the external senses. But it is certain that the will, and consequently the *voluntary* motions and reflection, depend on the brain; for no phenomena of this kind take place without the brain. Thus it is necessary to distinguish the regular motions into those which are regular but only automatic, and into those which are both regular and voluntary; the latter depend on the actions of the brain, the former take place without it. In the same manner it is necessary to distinguish the functions of the five external senses. It is undecided whether their passive consciousness takes place by means of their respective nerves alone, or by the assistance also of the brain; but it is certain that their active consciousness, accompanied with attention, reflection, and will, is possible only by the operation of the brain. After having considered the organization on which consciousness in general may depend, and that on which the voluntary motions depend, we shall investigate the organization on which depend the manifestations of the various feelings and the intellectual faculties. This proposition is doubtless of the highest importance to anthropology.

SECTION I.

Do the Manifestations of the various Feelings, and Intellectual Faculties, depend on the whole Body?

THE WHOLE BODY.

Neither the size nor the internal constitution of the whole body determines the manifestations of the various feelings and intellectual faculties. I have already mentioned that the functions of every part depend on the healthy state of its organization, and that, in as far as the organization of every part depends on others, these mediately contribute to the possibility of the functions of every part. The function of seeing depends mediately on the stomach, heart, lungs &c. because the organization of the eyes depends on digestion, circulation and respiration; but every well-organised part performs its proper function by itself. In this sense we maintain that the different feelings, and intellectual faculties, do not depend on the whole body.

SHAPE AND SIZE.

Neither do they depend on the size and shape of the whole body in respect to different species of animals, nor in respect to different individuals of the same species. Otherwise whales, elephants, rhinoceroses, horses &c. ought to have more understanding than man, and an ox or horse more than an oran-outang &c. It is certainly not possible to measure the faculties of the mind and understanding in men according to their size and shape. In general little persons have more understanding than tall men. In one word, daily observation is against the opinion that the manifestations of the feelings and intellectual faculties depend on the shape and size of the whole body.

TEMPERAMENTS.

Among ancient and modern authors, the opinion is more common that the faculties of the mind depend on the organic constitution of the whole body, that is, on the temperaments. It is very easy to refute this error. What are these temperaments of animals from which their faculties may be derived? Why are all animals neglected in this doctrine of temperaments? How can all their faculties be explained by the small number of temperaments and their combinations? Idiots have certainly some temperament, why do they not exert proportionate faculties? It is conceivable how a different organic constitution may produce a different degree of activity of the faculties in general; but it is inconceivable how the same temperament can give great energy and strong passions for some things, while the manifestations of other faculties are very weak. It is obvious that there is no proportion between the vital functions and the faculties of the mind. A man may be well nourished and active, and yet at the same time either stupid or intelligent. There is no fixed and constant proportion between temperaments and the determinate faculties of the mind and understanding. There are many persons who have a melancholy look, but who are not at all melancholy. We find sanguine and bilious individuals, who are intellectual or stupid, meek or impetuous; we may observe phlegmatics of a bold, quarrelsome, and imperious character. In short, the doctrine of the temperaments, as applied to the indication of determinate faculties, is not more sure, nor better founded, than divination by the hands, feet, skin, hair, ears, and similar physiognomical signs. I shall afterwards speak of these considerations. In many diseases, the humours and organic constitution of the body are much altered, but the faculties of the mind and understanding do not suffer a proportionate alteration.

We do not however deny the influence of the organic constitution upon the manifestations of the moral feelings and intellectual faculties; but the deriving of determinate faculties and positive propensities from the temperaments is quite different from saying, that the manifestations of the faculties of the mind are modified by the organic constitution of the body in general, and of the respective organs in particular. There are beyond doubt some individuals more irritable, more energetic, and more fit to be exercised than others. But the organic constitution of the whole body does not constitute the condition by which the manifestations of the moral sentiments and intellectual faculties are possible.

SECTION II.

Do the Moral Feelings depend on the Viscera of the Abdomen and Thorax?

VISCERA.

The greater number of physiologists, physicians, and philosophers, derive the intellectual faculties from the brain, and the moral sentiments from different viscera, or from the nervous plexuses and ganglions of the great sympathetic nerve; that is, from the nerves of the abdomen and thorax: but comparative anatomy and physiology entirely contradict this opinion. There are animals, which are endowed with faculties attributed to certain bowels or viscera, without having these viscera. Insects, for instance, become angry, and have neither liver nor bile. Oxen, horses, hogs &c. have a great number of viscera in structure analogous to those of man, but these animals want many faculties which are attributed to these viscera, and with which man is endowed. There is no proportion either in animals or in man between the size of the viscera, or even of the ganglions, and the determinate moral sentiments. Several viscera, nervous plexuses, and ganglions, are greater in animals than in man, and yet the qualities attributed to them are beyond doubt more energetic in man. There is no proportion between the number of viscera and moral sentiments in different animals. The four-footed animals have viscera and nervous ganglions very similar to one another, as the dog, wild boar, ox, horse, sheep, beaver, hare, roe, wolf, tiger, lion &c., but their inclinations are entirely different and even opposite. The heart of the tiger ought to be the organ of cruelty, and the heart of a lamb that of meekness. There is no proportion between the period of the developement of the viscera and the manifestations of the moral sentiments. In young animals and in children several viscera are sooner developed than their pretended inclinations manifest themselves, at least they are not manifested in the same proportion. It is astonishing that Bichat should derive all passions from organic life, while he believed that organic life was perfect in new-born children, but that children have no passions. Those who, with Reil, maintain that the nervous plexuses and ganglions are the organs of the affections and passions, and who say that the ganglions are destined to weaken or interrupt the propagation of internal impressions to the brain, fall into a similar contradiction; for affections and passions make great impressions, and their energy is felt both in animals and in man. Moreover, it is a principle that every organic part manifests only *one particular* function. Now each viscus has its particular function which is known and conformable to its structure. Hence viscera cannot manifest the moral sentiments.

In respect to man it may be added, that acephali and complete idiots have viscera and ganglions; that their assimilating power is sometimes very energetic; and that yet they manifest no moral sentiment. In man also there is no constant proportion between the energy of the moral sentiments, and the activity of the viscera. Finally, the moral sentiments are not subjected to derangements proportionate to the diseases of the viscera. The frequency of the pulse does not produce pride, attachment, compassion &c. We infer, from all these proofs, that the viscera do not produce the moral sentiments.

Objection.

It is objected that man, when he is influenced by any great affection or passion, as by anger, jealousy, fear &c., feels evidently some motion in the various viscera. It seems therefore natural to suppose that these affections reside in these parts. It may in general be answered, that it is impossible to infer from the sensations or other phenomena, which take place in different parts of the body, that the primitive cause of these phenomena resides in the parts which suffer these changes. All parts are in communication with, and exercise a mutual influence upon, each other. On this account, the great sympathetic nerve or the nerves of the abdomen and thorax, are connected with the spinal marrow, with the nerves of the external senses, and with the brain. Without this communication, animal life would be confined to the brain, and this organ could not put in action the instruments necessary to motion. Now the activity of one part produces different phenomena in other parts; and as the existence of pain and pleasure does not demonstrate that their consciousness resides at the place where we feel the irritation, so the mutual influence of the parts does not demonstrate that the affections have their seat in the thorax or abdomen, where we feel the influence of their action. Sorrow makes the tears to flow, and anger makes the knees to tremble, and the lips to quiver. But who would therefore assert that sorrow resides in the lachrymal gland, and anger in the knees and lips! When wounds of the brain produce contractions of the gall bladder, overflowing of the bile, and vomiting, the primitive cause resides in the brain; but nobody will place there the overflowing of the gall and the consequent vomiting. Indigestible aliments introduced into the stomach produce headach; intestinal worms, narcotics and similar extraneous bodies sometimes produce madness, blindness &c.; but who will therefore maintain that madness, blindness &c. have their seat in the alimentary canal? The remembrance of any injury acts upon the heart and augments the pulsations; but is the brain the organ of the circulation? It follows therefore, from these and similar considerations, that it is impossible to infer from the sensations which are produced in different parts by affections and passions, that these parts are their respective organs.

All that has been said in respect to the abdominal and thoracic viscera, in order to prove that they are not the organs of the moral sentiments, may be applied also to the nervous plexuses and ganglions of the abdomen and thorax. These nervous systems are essentially necessary to the performance of the functions of automatic or organic life.

SECTION III.

Do the Manifestations of the Moral Sentiments and Intellectual Faculties depend on the Spinal Marrow?

SPINAL MARROW.

The answer is negative; and all proofs alleged against the viscera as organs of the faculties of the mind serve also to show, that the nerves of the vertebral column do not manifest the moral sentiments, nor the intellectual faculties. Neither the number of these nerves, nor the period of their developement, nor their greater or less degree of perfection has any relation to these faculties. The nerves of the spine produce *muscular* motion and the sense of feeling.

SECTION IV.

Do the Manifestations of the Moral Sentiments and Intellectual Faculties depend on the Five External Senses?

FIVE SENSES.

The external senses bring men and animals into communication with the beings around them; and by the medium of the five senses, men and animals acquire a determinate consciousness of surrounding beings. Without these senses, men and animals would have only an *internal* existence; but not as Richerand says, a *vegetative* existence. What can interest man more than his five senses, to which he owes so many sensations, so many enjoyments? Hence the assiduous investigations of this object by philosophers, physiologists, and anatomists. However, not only the structure of the five senses, but also their functions, are far from being perfectly and precisely determined. A great number of odd, extravagant, and contradictory opinions relative to the senses may be mentioned.

I do not remember, that the *moral* sentiments have ever been derived from the external senses; consequently it is superfluous to prove that such an assertion would be erroneous. But it is quite different in respect to the *intellectual* faculties. According to many ancient philosophers all ideas are innate, but excited by the external senses. The greater number of philosophical systems, since the time of Bacon and Locke, rest upon the axiom of Aristotle: that all ideas come into the mind by means of the external senses. According to both these assertions, the perfection of the manifestations of the intellectual faculties depends on the perfection of the external senses. But if the ideas and sensations of man and animals are either produced or excited only or particularly by the five senses, man and animals ought to manifest themselves according to the external objects and accidental impressions. Their faculties ought to be proportionate to the perfection of the five senses, and to the education bestowed on them; and it ought to be possible to change and modify each individual at pleasure. But we have seen, in the chapter on the innateness of the faculties, that daily experience contradicts this hypothesis.

Another class of philosophers maintain that the mind acts independently of all organization, and that the senses are rather an impediment to than organs of action. They complain much of the illusions of the five senses; they despise all testimony, and all conclusions grounded upon the external sensations. According to them that only is truth, which may be conceived by the understanding alone. If the influence of all external objects, of all the social institutions, of education in general be denied, this opinion is evidently in contradiction with the history of all times and with that of every individual. If all truth resulted from reflection alone, it would be easy to establish general laws, and it would not be necessary painfully to collect a great number of facts and experiments in order to deduce from them general principles. But history proves the insufficiency of our reflection alone, that is, if it be not guided by experiments.

Finally, still other philosophers admit two sources of the manifestations of the intellectual faculties, an external and an internal; and they consider the manifestations of the intellectual faculties as dependent on one or on the other of these two sources. Here I do not intend to determine the functions of the five external senses; this consideration belongs to another chapter: I shall only prove that impressions on the senses are not sufficient to explain the manifestations of the moral sentiments and intellectual faculties. I shall consider each sense in succession, and examine what manifestations cannot result from them.

FEELING.

The sense of feeling and muscular motion are ordinarily considered as one sense; and this sense of touch, as it is called, produces, according to a great number of philosophers and physiologists, many instinctive labours of animals, and the mechanical arts of man: for instance, the proboscis of the elephant gives to this animal his intelligence; the beaver builds its hut because it has teeth fit to cut, and a tail which serves instead of a trowel;

the swan lives in water because its feet are natural oars &c. Some philosophers and physiologists, who believe in chance, maintain that man and animals make use of their external instruments, because these instruments exist, without considering the external instruments as the source of the faculties. I do not agree with any of these opinions. The order and regularity of all nature, of all phenomena in man and animals, seem to me contradictory to mere chance. According to my understanding, I am forced to admit a final cause, though I am also convinced that this final cause cannot be understood by man.

INSTINCTS BEFORE THE DEVELOPEMENT OF THE INSTRUMENTS.

The other hypothesis, that the external instruments produce the determinate faculties, may be easily refuted. A great number of insects exert different instincts, before their antennæ or their external instruments are developed.

ORGANS WITHOUT FACULTIES.

Many animals have the instruments to which certain faculties are attributed, but they do not produce the corresponding functions. Would it not be more natural to suppose that apes and monkies possess the building power on account of their hands, than to think that the beaver builds on account of its tail? Monkies have hands, they can put wood on a fire, but have they understanding enough to keep up the fire? According to this opinion insects, crawfish, lobsters, and especially cuttle fish, ought to have exact ideas of extension, size, and mathematics, on account of their numerous and perfect organs of touch.

SIMILAR ORGANS AND DIFFERENT FUNCTIONS.

The external instruments are often similar, and the functions performed by them quite different. There is a great variety of cobwebs, which different species of spiders make in order to catch flies. What diversity of structure in the nests of birds whose bills are similar? Animals of the same genus vary much in their food and their manner of living. The large titmouse builds its nest in hollow trees; the long-tailed titmouse in clefts of branches; the bearded titmouse among reeds; the titmouse of Poland suspends its delicate and curious nest on a slender branch; whilst the cuckoo, though it is endowed with a bill and feet fit to build, does not build at all. The hare and rabbit have similar feet, yet the hare lies in the midst of the fields, while the rabbit makes burrows.

SIMILAR FUNCTIONS AND DIFFERENT ORGANS.

On the contrary, similar functions are observed in animals which have quite different instruments. The proboscis is to the elephant what the hand is to man and to the monkey. The swallow attaches her nest to the wall; and the thrush cements the interior of her's by the assistance of the bill; while the beaver covers his hut with mud by means of his tail. The hands of monkies, the feet of parrots, and squirrels, are certainly different; yet by means of these instruments they hold up their food when they eat. The hog ploughs the earth with his snout, and the dog scratches it with his feet in order to dig up truffles. In our manner of thinking we say, Similar internal faculties produce similar effects by means of quite different instruments.

MANY FACULTIES WITHOUT ANY RELATION TO EXTERNAL INSTRUMENTS.

There are in man and animals many faculties which cannot be considered as the effect of external instruments. Who for example, can show, by an external organ, why crows live in society, and magpies in pairs? Why the cuckoo and chamois are wild by nature, and the pigeon and goat tameable? Why bustards and cranes place sentinels; and why ants gather provisions &c.?

Finally, even in mankind there is no proportion between the manifestations of the faculties and the perfection of the external instruments. If man owe his arts to his hands, why do not idiots invent? Why do painters drop the pencil, sculptors the chisel, and architects the compass, as soon as their understanding is deranged, while other individuals bring forth stupendous things by the assistance of their crippled hands or their stumps. Who can measure the talents and capacities for the art of building, according to the conformation of the hands? From these considerations we consequently see that the external instruments do not produce the faculties: I do not however deny the importance of these external instruments. It must even be admitted that there is some relation between the internal faculties and the external instruments. Without external instruments, the internal faculties cannot manifest themselves; without muscles, the will cannot actuate any limb; without hands, or something equivalent, we cannot seize any thing. Carnivorous animals could not destroy without claws and teeth; without these instruments therefore they could not subsist &c. Moreover, when the instruments are more perfect, the manifestations of the internal faculties are also more easy and more perfect. Nevertheless it is unquestionable that the inclinations, propensities, and intellectual faculties, which make use of the external instruments, must be derived from within.

FEELING.

It remains still to be considered, whether the acuteness of feeling produces the instinctive labours of animals and the mechanical arts of man? Experience shows the contrary. For there is no proportion between the fineness of the skin, the acuteness of feeling, and the manifestations of the faculties of the mind. Some individuals have rough hands and an obtuse feeling, and they produce however surprising things. Till the present time no artist has judged of the capacity of his disciples according to the acuteness of their feeling.

It results from these observations that the sense of feeling, even when muscular motion is considered along with it, is not sufficient to explain the mechanical arts of man and the instinctive labours of animals.

TASTE.

Neither any moral sentiment nor any intellectual faculty has been supposed to be derived from the sense of taste; therefore it would be superfluous to speak here of this sense.

SMELL.

The greatest number of physiologists attribute to the sense of smell the surprising faculty of many animals, by means of which they find again their dwellings at a very great distance; but many phenomena of this kind cannot be explained by the smell alone. For example, a dog at the end of several months, and at a distance of more than a hundred leagues, finds his former dwelling and master; when he has been carried away in a coach; when it has rained during this interval of time; when the dog has gone by water and comes back by land; when he is obliged to make circuits instead of taking the nearest way; when the wind has changed in all directions. Moreover, pigeons transported to a distance of twenty or fifty leagues, and shut up for several weeks, return to their former residence; the falcon of Iceland, confined for several months, flies away at the first moment of its freedom &c.: these and similar phenomena it is impossible to explain by the sense of smell. It is necessary to admit still another superior faculty, sometimes called the sixth sense.

HEARING.

It is a quite common opinion that music and the faculty of speaking are the result of the sense of hearing. But neither one nor the other faculty is produced by the sense of hearing. First I shall show that hearing cannot produce music. Le Cat, Ackermann, and others think, that the cochlea is the most important part of the ear, and the principal instrument of the musical faculty. Ackermann maintained that man alone has the cochlea, but different quadrupeds not only possess this part, but have it also more perfect than man. Sheep, cats, dogs, and hogs, have the cochlea, and they are certainly not fond of music. Hence, the opinion of Ackermann falls, and that of Le Cat is erroneous, because the cochlea is in many animals, which are not sensible to music, more perfect than in man. Besides, birds, whose ear is destitute of this part, yet sing. Le Cat, knowing this contradiction, answered that the whole skull of birds is more sonorous than that of quadrupeds, because the skulls of birds are less covered with muscles. He thinks that if nature had joined a cochlea to the sonorous skull of birds, they would be still more sensible to harmonious modulations, and as passionate for harmony as almost all animals are passionate for food. But, continues he, because birds are destitute of the cochlea, their musical talent depends more on their throat. In this Le Cat is mistaken. There is a great number of singing birds, the skulls of which are covered proportionately with more muscles than those of many quadrupeds which do not chew hard food; for instance, the ant-eater &c. The heads of the goldfinch, bullfinch, chaffinch, linnet &c. are covered with great muscles, while the head of the green wood-pecker, which is certainly not a melodious bird, is almost destitute of muscles. The heads of the March thrush with its hoarse voice, of the monotonous cuckoo, of the miserable babbler of Bohemia &c. are not covered with more muscles than the skulls of the charming mocking bird, of the melodious blackbird, and of the vineyard thrush with its delightful song. If we arbitrarily suppose that the whole skull of birds is sonorous, the only consequence to be drawn from it might be, that a weak sound is extremely strengthened in them; but it would be inexplicable why certain birds are so fond of singing, and why some nightingales continue sometimes their song till they die from exhaustion.

Hearing in general cannot produce music, because there is no proportion between hearing and the faculty of music, either in animals or in man. Many animals hear very acutely, and they are insensible to music. In birds the female hears as well as the male: why does not the former sing if hearing produces music? In mankind there are individuals whose hearing is very obtuse, and whose talent for music is very considerable. Finally, hearing cannot produce music, because hearing perceives only the tones which are produced. The first musician began to produce music from an internal impulse, and music which he had never heard. Singing birds, which have been hatched by strange females, without any instruction sing the song of their species as soon as their internal organization is active. Hence the males of every species preserve their natural song, though they have been brought up in the society of individuals of different kinds. Hence also musicians, who have lost their hearing, continue to compose. Hence likewise deaf and dumb persons have an innate sentiment of measure and cadence.

Le Cat confounds the crying of dogs at the sound of a hunter's horn, and the stamping and neighing of horses at the sound of a trumpet, with the sentiment of music. If this were the case, we must allow that fishes, reptiles, even spiders, which are allured by sound, are sensible to music. Buffon, Dumas, Bichat &c. think that the talent of music depends on the circumstance that the power of hearing is equal on both ears. But if the inequality of both ears were sufficient to prevent the perfection of music, a good musician would be extremely rare; for far the greatest number of men hear better with one ear than with the other. It follows from all this that hearing does not produce music. However it is to be considered that hearing is necessary to perceive and to execute music; but this consideration belongs to the chapter on the sphere of activity of each faculty. Here I intend only to prove that hearing cannot produce music.

LARYNX AND VOICE.

Some authors derive music, and the singing faculties of birds, from the larynx or throat, and voice. But if the larynx produce the instinct of singing, why do not all animals endowed with this part manifest the faculty of singing? Cuvier has examined the larynx of many birds, and found its structure similar in birds which sing, and in others which do not sing. What difference is there between the throats of the females and males of the same species? Is there in man any proportion between the agreeableness of the voice and the musical talent? Have not many individuals great musical talent and no voice; and do not others sing very agreeably without excelling in their musical talent? Consequently music is neither the result of hearing nor of the voice. Now I shall show that neither hearing nor voice can produce the faculty of speaking.

It is also a very common opinion that hearing alone, or hearing and voice, produce together the faculty of speaking. The best way to refute this error is by inquiring, in what any language consists, and how every language is produced? Language in general is the medium by which sensations and ideas are mutually communicated. This may happen by sounds, gestures, or by other signs. Language may be divided into two classes: into natural and arbitrary, artificial or conventional.

It is a natural law that the internal faculties of man and animals, as soon as they are active, manifest their activity by the intermedia between them and the external world, by the five external senses, and by muscular motion. These external manifestations happen involuntarily according to determinate laws. They are modified in every kind of animals, but are always conformable to some kind of sensations or ideas. The horse neighs, the lamb bleats, the cow bellows, the child cries &c. according to their wants. This natural language is quite general, because all animals need to communicate their sensations, were it only for sexual purposes. We generally observe that animals which live in society communicate their wants, the approach of danger, or of an enemy. To what purpose their calling, their placing sentinels, their sounding alarms, when they do not understand one another? Without this supposition how were it possible that hunters could deceive animals in imitating their voice and calling? Consequently we must allow with George Le Roi, Condillac, Dupont de Nemours, Tracy, and many others, that animals have their language, and that this language is proportionate to their faculties.

It may be objected that the language of animals has no words. Animals have only natural language, and it consists partly of sounds and partly of gestures, as well as the natural language of man, which has also no words. But man has, besides his natural language, a particular faculty of producing arbitrary signs, whether sounds or gestures, or other signs. Animals, on the contrary, are destitute of this faculty of producing arbitrary signs; they have only the faculty of learning the different arbitrary signs of man; for instance, cats, dogs, horses, oxen &c. learn the language of every nation as far as they have the respective sensations. A dog may learn to understand the signification of *eating*, *manger*, or *essen;* but animals cannot understand any sign, either natural or arbitrary, if they be destitute of the respective sensations or ideas. Under the physiology of the brain, we shall consider the faculty which produces the arbitrary signs, and another which acquires them. Here I intend only to demonstrate that neither hearing nor voice produces the faculty of speaking. Both are in respect to language what they are in respect to music, that is, only means of manifestation, or certain intermedia. There are animals which can pronounce words, imitate different sounds, and hear very well; nevertheless they have no arbitrary language. Some imperfect idiots hear very well, and pronounce with facility the words they know, but they cannot keep up a conversation. Their manner of communicating, or their language, becomes consistent in proportion to their internal faculties. Moreover, if the mind and understanding are deranged, orators and poets become dumb, or their eloquence is changed into incoherent babbling. It is therefore evident that the faculty of speaking does not result primitively from the voice and hearing.

SIGHT.

We have still to examine whether sight produces any moral sentiment or intellectual faculty. It is a common opinion that the art of painting is the result of sight; and it is true that eyes are necessary to perceive colours, as the ears are to perceive sounds and tones; but the art of painting does not consist in the perception of colours, any more than music in the perception of sounds. Sight therefore and the faculty of painting are not at all in proportion. The sight of many animals is more perfect than that of man, but they do not know what painting is; and in mankind the talent of painting cannot be measured according to the acuteness of sight. Great painters never attribute their talent to their eyes. They say, it is not the eye, but the understanding, which perceives the harmony of colours.

It follows from all these considerations, that many intellectual faculties which have been attributed to the five external senses do not belong to them. Moreover, it is easily conceived that there are many other faculties which cannot be, and which never have been considered as the effect of the five external senses; for instance, the moral sentiments of justice and charity, the faculty of inquiring into the relations between cause and effect &c. The brain alone remains to be investigated. Let us then examine whether the manifestations of the feelings and intellectual faculties have any relation to the organization of the brain?

SECTION V.

The Brain is exclusively the Organ of the Feelings and Intellectual Faculties.

PHYSIOLOGY OF THE BRAIN.

I have demonstrated that the manifestations of the feelings and intellectual faculties do not depend on the whole body—neither on its configuration, form, and size, nor on its organic constitution; that they do not depend on the viscera, or on the nervous plexus and ganglia of the abdomen and thorax, nor on the spinal marrow, nor on the five external senses. I shall now prove that they depend only on the brain. For many centuries it has been said that the brain is the organ of the soul; and hence it might be objected that it is superfluous to give any detailed demonstration of this truth. But there exist still many doubts to be resolved, many difficulties to be removed, many notions to be fixed with more precision; and the repetition of transitory and contradictory opinions is quite a different thing from the accurate knowledge of an object in all its details.

If, according to the ancient philosophers, the intellectual faculties be placed in the brain, and the moral sentiments in the viscera of the abdomen and thorax for the purpose of preventing the understanding from being disturbed by the passions;—if it be said that the nervous plexus or ganglia are the seats of the affections;—if, according to Dumas, Richerand, Sprengel, and other physiologists, the difference of the feelings and intellectual faculties result from the difference of the temperaments;—if Pinel and others do not dare to seek in the brain for the proximate causes of the mental alienations;—if Bichat consider the hemispheres of the brain as mere coverings of the internal parts;—if, according to Sabatier and Boyer, the brain be a secreting organ, and, according to all anatomists before us, the origin and source of the nerves;—if all the sensations and ideas be derived from the five external senses;—if the instinctive labours of animals, and the arts of man, be ascribable to their hands, eyes, ears, and other external instruments;—if it be maintained that one nerve can perform the function of another nerve, so that the nerves are homogeneous;—if it be taught by some magnetisers, that, in the perfect state of animal magnetism, the spirit acts without the assistance of the organization;—if the soul of the world be spoken of and admitted;—if the greatest number of metaphysicians maintain that the highest faculties of the understanding—reason and will at least act independently of all the organization;—if hydrocephalic persons be quoted, who without brain have manifested moral sentiments and intellectual faculties;—if the same be related of animals whose brain was ossified;—if any of these assertions be admitted, and if it be at the same time maintained that the brain is exclusively the organ of the soul, the contradiction is evident. Now there is no author who has not advanced one or other of these suppositions; and consequently it is not superfluous to detail our ideas relative to the organ of the soul, and to inculcate our principle that the brain is exclusively the organ of the feelings and the intellectual faculties.

All the parts of the body may be wounded or destroyed—even the nervous mass of the spine may be compressed or injured at a certain distance from the brain, without destroying immediately the feelings and intellectual faculties. In tetanus, produced by a cause remote from the brain, the other nervous systems are attacked in the most violent manner, while the functions of the mind remain sometimes till death. On the contrary, if the brain be compressed or destroyed, its functions are deranged, and the manifestations of the feelings and intellectual faculties are suspended or annihilated. Moreover, automatic life requires neither the brain nor the cerebellum. The superior parts of both hemispheres, the great commissure, even more than half the cerebellum, may be wounded, destroyed by suppuration, diminished in size, or taken away, without destroying the functions of the five external senses and automatic life. Several acephali, or monsters destitute of the brain, are born strong and fat, some of them even live some time after birth. Consequently if the brain be not destined to superior functions, its existence would be useless. But it is probable that the most perfect of all the nervous systems has also an object corresponding to its organization.

However defective our knowledge of the scale of the brain from the lowest animals to man may be, it is nevertheless certain that the number of faculties increases in proportion as the cerebral parts multiply. This multiplication of the feelings and intellectual faculties of man, and of the instinctive labours of animals, is neither in proportion to the five external senses, nor to any other part of the body, but only to the cerebral parts. This could not happen if the brain were not exclusively the organ of the feelings and intellectual faculties. In treating of the innateness of the faculties, and their dependance on the organization, I have stated that, if the developement of the brain be defective, the manifestations of the feelings and intellectual faculties are also defective. In fact, an infinite number of observations prove that the brains of idiots from birth are defective; and that the manifestations of the feelings and intellectual faculties improve and become perfect in the same proportion as the organization of the brain improves.

I have proved at the same time that, if the developement of the brain be very considerable, the manifestations of the feelings and intellectual faculties are very energetic. Consider the heads of those who have excelled by great talents and capacities. Bear in mind however the difference between a large brain and a large face: the brain may be small and the face large, or the brain large and the face small. I have also demonstrated that the manifestations of the faculties follow the ordinary or extraordinary growth of the organs: that in children the brain is yet pulpy, and that therefore the functions of animal life cannot be manifested; that in proportion as the brain increases by degrees the faculties manifest themselves; that in the state of maturity the brain has acquired the highest degree of developement, and the manifestations the greatest energy; and that in proportion as the organization of the brain decreases, the energy of the moral sentiments and intellectual faculties decreases also.

We have mentioned that, if the developement of the brain do not follow the common order, if it take place too early or too late, the manifestations of the moral sentiments and intellectual faculties are subjected to the same changes; and that certain faculties are more active in men, and others in women, according to the difference of their cerebral organization. I have also shown that the feelings and intellectual faculties are hereditary in the same proportion as the organization of the brain is propagated from parents to their children. Hence as there is a proportion between the developement, increase and decrease of the brain, and the manifestations of the moral sentiments and intellectual faculties, the conclusion is evident that the brain is the organ of these faculties.

To the preceding proofs I may add, that the moral sentiments and intellectual faculties are weakened or deranged either by age or diseases, in the same proportion as the brain is altered. Finally, every one feels that he thinks by means of his brain. Thus all concurs to prove that the brain must be considered as the organ of the moral sentiments and intellectual faculties.

Objections.

There are, however, various objections against the assertion that the brain is exclusively the organ of the moral sentiments and intellectual faculties. I shall answer the most important of them which are still repeated in different writings.

On the Influence of the Diseases and Wounds of the Brain upon the Manifestations of the Moral and Intellectual Faculties.

In order to prove that the brain is exclusively the organ of the mind, I have said that its functions are more or less disturbed by the diseases and wounds of the brain. Hildanus relates that the skull of a boy, ten years of age, was depressed near the lambdoid suture by an accident; and because no harm immediately resulted from it, the bone was not lifted up. The boy, however, who was endowed with strong mental dispositions, lost by degrees his memory and judgment; he became incapable of learning any thing, and finished with becoming an idiot, living till forty years of age. Repeated observations induced Boerhaave to say, that if the bones of the skull be depressed, and compress the brain, numbness of the senses, fainting, giddiness, want of consciousness and delirium, result from it. In the writings of Morgagni, Haller and others, a great number of slight injuries of the brain are quoted, by which the faculties of the mind were disturbed. It seems superfluous to me to quote a greater number of similar examples. Several authors have even maintained that every injury of the brain produces necessarily some derangement of the functions of the mind.

On the other hand, there is a great number of observations according to which the most considerable injuries of the brain have not done any harm to the manifestations of the soul. A person was wounded in the head by a shot, and the ball remained in the brain. After the death of this person the ball was found near the pineal gland. However this man lived for several years after the accident without manifesting the least derangement of the intellectual faculties.* The skull of a child of eight years of age was broken by the kick of a horse: bits of the cineritious substance, larger than a hen's egg, (as it is expressed,) came out and were lost; however this child was perfectly cured, and his intellectual faculties did not suffer.† A young person, fifteen years of age, received a blow on his head with a stone; his brain became black, and issued out of the wound. This young man, in a fit of delirium, took away with violence the apparatus which covered the wound, and at the same time a considerable portion of the injured brain. The cerebral substance was injured down to the corpus callosum; and the patient was pa-

* Memoires de l'Acad. de Chir. T. i. p. 134. † Ibid. p. 126.

ralysed, but his intelligence was not impaired.* A child of seven years of age had a severe wound on his head by a fall from a horse: the brain issued continually by new excrescences without doing any harm to the intellectual faculties, though the ulceration penetrated to the cerebral substance. Another child lost a great deal of his brain by fungus, which grew during four months. The cineritious substance was entirely destroyed at the place of the wound, and changed into purulent matter. However the child preserved his consciousness, and spoke with understanding till his death.† A stag drove its horn into the head of a hunter through the orbit, so that the end of the horn came out at the top of the hunter's head. Notwithstanding this accident the hunter walked home two leagues on foot. A great number of similar examples have been noted, partly as extraordinary observations, partly in order to prove that the brain is not the organ of the mind, and that the functions of the intellectual faculties are independent of the organization.

There are still many more examples of derangement in the intellectual faculties, while not the least defect could be discovered in the brain. And in many cases of mental alienation, instead of finding out any cause in the brain, an evidently diseased state has been observed in quite different parts, as in the liver, bowels &c. Hence Pinel affirms that the most exact dissections have not taught any thing

* Memoires de l'Acad. de Chir. T. i. p. 150.

† Van Swieten, T. i. p. 440.

in respect to the seat of mental alienation, and that we have no sufficient data to conclude from the diseases of the brain that the brain is exclusively the organ of the intellectual faculties.

In order to rectify these facts, opposite in appearance, we must consider two questions: Was it possible before now to judge exactly of diseases and wounds of the brain in respect to their nature? And was it possible before now to judge perfectly of the effects produced in the manifestations of the intellectual faculties by such diseases and wounds? It is evident that it was impossible to make exact anatomical observations upon an organization which was not only unknown, but in respect to which there were notions quite erroneous, nay entirely opposite to its real structure; and it is beyond doubt that hitherto this was the case with the internal structure of the brain. On the other hand, the authority of writers induces too often the admission of facts which never existed. Morgagni, for instance, maintains that the brains of those who are proud and stubborn, are hard and coriaceous; and that the brains of those who have manifested a meek, unsteady and undecided character, are soft. Theophilus Bonnet relates that the brains of those who died of anger and fury, were hard, dry and friable. According to the opinion of Portal, in fools the convolutions of the brains are less deep; according to Dumas, in reasonable men the form of the brain is round: this author advances also that the character of any person is mild or hasty; that his ideas are lively and rational, or heavy and confused; that he is an idiot or a fool, according as his brain is more or less of a dark colour, more or less firm &c. Now though such exaggerated notions are ill-founded, is it right to conclude that in madness and idiotism the organ of the mind has not at all undergone any derangement? Hence it is necessary to inquire what changes can take place in the cerebral mass in general, or in any of its particular parts. And it is also necessary to consider whether a derangement may happen which cannot be observed by the five external senses? If anybody die by being struck by a thunderbolt, or in consequence of the gout in the stomach, or of hydrophobia, or of tetanus, no derangement is discovered in the nervous system; are we therefore authorised to say that the nervous system has not suffered any change?

In the same way, certain altèrations of the brain are not visible if they be transitory, but they become manifest after a lapse of time. The blood-vessels are sometimes ossified; sometimes a great quantity of bony substance is deposited on the internal surface of the skull, and the cerebral mass itself is diminished in size.

We are of opinion that all the derangements of the manifestations of the mind result immediately from any change in the brain. We admit that the remote causes of mental diseases often reside in the viscera of the abdomen; but does it follow that the immediate cause is not in the brain? Intestinal worms produce by their irritations of the bowels a bad breath, a cough, grinding of teeth, a tickling in the nose, blindness, madness &c. but the bowels are no more the seat of the madness than they are the seat of the gnashing of teeth, of the tickling of the nose, or of the blindness. There exists an influence of the viscera upon the brain, and *vice versâ*. Therefore the functions of the brain may be deranged by the influence of any remote part. It is, however, conceivable that a derangement of the brain, which is only sympathetic at the beginning, may continue after the first cause no more exists, that is, if the first cause have produced an alteration in the cerebral mass itself. On account of the reciprocal influence of the brain and the viscera of the abdomen, many derangements of the functions of the viscera result from different affections of the brain; for instance, fear relaxes the bowels, grief troubles digestion, anger deranges the secretion of bile &c. And as a derangement of the viscera may produce a derangement of the functions of the brain, which may still augment the disease of the viscera; so a derangement of the functions of a viscus may result from any moral sentiment, and it may reciprocally augment the disease of the brain.

It is also true that very considerable injuries of the brain produce sometimes very slight perturbations in the manifestations of the mind; and that very slight injuries of the brain are accompanied often with the most violent accidents. But this also happens in other parts of the body. Sometimes very considerable abscesses are found in the lungs without a considerable preceding derangement in the respiration. Are not the lungs therefore the organ of respiration? Sometimes ossifications have been observed in the heart, without any remarkable disturbance of the circulation; is not therefore the heart the organ of circulation? Hence, it is wrong to attribute to the wound, or to its seat, what must be attributed to the particular irritability of the sick person. Thus we may explain why often no accident results from a very considerable wound of the brain, namely, in patients whose irritability is very weak; while in very irritable persons very slight wounds produce the most serious consequences.

It remains to mention certain observations, where half the brain was completely destroyed by suppuration, while the manifestations of the intellectual faculties remained. It seems at least that in such a case the half of the manifestations ought to be annihilated. Though these observations seem to be incorrect, let us admit them as they are related. Let us even join to them an observation made by Gall at Vienna. He attended a clergyman in the Theresian Institution, who for a long time had a pustular erisypelas, which disappeared and re-appeared from time to time; his left side became weaker by degrees, so that at last he could not walk without a stick; finally, he was struck with apoplexy and died in a few hours. Three days before, he had preached and given a lecture at the school. On the dissection of his head the middle part of the right hemisphere, as large as one's hand, was found changed into a yellowish and grumous substance. Gall regrets his not knowing the structure of the brain, and being prevented from making an exact observation of it. It is however certain, that notwithstanding this considerable alteration of the hemisphere, the intellectual faculties manifested themselves in this individual with a surprising regularity. Consequently, it is to be examined how similar observations are to be explained, if the brain be the organ of the mind.

In this objection, and generally in injuries of the brain, the duplicity of the nervous systems has been forgotten. One half of the brain may be destroyed, and the other half continue to exert the manifestations of the mind. One of the optic, auditory, olfactory, or other nerves may be destroyed, while the other manifests the respective function. In the same manner, one side of the brain, one hemisphere may be destroyed, while the other hemisphere continues to manifest the faculties of the mind. It is evident that both hemispheres of the brain may be in a quite different or even opposite state. Tiedeman relates the example of one Moser, who was insane on one side, and who observed his madness with the other side. Gall attended a minister who had a similar disease for three years. He heard constantly on his left side reproaches and injuries; he turned his head on this side, and looked at the persons. With his right side he commonly judged the madness of his left side; but sometimes in a fit of fever he could not rectify his peculiar state. Long after being cured, if he happened to be angry, or if he had drunk more than he was accustomed to do, he observed in his left side a tendency to his former alienation.

These observations seem to be extraordinary; but the opposite state of both hemispheres is not rare. It exists evidently in the hemiplegia, when one hemisphere is paralysed and deprived of activity, while the other hemisphere continues to exert its functions, so that the patients do not seem to have lost any faculty of the mind. One half of the tongue is paralysed, one eye is blind, one ear deaf; while the taste remains, the other eye sees, and the other ear hears. Sometimes one hemisphere of the brain is inflamed, the other not. In the megrim, the blood-vessels are more full on the diseased side. A child died by a violent blow applied to the right side of his head: on dissection the right side was found quite pale and bloodless, and the left on the contrary, injected and filled up with blood—an evident proof that the hemispheres may be in an opposite state. If this child had continued to live, he would have been paralysed on one side, and he would have suffered violent convulsions on the other. I dissected the brain of a mad girl, and found that on the left side a great deal of the inferior large apparatus of increase (thalamus) was destroyed by ulceration; the nervous bundles were diminished in size, and the convolutions were proportionate; while on the right side all the parts were larger. Thus as it is proved that all cerebral parts are double, and that one half may be in a different state from the other; it may easily be conceived that any special faculty may manifest itself, as long as the respective organ is not utterly destroyed on both sides.

Let us examine whether it was hitherto possible to judge exactly of the derangement of the manifestations of the mind. No one feels better the insufficiency of the actual state of our knowledge of human nature, than those who observe the derangements of the manifestations of the mind. Pinel despairs of our ever being able to know the cause of the derangement of the mind, on account of our ignorance concerning its healthy state. I shall here confine my considerations to the exposure of the defectiveness of the proceedings of our predecessors.

All the reports relative to the wounds of the head, to the injuries of the brain, and preservation of the manifestation of the mind, are confined to the following expressions:—The patient continued to walk, to eat and drink; he had his consciousness entire, *viz.* he knew all around him; he manifested some memory and judgment; consequently he possessed all the faculties of the mind, and nothing was disturbed. But if a person of a meek and peaceable character, after being wounded on the brain by a stone, become quarrelsome and morose; if another, whose actions were irreproachable, after being wounded on the head feel an irresistible inclination to steal; it is evident that these persons have preserved consciousness, memory, judgment and imagination; but can we infer that the injuries of the brain have not produced any derangement of the manifestations of the mind? Moreover, animals have consciousness, memory and judgment; are they therefore men? If a man by any disease be brought down to the faculties of a dog, and preserve the functions of the five external senses, memory and judgment, would he therefore have lost no characteristic faculty of human nature? If partial idiots have perception, memory and judgment, do all their faculties manifest themselves? If in partial madness the patients preserve consciousness, memory and judgment; if their imagination be even exalted; are therefore all their faculties unimpaired. Finally, if persons by a commotion of the brain, or by a fit of apoplexy, lose the memory of proper names, or of a language, and if they preserve the functions of the five senses, memory and judgment, have they lost nothing at all? Thus it is evident that now the manifestations of this, and then of that faculty of the mind may be deranged or destroyed, though the patient preserves the faculties which are said to constitute the whole intellectual being. It follows also that it has hitherto been impossible to judge exactly of the effects of diseases and injuries of the brain, because all physiologists considered only the general attributes of the understanding, and were quite ignorant in respect to the special faculties. Hence, inquiries into the injuries of the brain, in respect to mental alienation, must be made with more exactness than it has hitherto been possible to make them.

Objection.

An objection has been founded on pretended observations, according to which, although the brain was destroyed, dissolved, or disorganised by water, yet the manifestations of the mind continued unimpaired.

Zacutus Lusitanus maintains that he saw a child who lived for three years without brain. This author believes that he found in this child a double dura mater. Duverney says that he found in a skull only water and no brain. Haller and Soemmerring speak of these observations without denying them. Lauffer * speaks of a new-born child in whose head he found no brain, but only water: he maintains that the brain existed before, and that it was dissolved by the water. This opinion was very general, and this phenomenon is spoken of under the name liquefaction, or dissolution of the brain.

Anatomists were accustomed to see the brain presenting a thick and solid mass in its natural state; if they did not find this solid mass, they considered the brain as dissolved or annihilated. However Morgagni reproached Duverney with his inadvertency, and he assured us that, in perfectly similar cases, he has always found the brain only distended into a thin membrane, and he relates that the same has been observed before him by Tulpius, Vesalius, and several other anatomists. In order to answer exactly this objection, we must consider three points. First it is to be examined where the water is found; then what change the cerebral mass

* Diss. de Infante sine Cerebro nato. Halae, 1743.

has undergone; and what change takes place in the manifestations of the faculties of the mind.

Physicians are not agreed where the water is contained in hydrocephalic persons. I speak here only of those hydrocephalic patients, whose skull is distended beyond the natural size. There are two other kinds of this disease, which are very important in the practice of medicine, but which do not belong to this subject. In the hydrocephalic persons, whose skulls are larger than natural, the water is said to be accumulated either in the cavities of the brain, or between the membranes, or between the dura mater and the skull. The greatest number of practitioners consider the two latter cases as the most common, but all physicians admit these three kinds. Professor Walter, at Berlin, maintained publicly, that in sixteen hydrocephalic persons he always found the water without the brain. Pinel* says that in hydrocephalic persons the water is contained between the skull and the dura mater, or between the membranes, and sometimes in the cavities of the brain. Odier fancies that the hydrocephalus is always produced in the windings of the pia mater. He distinguishes this hydrocephalus from the acute, which latter, according to his opinion, is only formed by an accumulation in the ventricles. He gives a detailed description of the acute hydrocephalus, and calls it internal, in opposition to the hydrocephalus of which I

* Nosographie Phil. Edit. 3me. T. iii. p. 423.

speak here, and which is called external by Odier. Petit, on the contrary, maintains that in all distended hydrocephalic heads he found the water in the ventricles, and never between the membranes, nor between the dura mater and the skull. Our observations agree perfectly with those of Petit. We maintain that in all hydrocephalic persons, whose skulls are extraordinarily distended, and consequently contain a great accumulation of water, the liquid occupies the cavities of the brain.

We have proved that Walter has only advanced his assertion in order to support his erroneous opinion relative to hydrocephalus, and that he has not opened any one of the sixteen mentioned skulls. In his defence, he allows that nine of these heads were not in a state to be examined: the tenth was opened by professor Buttner at Konigsberg. In his work, called *Museum*, he makes no mention of these skulls; and in his considerable collection we found not any dissected skull of hydrocephalus, while there were several unopened ones. It is easily explained how anatomists and physicians have been led into this mistake. In those hydrocephalic skulls which contain a large quantity of water, the hemispheres of the brain are so much unfolded, that the brain is distended like a bladder, not more than a line in thickness. In sawing the skull without precaution, this thin membrane of cerebral matter is commonly wounded; the water which distended the brain issues, and the brain sinks down. The water flows out; and if the superior part of the skull be taken away, the water appears on the surface of the brain. Some physicians also of little experience did not consider this membrane of cerebral matter as brain, but they fancied that the brain had been dissolved by the water. There were even some who said that the brain had been compressed into a small mass, that is, they considered the inferior parts as the whole brain.

If the hydrocephalus of the cavities be confounded with an accumulation of water without the brain; and if, according to the advice of Darwin,* an aperture be made in the skull in order to make an outlet for the water, the patient is sometimes killed suddenly, and sometimes dies in a few days. Some fluctuation, however, felt at the fontanel might easily deceive bad observers; for sometimes the skull of such children remains very thin; at different places the ossification takes place very late in life; and a cartilaginous transparent mass alone covers the brain. It is necessary to be perfectly acquainted with these observations in order not to be deceived. Not long ago, Dr. Martin junior† endeavoured to cure this disease by puncture; but after seven days the patient died. He erred in thinking that the water was accumulated between the brain and membranes.

Let us now examine what change the brain undergoes in the dropsy of the cerebral cavities? It was by many anatomists admitted that, in the hy-

* Zoology, vol. iii. p. 162, 236.

† Bulletin de la Societé d'Emulation de Paris, 1810, Mai, T. v. p. 294.

drocephalus of the cavities, the brain was distended like a bladder; but it was unknown in what this distension consisted; and it seemed inconceivable how a medullary substance could be distended to such thinness without breaking. Walter, at Berlin, Ackermann, at Heidelberg, and many others, admit the existence of the cerebral mass in hydrocephalic persons; but they maintain that this mass is destroyed or disorganised. We maintain that the cerebral substance is not disorganized. We prove our assertion by anatomy and physiology.

It may be proved by anatomy, that the fibres of the brain are directed vertically or perpendicularly above the cerebral cavities, and that every convolution consists of two layers applied one against another, and which may be separated one from another. Thus if a great quantity of water be accumulated in the cerebral cavities, and act against the convolutions placed round about the cavities, it separates gradually the two layers whose natural position is vertical, till at last their situation is horizontal. In this manner, in large hydrocephalic skulls, the convolutions are entirely unfolded, and present a smooth surface and a membranous expansion.

This expansion was considered by Zacutus Lusitanus as a second dura mater. If such a hydrocephalic head have not been shaken, and if the opening have been made with precaution, the water is limpid. But if such heads be carried from one place to another, and thereby shaken, it is not astonishing that the water is troubled, and the brain dissolved or eroded in appearance, and swimming in flakes among the water.

We also prove our assertions by physiology. If the brain be the organ of the soul, and if at the same time the cerebral substance be destroyed in hydrocephalic persons, it would be impossible that these patients could manifest any intellectual faculties. Indeed one of the two following assertions must be maintained: either that the brain is the organ of the soul, and in this case it cannot be destroyed in those hydrocephalics who manifest intellectual faculties; or that the brain is not the organ of the soul, because the hydrocephalic persons, whose brain is disorganised, nevertheless manifest feelings and intellectual faculties.

Walter, at Berlin, fancied that the brain of hydrocephalic patients was disorganised; and he therefore maintained that in them all the intellectual faculties were annihilated. But there are many examples of hydrocephalic persons, in which, although the disease is very considerable, there is a manifestation of intellectual faculties. Tulpius had observed such a hydrocephalus endowed with understanding. He inferred from this observation that the structure of the brain ought to be quite different from what is supposed. Camper, and many other anatomists, speak with amazement of similar observations.

In order to procure yet stronger proofs against those who deny that the brain is exclusively the organ of the soul, and to refute at the same time those who deny that hydrocephalic persons continue to manifest intellectual faculties, I shall quote several examples of this kind. We observed for some years a woman with a considerable dropsy of the brain, who manifested a moderate understanding like other women of her class. She died at fifty-four years of age of an intestinal inflammation; and the cavities of her brain contained almost four pounds of limpid water. We have seen a learned man, whose head is extraordinarily high on the anterior superior part of the forehead, and which, according to its size, must contain from three to four pounds of water, yet this man has extensive knowledge. The only inconvenience which results from his peculiar state is, that he often falls suddenly asleep in the midst of the most interesting conversation, at table, at the theatre, and elsewhere. At Copenhagen, we saw a girl thirteen years of age, whose head was twenty-five inches in circumference, nineteen inches from one ear to the other, and the same measure from the root of the nose to the neck. The head must have contained from ten to thirteen pounds of water. The legs of this girl were almost paralytic, so that she had to be carried from one place to another. Yet she was genteel in her manners, and learned very well what other girls learned at school. At Augsbourg, we met with a girl thirteen years of age, whose head presented the same shape and size with that of the woman of fifty-four years mentioned above. This girl was little, but she walked well, and spoke with understanding. A similar girl, eleven years of age, was shown to us at Marbourg. At Bruchsal, a hydrocephalic girl of fourteen years of age, who was obliged to lie constantly in bed, and was certainly too childish for her age, yet talked with understanding enough of every thing she was interested in. At Leipzic, Dr. Tobias showed us a hydrocephalic head of an extraordinary size. This person had lived thirty-six years, and had common understanding, which he lost only one year before his death by a violent fit of anger. Messrs. Laumeyer and Nueffer, at Fribourg in Brisgau, preserve the skeleton of a girl of seven years of age, whose skull contained seventy ounces of water, and who was nevertheless able to remind other persons of news she had heard read in the papers some time before. Dr. Maler, of Carlsruhe, told us the history of a person affected with hydrocephalus, who died at twenty years of age, and whose skull contained above ten pounds of water. This patient manifested an ordinary state of understanding. I have seen at London, four considerable hydrocephalic heads. One was thirty-three inches in circumference, twenty-four and a half inches from one ear to another, and twenty-three and a half inches from the root of the nose to the neck. Yet the person, then nineteen years of age, manifested all the moral sentiments and intellectual faculties. He read and wrote tolerably well.—(*Pl.* V. *fig.* 2). Thus these examples prove that hydrocephalic patients are not entirely destitute of the manifestations of feelings and intellectual faculties.

The explanation of these phenomena is easy to those who know the structure of the convolutions. It follows from it, that in large hydrocephalic persons the brain is not disorganised, but that the cerebral fibres have only changed their vertical direction into a horizontal one. Now the functions of the intellectual faculties do not depend essentially on the vertical, horizontal, or inclined position of the cerebral fibres, and the manifestations of the intellectual faculties may continue without great derangement, if the pressure of the water upon the brain be not too strong, and only act upon it by degrees. It is also possible that the cerebral fibres may grow longer without the internal organization being destroyed. Sometimes the optic nerves grow longer, if an excrescence pushes the eyeball out of the orbit without losing the faculty of seeing. Thus all the arguments which have been founded on hydrocephalus, in order to prove that the brain is not exclusively the organ of the soul, fall to the ground.

Objection.—Of the pretended petrified or ossified Brains, which, we are told, have not prevented the Manifestations of the Intellectual Faculties.

Among the phenomena which seemed calculated to refute the principle that the brain is exclusively the organ of the soul, it is asserted that petrified or ossified brains have not hindered the mind from manifesting its faculties. Instead of examining the truth of these narrations, they are admitted by our adversaries, because they seem decisive in the refutation of our principle. We have seen similar ossifications at Vienna, Leipzic, Amsterdam, Cologne, and at Paris;

and these pretended ossified brains were shown to us always with the intention to refute our assertion that the brain is exclusively the organ of the moral sentiments and intellectual faculties. Thomas Bartholin, in 1660, first mentioned this phenomenon. In 1670 an ox was slaughtered in the Benedictine monastery of St. Justine, near Padua, and, according to the narration of a monk who was cook, its brain was hard like marble. Duverney showed such a pretended ossified brain to the Academy of Sciences in 1703. Moreschi, Professor of Anatomy at Bologna, and Dr. Giro,* maintain that they examined, at Rovigo, a similarly ossified brain. They cut it horizontally almost on the level with the corpus callosum, in order to examine the interior parts. They found the colour of the circumference different from that of the interior parts, but they did not distinguish the cavities, the thalami, or the corpora striata, any vestige of the third and fourth ventricles, no corpora quadrigemina, no pineal gland. The cerebellum presented only parallel transverse ridges. On the basis of this pretended brain they found only unevennesses without any origin of the nerves. However they maintain that the ox, to which this brain belonged, manifested the same inclinations as every other ox with a sound brain. The ox was eight years old when it was killed. Dumas has maintained that these facts refute completely our doctrine of the cerebral organs, because, according to the narration of Duverney, the ox preserved its un-

* Gazette de Santé. Paris, Nov. 11, 1809. N° XXXII.

derstanding. Indeed this erroneous opinion relative to ossified brains is very far from being destroyed, though Vallisneri has completely refuted it.

From the number of such ossifications which we have seen, and of those Vallisneri speaks of, it seems that they are not rare. But let us first consider what Vallisneri thinks of them. He shows * that there is no such thing as a petrification of the brain, and that this opinion took its rise from the ignorance of a Benedictine friar. He states that he has seen this pretended petrifaction, and he assures us that it is only an ossification. Vallisneri proves morever that these bony masses are not at all ossified brains, but only bony excrescences of the skull. He has made drawings of the convolutions of a natural brain of an ox from above, from below, and in the middle line, in order to show that there is no analogy between the protuberances of these bony excrescences, and the convolutions of the brain. He shows that one of the excrescences which was in his possession had a much stronger resemblance to the natural brain of an ox than the excrescence which Duverney had caused to be drawn, and he mentions that he knew of five such excrescences. He consequently reproached Duverney with his ignorance in thinking that Bartholin and himself only had observed this phenomenon; and shows the greatest amazement that the Academy of Sciences had been deceived by that which Duverney presented as an

* Opere Physico-Mediche. Venezia, 1733. T. i. Art. Cervello Impetrito.

ossified brain. He moreover reproaches Duverney for not opening, and for not having examined, the interior parts, in order to see that there was no vestige of cavities, of corpora striata, of thalami; and blames his credulity in supporting his assertion only by the relations of a butcher.

It may be joined to the observations of Vallisneri, that Duverney calls some part on the surface pineal gland; but, in the first place, this part is much larger than the pineal gland of an ox; next, its form is quite different; and finally, the pineal gland is not situated on the surface but interiorly. In the same manner, the part which he considers as a cerebellum, with its vermiform process, does not at all resemble the natural cerebellum. Moreover, Vallisneri justly remarks that Duverney would have found the brain as well as the bony excrescence, had he himself opened the head. He relates that a butcher of Modena, proceeding more exactly and more carefully, found both the brain and a bony excrescence of the skull.

Messrs. Giro and Moreschi maintain that they found the centrum ovale of Vieussens in the bony excrescence which they possess. This error is easily explained. If the brain be cut horizontally, it presents a large white surface, called by Vieussens, centrum ovale. Now if the bony excrescences are sawed in any direction whatever, they also present a white surface like ivory, and this white surface has been considered as the centrum ovale. But why have these gentlemen not found the ventricles, the thalami, the corpora striata, the tubercula quadrigemina &c.? What is most inconceivable is, that they found no vestige of nerves, although the ox had preserved not only its intellectual faculties, but also its five external senses! Moreover, the cerebellum of the ossified brain, mentioned by Moreschi and Giro, presents transverse and parallel rings and ridges, but the natural figure of the cerebellum of an ox is altogether different.

Dr. Simson * gives an account of the ossified brain of a cow killed at Fettercairn, a village in the county of Angus, in Scotland. Simson allows that this brain was much larger; that the cerebellum, in particular, was indeed six times at least bigger than the natural; that the natural shape was not at all preserved; that the cerebellum was raised much above its ordinary height, and out of all form; that only one small end, which was quite rough, might be suspected of having been joined to the skull, and broken off from the parts next to it. However, Dr. Simson thought that it was the ossified brain, because the butcher found it in the skull, and depended upon its being the brain; and he to whom the cow belonged received it as such, and all those who possessed it looked upon it as such.

Haller † mentions that the ossified brain, which Bartholin speaks of, was only a bony excrescence. Soemmerring advances the same opinion which we profess, *viz.* that all the pretended ossified brains are

* In an inquiry how far the vital and animal actions are independent on the brain. Edinburgh, 1752.

† Phy. T. iv. p. 356.

only bony excrescences, which take origin at the internal surface of the skull, compress the brain, and push it by degrees from its place without destroying it. These bony excrescences are formed ordinarily on the internal surface of the skull; but sometimes also on its external surface, and sometimes on both sides externally and internally. We saw a specimen of the latter kind at Goettingen, of which Peter Frank had made a present to the university. In the anatomical collection of the medical school at Paris, there is also a skull which presents a bony excrescence both without and within. These bony excrescences are sometimes spongy, soft, and smooth: usually however they are solid, hard, and uneven, or gibbous, like stalactites or cauliflowers. These gibbosities have been considered by superficial observers as the convolutions of the brain; but neither the superior nor inferior surface of these excrescences presents any part analogous to the shape of a natural brain. In every one of them, may be distinguished the place of adhesion to the surface of the skull. This root is sometimes large, sometimes small. Sometimes the size of such excrescences is more considerable than that of a natural brain. Professor Bonn of Amsterdam, for instance, showed us half an ossified brain of an ox, and this half was larger than a whole natural brain.

In respect to the influence of these bony excrescences upon healthy functions, it is certain that, notwithstanding such affections, man and animals can live for many years, and manifest various faculties. But it is not probable that the faculties suffer from them no derangement. In all examples, except that of Duverney, which he himself had not observed, the same symptoms have been remarked which take place when the brain is compressed by some other cause. The cow of which Dr. Simson speaks ate and drank, saw and heard, as well as any cow, but she had a difficulty of breathing which made her snort in her sleep, and sleep ill; she was fed to be slaughtered, yet did not get flesh, but on the contrary fell away. This pressure does the less harm, because the excrescence grows only by degrees and very slowly. We have not yet had an opportunity of observing a similar case; but it is very probable that the brain is not compressed in proportion as the bony excrescence increases, but that the cavities of the skull become larger by degrees in the same way as happens in dropsy of the brain. Consequently all that has been said in respect to ossified brains must be attributed to ignorance concerning anatomy and physiology, and principally to inexact observations and an excessive love of the marvellous. I repeat what we have always said, that if ever any brain be ossified, and the animal preserve the manifestations of its intellectual faculties, we shall be the first to declare that our whole doctrine of the functions of the brain is a mere chimerical invention.

SECTION VI.

On the absolute Size of the Brain.

The greater number of natural philosophers, being convinced that the brain is the organ of the soul, have concluded that its functions must be proportionate to its size. The brain of man was found larger than of the greater number of tame animals, as of the horse, ox &c. Therefore without examining living beings more strictly, the superiority of man was attributed to the absolute size of his brain. Thus, according to Erasistratus, Aristotle, Pliny, Galen, Portal * and others, man has the largest brain.

Modern discoveries however have shown that the brains of whales and elephants are larger than that of man. Those therefore who measure the faculties of animal life according to the absolute size of the brain must err; for whatever the understanding of the elephant may be, and though the whale be declared king of the inhabitants of the sea, no one will attribute either to the one or to the other the superior faculties which constitute the distinctive character of man. Besides, if we consider more strictly the study of nature, we find that the brains of the monkey and the dog are smaller than those of the ox, ass, and hog, yet the former come nearer

* Anatomie Medicale, T. iv. p. 30.

to man in respect to their intellectual faculties. Moreover, different animals, as the wolf, tiger, sheep, and roe, may be ranged in the same class in respect to the size of their brain, but their qualities are quite different and even opposite. It is the same with the sparrow-hawk, cock, and pigeon. Finally, we see that nature produces the most surprising effects by means of very small brains. Observe the honey-bee and the ant; think of their interior economy, of their local memory, of the care they take of their progeny, of their anger and revenge, of their natural language. Is there any thing more curious than the conic hole of the pyrmicoleon, or the web of the spider? Do we not observe in the cock the jealousy of the stag; in the red-breast the propensity to fight of the wild boar &c.? Thus if the absolute size of the cerebral mass were sufficient to measure the moral sentiments and intellectual faculties, all the animals which have the same quantity of brain ought to manifest absolutely the same faculties, and the faculties could only differ in energy. It would then be inexplicable why one animal lives in society, another in solitude; why one takes care of its progeny, and another does not; why one constructs, another sings &c. It is not even possible in the individuals of the same kind to measure their faculties according to the absolute size of their brain. Hence it is necessary to look for other means of determining the measure of the faculties of the mind.

SECTION VII.

On the Proportionate Size of the Brain to that of the Body, and to that of the Nerves.

The brain of the elephant and whale is larger than that of man; but their bodies are also much heavier than that of man. This peculiarity seemed sufficient to prove the superiority of the human brain; and anatomists no longer said that man had *absolutely* the largest brain, but that he had the largest brain *in proportion* to his body. According to the principle admitted in respect to the origin of the nerves, it was easy to explain how the moral sentiments and intellectual faculties are indicated by the size of the brain, compared with that of the body. For all nerves were said to be prolongations of the cerebral mass, and to be proportionate to the body. Consequently, in a large body the greatest part of the nervous system is employed for the purpose of bodily functions, and there remains a small portion of the brain for the superior faculties.

Some authors, it is true, considered the brain and spinal marrow as a homogeneous mass, and they derived the nerves from the spinal marrow itself; but then they supported this assertion by other observations. The brains of reptiles and fishes are very small in proportion to their bodies. A crocodile twelve feet long, a serpent eighteen feet long, a turtle that weighs from three to five hundred pounds, have brains that scarcely weigh one drachm. There are insects in which the nerve of one single sense exceeds the size of their brain. The great vulture of the Alps (lammergeyer) has the brain almost as small as that of the raven: the turkey-cock has no more brain than the parrot. It was concluded from these facts, that the faculties are in the proportion of the brain to the body.

This conclusion was drawn too hastily, and it was not grounded upon a sufficient number of observations. Wrisberg, Soemmerring, Blumenbach, Cuvier, and other anatomists wished to verify this principle. But they found that the sparrow, canary-bird, linnet, red-breast, bulfinch, and several species of monkies have, in proportion to their body, more brain than man: therefore the intellectual faculties of these animals ought to surpass those of man, or at least to approach to them. Rats and mice ought to have more understanding than the horse, stag, dog and elephant, because the former animals have, proportionately to their bodies, a more considerable quantity of brain. According to this principle, it should be impossible to find out any difference in respect to the faculties of different species of animals, whose brain bears the same relative proportion to the body. Moreover, it would be very difficult to determine the just proportion of the brain to the body and to the nerves. The proportions noticed by Cuvier are evidently incorrect. In adult men, he admits the proportion of one to thirty-five. We believe that the proportion of one to forty, or fifty, or even sixty, is more general. For if we suppose that a grown-up man weighs only a hundred and twenty pounds, and his brain from two to three pounds, the proportion fixed by Cuvier is inexact. Finally, this anatomist does not say how he had separated the brain from the other parts; whether he left smaller or larger portions of the nerves and membranes; whether the blood-vessels were empty or filled; and at what age the comparisons were made.

Haller remarked that children have a larger brain in proportion to their body, consequently that they ought to excel grown-up persons in understanding, if their faculties were measurable by the proportionate size of the brain. It may however be answered, that the brain of children is not yet perfectly developed, hence unfit for the manifestations of the intellectual faculties. Haller remarked also, and Soemmering and Cuvier after him repeated, that it is very difficult to determine the proportion of the brain to the body, because the body grows lean or fat, augments or diminishes half its weight, while the brain does not undergo any change. This assertion is refuted by experience. It is true that the brain cannot grow fat, that is, no adipose substance can be deposited in the cerebral mass any more than in the substance of the lungs, but the brain participates in the nutrition of the body as well as every other organic part. In young and well nourished men and animals, in the flower of youth, the convolutions of the brain are more plump and nearer one to another; the whole brain is more heavy than in old lean and emaciated persons, who have died of hunger and consumption. We directed our attention to this subject, and examined with this view rabbits, cats, monkies and men. Hence the remarks made by Haller would not be sufficient to refute the opinion that the faculties of the mind may be measured according to the proportionate size of the brain.

Wrisberg and Soemmerring thought they might proceed in a surer way if they determined the faculties according to the proportion of the brain to the nerves. They observed that the nerves are much more considerable in many animals than in man. This proportion however, though more plausible than that of the brain to the body, is not yet general. The seal has, proportionally to its nerves, a larger brain than the house-dog; and the porpoise more than the orang-outang: yet we do not observe the same proportion in the faculties of these animals.

It seems that Soemmerring, in some women, found smaller nerves than he was accustomed to see in men. He concluded from these observations, that as the brain of women is smaller than that of men, the proportionate size of their nerves is preserved, *viz.*, that although their brain is ordinarily smaller than that of men, yet they possess the same degree of understanding, because their nerves are also smaller than those of men. We were attentive to this subject. There is neither any proportion between the nerves of the five external senses one to another, nor between the nerves and the brain; neither is there a general rule in respect to the sexes. Sometimes one, sometimes another pair of nerves is large or small in men or in women, and without any proportion to their brain. Therefore it is also observed that the functions of these different parts are in no proportion one to another. There are individuals whose senses are very weak, and who yet manifest great energy of moral sentiments and intellectual faculties, and *vice versâ*. Moreover, if the proportionate size of the brain to the nerves were a means of measuring the faculties of the mind, these means would yet be confined to theory, and could never be applied to living persons, because there is no possibility of distinguishing the size of the nerves before the opening of the body.

The comparison of the brain with the spinal marrow, admitted by Soemmerring, Ebel, and Cuvier,* is not more exact than the other proportions I have mentioned. Cuvier himself quotes exceptions; for instance, in the porpoise. Blainville is entirely wrong in saying that the occipital hole indicates the proportion of the spinal marrow to the brain. The occipital hole is proportionate to the medulla oblongata, and not at all to the spinal marrow. Besides, there is no proportion of the spinal marrow, nor even of the occipital hole, to the brain. The brain may be large, and the occipital hole or the spinal marrow small, or *vice versâ*. This is not only the case in different species of animals, but even in different individuals of the same

* Leçons d'Anatomie comparée. T. ii. p. 150.

species. Moreover, this proportion could not be known in living persons: consequently, even if it were exact it would be useless in anthropology.

SECTION VIII.

On the Facial Angle of Camper; on the Occipital Angle of Daubenton; and on the Proportionate Size of the Brain to the Face and Neck.

In order to measure the extent of the brain and the energy of the intellectual faculties, Camper drew a vertical line from the upper lip to the uppermost point of the forehead, and a horizontal line from the upper incisores to the external opening of the ear. Camper thought that man and animals have the more understanding, the more the angle formed by the two lines is obtuse; and on the contrary, that man and animals are the more stupid, the more this facial angle is acute. Lavater, Cuvier, Richerand, and a great number of anatomists and physiologists, are partisans of the facial angle. According to this opinion, Lavater composed the progressive scale of heads from the frog to Apollo Belvidere. Cuvier composed different tables, which indicate the facial angles of men and different animals. He fixed for the facial angle of Europeans, in a child ninety degrees, in an adult person eighty-five, and in an old decrepid man fifty degrees. This manner of measuring the intellectual faculties is not more exact than all I have hitherto mentioned. The facial angle considers only the anterior parts of the brain situated in the forehead, and it overlooks all the lateral and posterior parts: hence the facial angle could only indicate the faculties whose organs constitute the forehead. Besides, it is entirely impossible to fix in general the proportion of the forehead to the face. In new-born children the forehead is flat; in children from three months to eight or ten years of age, the forehead is ordinarily prominent, and forms a more obtuse angle than in new-born children, or in adult persons. Hence Cuvier is wrong in admitting that the facial angle decreases in proportion as the child advances in age. And even if this were the case, it would be only possible to say that the facial angle will be of so many degrees in grown-up and in old persons, when it was such or such in infancy. But it is utterly impossible to draw a conclusion from one individual; for among a hundred individuals not two will present the same facial angle. And according to the supposition of Cuvier, all children, all grown-up, and all old Europeans, ought to have the same proportion of the cerebral mass to the face. Moreover, this facial angle is useless in respect to animals. For, as Blumenbach has observed, three fourths of the animals known to us have almost the same facial angle: they are however endowed with quite different propensities. Finally, Cuvier himself has remarked that the brain is not situated immediately under the forehead in all animals, but that in a great number of them the two plates of the skull are very distant one from another. This happens indeed not only in different species of animals, but also in old persons, whose skulls often present a considerable distance between the two plates. In hogs, the brain lies one inch, and in the elephant thirteen inches deeper than the external table of the skull indicates. Cuvier, in order to avoid this inconvenience, draws the tangent or vertical line upon the internal plate. In many animals, as in several species of cats, in rodentia, the brain inclines downward behind the frontal sinus, and it is quite impossible to draw a facial angle according to the most prominent point of the forehead.

The facial angle is also a very imperfect measure of the faculties of man. We know negroes whose jaw-bones are extremely prominent, but who manifest great intellectual faculties, because their foreheads are much developed. According to their facial angle, they ought to come after many stupid Europeans who have a little forehead, but whose jaw-bones are inclined backward. It follows then from all these considerations, that the facial angle cannot serve as a means of measuring the moral sentiments and intellectual faculties.

The occipital angle of Daubenton is formed by a horizontal line drawn from the inferior edge of the orbit to the posterior edge of the occipital foramen, and by a vertical line that cuts the first, and passes between both condyles over the surface of the occiput. Now this occipital angle, according to the observation of Blumenbach, is in all animals from eighty to ninety degrees; consequently, its difference is not proportionate to the divers faculties of animals. Moreover, the occipital angle indicates only the developement of the occiput, but it does not show that of the lateral and superior parts of the brain; and this is sufficient to show its inutility.

Some physiologists, as Soemmerring and Cuvier, have compared the proportionate size of the brain to the face, and, according to them, animals are more stupid as the face is larger in proportion to the brain. Cuvier calls the senses of smell and taste, which occupy principally the face, the most animal functions. In order to facilitate the examination of this proportion, Cuvier saws the skulls vertically and longitudinally: in this way then it is easy to compare the proportionate size of the cavity of the brain to the bones of the face. The ancient artists observed a certain proportion between the forehead and the face. The statues of their high-priests, sacrificators, demi-gods, gods, and principally that of Jupiter, present high, large, and vaulted foreheads. But the superiority of the intellectual faculties does not result from the proportion of the forehead to the face, but from the developement of the forehead itself. There have been great men whose faces were very large, and whose jaw-bones were very prominent. Leo, Montaigne, Leibnitz, Haller, Mirabeau &c., had large faces and very considerable brains. On the contrary, Bossuet, Voltaire, Kant, had small faces and large brains. Soemmerring errs in saying that the skulls of women are larger in proportion to their face than those of men. Moreover, in many animals this proportion is evidently inexact. The face of the sloth and seal is, proportionally to their brain, smaller than that of the stag, horse, and ox; but no one will maintain that the former animals exceed the latter in their intellectual faculties. Finally, this proportion is not at all applicable to birds, as Cuvier himself has observed.

Plato in ancient times, and Bichat and Richerand in our days, maintained that there is a proportion between the intellectual faculties and the length of the neck. According to this assertion the intellectual faculties are the smaller the longer the neck is, because the brain is more removed from the heart, and consequently is less excited by the blood. This assertion is too evidently against all natural history and physiology to endeavour to demonstrate its falsehood.

SECTION IX.

On the Proportionate Size of the Cerebral Parts one to another.

The cerebral parts have been compared one with another, in order to point out their functions. Cuvier says * that it is possible to determine the exact proportion of the brain to the cerebellum; because no change of health produces any influence

* *Loc. cit.* p. 152.

upon the cerebral mass; and he composed several tables relative to this object. He admits the proportion of the cerebellum to the brain, in man as one to nine, in the Saïmiri as one to fourteen, in the ox as one to nine &c. These few examples prove that the intellectual faculties cannot be measured according to the proportion of the cerebellum to the brain; for in this hypothesis man and the ox ought to belong to the same order. If, according to the opinion of Malacarne, the cerebellum were the organ of understanding, the Saïmiri ought to have the most understanding; if according to our doctrine the brain be the organ of the feelings and intellectual faculties, the Saïmiri ought to have less understanding than the ox; and if the hypothesis of Cuvier were true, the ox should have as much understanding as man has.

It is not necessary that every part of the brain always participates in the healthy and diseased state of the rest of the body; for, why should not that happen with the cerebral parts, which happens in other organs; for example, any sense, or any viscus, may fall into disease, while the rest of the body is in good health. In the same way, each cerebral part alone may be diseased. And even in the supposition that all cerebral parts are influenced equally at the same time, by the healthy or diseased state of the whole body, it may still be asked, whether there is a determinate proportion between the brain and the cerebellum, and between the particular parts of the brain one to another. The answer must be affirmative in one respect, and negative in another. The constituent parts of one organ are in proportion one to another; for instance, the cineritious and white substances, the different apparatuses of increase, the ganglia, and the number of fibres which spring out of them &c. But the different cerebral systems which constitute the particular organs, and manifest the determinate faculties, are in no constant proportion one to another. There are large brains joined to small cerebella, and *vice versâ.* The cerebellum of young persons is smaller in proportion to the brain than in grown-up persons. Sometimes one, sometimes another part of the brain, sometimes the forehead, sometimes the posterior part is more developed. The proportions of the cerebral parts one to another are the more numerous the greater the number of the particular parts is. Hence the almost infinite number of size and forms of heads in the human species. Soemmerring, therefore, errs in saying that in sound brains not only the position and mutual connexion of all cerebral parts does not vary, but also that in the brain of man no considerable deviation relative to form and size is observed.

According to these considerations, and to the principle that every particular system manifests some particular faculty, it is evident that the faculties in general cannot be determined either according to the whole form and size of the head, or according to any comparison of one part with another. It is therefore also evident, that it is impossible to point out the different species of insanity by measuring and comparing the different dimensions of the skull.

SECTION X.

Our Manner of judging the Cerebral Parts in respect to their Functions.

After so many useless attempts, it was natural to despair of being able to point out the organs of the moral sentiments and intellectual faculties. Indeed physiologists could not succeed, as long as they endeavoured to measure the moral sentiments and intellectual faculties, according to the whole mass of the brain, or according to any proportion whatever. Our predecessors moreover had not the least notion of the special faculties; they were acquainted only with common or general faculties; and they sought organs for these common faculties; but it was impossible to discover any organ, because the common faculties have no particular organs. The idea that the special faculties are manifested by particular organs was the only way to find the organs of the moral sentiments and intellectual faculties. According to the new psychological system, then, it must be asked what are the functions of an animal and of man, and what proportion exists between every determinate kind of function and its respective organ? According to this idea, Gall first thought that there is a proportion between the energy of the functions and the respective organs. Therefore he no longer compared different systems one with another, but he considered every system and its functions by themselves. In the investigation of the internal senses he followed the same means as we pursue in all inquiries concerning the external senses. The sense of sight is not determined by comparing it with any other sense, but vision and the optic organ are compared &c.

It is however necessary to remark that all observations of this kind can only be made upon beings of the same species, and it is useless to compare the same faculty with the respective organ in different species of animals. The faculty of seeing is not generally in proportion to the size of the optic nerve, for there are species of animals whose optic nerve is smaller, and whose sight is stronger, while other species have a larger optic nerve though their sight is weaker. It is the same with the internal organs of the brain. There is no proportion between the size of different cerebella and the manifestations of the faculty which we attribute to this organization. The irritability is very different in different kinds of animals. Hence in order to point out the particular organs, we are obliged to compare individuals of the same species; and if we do not endeavour to determine every insignificant degree of difference, it is possible, in comparing different individuals of the same species, to find the relation of determinate functions to particular parts of the brain. However, the manner of proceeding and the determinations of the organs are yet sure, if we examine every individual by himself, and determine the organs according to his functions, or the functions according to the organs. This last is the only method of which we make use. Hence in future it can no more be asked, whether there is a proportion between the faculties of animals and man, and the absolute size of their brains, or between the faculties and any proportionate size of the brain to the body, to the nerves, or to the spinal marrow, or of one cerebral part to another. Every faculty must be compared with its respective organ, not in individuals of different kinds, not even in different individuals of the same species, but in the same individual. That organ then is larger whose function is stronger, and *vice versá*. I speak here of this subject summarily: I shall treat of it in detail when I examine the means necessary to point out the organs of the animal functions.

RECAPITULATION.

In this chapter I have first examined whether the brain is exclusively the organ of all consciousness, or whether any consciousness is manifested by means of the nerves? I have then demonstrated the uselessness of the proceedings of our predecessors; and with this view I have proved that the manifestations of the mind do not depend either on the size and form of the whole body, or on its organic constitution. I have moreover shown that the moral feelings do not depend either on the viscera or on the nervous plexus and ganglia of the abdomen and thorax; and finally, that there is no proportion between the manifestations of the mind and the size of the spinal marrow, or of the five senses, but exclusively of the brain. I have also answered the most important objections against this principle. These considerations led me to examine the different methods of measuring the intellectual faculties; and I have demonstrated that the faculties of the mind can neither be determined according to the absolute size of the brain, nor according to any proportion between the brain and the body, the nerves, the face, or the neck, nor according to any proportion of one cerebral part to another. We have seen that it is necessary to compare each special faculty only with its relative organ. Let us consider this subject in a new chapter.

CHAPTER IV.

ON THE PLURALITY OF THE CEREBRAL ORGANS.

As it is demonstrated that the brain is exclusively the organ of the manifestations of the mind, it is to be investigated whether the whole brain must be considered as one single organ, or whether it is composed of as many particular and independent organs as there are particular and independent manifestations of the mind. On this subject there are the most ridiculous, absurd, and contradictory opinions in philosophical writings. Those who admitted the simplicity of the soul, inferred from it that its organ must be single; others, who examined the particular faculties of the soul, maintained that the manifestations of every special faculty must be attributed to a particular organ.

As soon as philosophers began to think of the beings of nature, it was necessary to make divisions. Moses speaks of a division into brutes which live and feel, and into those which reason. The Greek philosophers called, with Thales, *soul* the cause of every phenomenon; they then spoke of a soul of plants, a soul of animals, and a soul of man. Consequently soul, or *anima*, was all that which gave life and sensation. The soul (*anima*) was not only divided into anima of plants, anima of animals, and into anima of man; but one soul was considered as vegetative, and another as sensitive. All the inclinations were regarded as the result of the *animus*. Finally, the intellectual part which reasons, was called *mens*. Pythagoras, St. Paul, Galen, Gilbert, Gassendi, Bacon, Van Helmont, Wepfer, Leibnitz, Frederick Hoffmann, Haller, Blumenbach, Soemmerring, Reil, Barthez &c. admit different causes of the different phenomena of animals and man. Plato and several ancient writers speak of an unreasonable and of a reasonable portion of the soul. All those who admit only one soul in man, as Anaxagoras, Aristotle, Thomas Aquinas, Descartes, Stahl &c. are obliged to acknowledge at least several faculties of the single soul. St. Augustin determined with great exactness the faculties common to man and animals, and those which are proper to man. Malebranche and many other philosophers speak of principal and secondary faculties; the former are understanding and will. The subdivisions of understanding into perception, memory, judgment, and imagination; and the subdivisions of will into inclination, desire, affections, and passions, are generally known. Some authors have even subdivided these special faculties; for instance, Vieussens speaks of two kinds of imagination; others admit several kinds of memory, as a local, a verbal memory, a memory of facts, and another of time. Thus various principles, at least various faculties of the same principle, have been admitted at all times.

As the principles, or the faculties, were divided and subdivided, so different seats were assigned to them.

The reasonable soul was commonly placed in the head, the unreasonable in the viscera of the abdomen. The ventricles of the brain have been considered at all times as of principal importance. The Arabs placed common sense in the anterior cavity of the brain, imagination in the second, judgment in the third, and memory in the fourth ventricle. For several centuries the brain was considered as the organ of perception, the cerebellum as the organ of memory, and the degree of memory was measured according to the protuberance of the occiput. St. Gregorius Nyssenus, in order to explain why the functions of the mind are not troubled, although the different senses propagate different impressions, compares the brain with a town which has several entrances and a great number of streets, by means of which it is possible to arrive at the same point. Nemesius, the first bishop of Emesa, under the reign of Theodosius, taught that the sensations have their seat in the anterior ventricles, memory in the middle, and understanding in the posterior ventricles.

Albertus Magnus, archbishop of Ratisbon, in the thirteenth century, delineated a head, and indicated upon it the seats of the different faculties of the mind. He placed common sense in the forehead, or in the first ventricle of the brain, cogitation and judgment in the second, memory and moving power in the third. Peter de Montagnana, in 1491, published a delineation of a head, on which were indicated the seat of sensus communis, the cellula imaginativa, cellula æstimativa seu cogitativa, cellula memorativa, and cellula rationalis. Lodovico Dolci published a similar delineation. He placed common sense in the forehead; behind it imagination; understanding in the cerebellum; and memory the most downward in the neck. According to Serveto, the anterior ventricles receive the images of the external impressions; the third ventricle is the seat of thought, the aqueduct of Sylvius the seat of the soul, and the fourth ventricle the seat of memory. Willis considered the corpora striata as the seat of sensation and attention, the medullary mass as the seat of memory: he placed reflection in the corpus callosum, and derived the moving spirits from the cerebellum.

Charles Bonnet considered each fibre of the brain as a particular organ of the soul. Boerhaave said that imagination and judgment ought to be attached to different seats, because the former is active in sleeping and dreaming, the latter in watching. Haller and Van Swieten * fancied that the internal senses occupy different places of the brain; but they considered the organization of the brain as too complicated, too intricate, and too difficult to permit us to hope to point out the seat of memory, of judgment, or that of imagination. Mayer, Professor at Frankfort on the Oder, thought it probable that the soul exercises its different faculties at different places of the brain. He was disposed to think that the cineritious substance is the organ

* Van Swieten, T. ii. p. 454. "Quis memoriæ et rationis sedem in hoc mirabili et intricatissimo organo determinare poterit?"

of memory, and the cerebellum that of abstract ideas. Prochaska thinks it more than probable that every internal sense is attached to a particular organ. Platner speaks of two organs of the soul; of a superior, and of an inferior. Mallacarne cannot imagine that the medullary substance of the brain is fit to receive the same impressions at every point. He denies the central point of the nerves, he considers the cerebellum as the seat of the intellectual faculties, and measures them according to the number of lamellæ of which the cerebellum is composed. Tiedemann, Wrisberg, Soemmerring, and an infinite number of physiologists and philosophers, admit the plurality of the organs. They maintain that the different parts of the brain are destined to different functions. Soemmerring speaks, like Haller, of different provinces of the brain.

Thus it follows from all these quotations, which might be extremely multiplied, that the idea of the plurality of the seats or organs is very ancient, and that those who maintain that Gall first invented it are mistaken. It is only to be determined which are the faculties, and which are the respective organs? I afterwards shall inquire into these two questions in more detail. First let us examine in general the proofs which induce us to think that the brain must be considered as composed of different organs.

It is a general observation that nature, in order to produce various effects, has varied the material conditions. This is observed throughout all nature: every salt, every metal, has its own crystallization;

every plant and every fruit-tree has its particular organization; even the parts of the same tree, as wood, bark, leaves, flowers, and fruit, possess somewhat varying qualities. It is the same with animals: the organization of every kind of animal is modified, and in the same animal there is a particular organ for every function: the liver is destined to the secretion of bile, the heart and blood-vessels to circulation, and the lungs to respiration. The five external senses are separated, and independent one of another. Thus nature is not so attached to simplicity and unity, as certain speculative philosophers are pleased to maintain. This plurality and independence of the organs of automatic life, and of the five senses, makes it probable that the different internal sensations and functions of the mind are also manifested by different and independent organs. However, besides analogy, there are still other proofs furnished by the psychology of animals and man in the healthy and diseased state.

It is necessary that the brains of different animals should be different, because the faculties of these animals vary. The beaver which builds its hut, the dog which hunts, the black-bird which sings, the swallow which migrates, cannot have similar brains. Thus it is not indifferent to have such or such a brain: the organization of the brains of these animals must be as different as their muscles. Even individuals of the same species do not possess all faculties in the same degree: certain individuals excel, others are middling in all; some individuals are endowed with genius, others are idiots: hence the organization of their brains cannot be equally perfect. Moreover, if the brains of different animals were not composed of different organs, why should their understanding increase in the same proportion as their brains are complicated? It is also necessary that the cerebral organization of both sexes should be at least modified; for certain faculties are more active in women and females, and others in men and males. These modified manifestations are easily understood if we admit that certain organs are more developed in men and males, and others more in women and females.

In the same individual certain propensities, sentiments, and intellectual faculties, manifest themselves with great energy, while others are scarcely perceptible; one excels in verbal memory, while he cannot combine two philosophical ideas; another is a great painter, and a bad musician, or a miserable poet; and a third is a great poet, and a bad general; one may be pious and stupid, or pious and intelligent; and every one has his peculiar gifts. Hence the same mass of the brain cannot preside over the same functions. If there were only one external sense for all impressions, all functions ought to take place as soon as one sense were active; but as the functions of the external senses are attached to different organs, one may be weak and another strong. It is the same with the internal senses: if the same organ manifested every faculty, how should the mind, by means of the same instrument, manifest one faculty in its perfection, and another in a very limited manner?

The propensities and intellectual faculties do not manifest themselves simultaneously; several appear earlier, and others diminish and disappear more lately. Certain faculties are very energetic in children, others appear only in adult persons: some faculties disappear at the age of fifty or sixty, others last till ninety or a hundred. Now if the manifestations of all faculties were dependent on the same organ, they ought to appear and disappear simultaneously. But all difficulty is removed, if we admit different organs which are developed and diminished, at different periods, in the same way as the five external senses. The smell and taste appear earlier than the senses of seeing and hearing, because their relative organs are earlier developed. The faculties of animal life cannot continue incessantly to act, but they need rest. It is known that study too long protracted produces fatigue, but we can continue to study by changing the object. Now if the brain were a single organ performing all the functions of the mind, why should not the organ be more fatigued by this new form of study? Our eyes may be fatigued by looking at pictures, but we can still listen to music, because there is one organ for hearing and another for seeing. This consideration is very important in medicine; for by these circumstances it is often possible to prevent partial insanities, that is, if a person have one organ very active, whether on account of its considerable developement, or on account of its great irritability, so that its activity is almost involuntary, or that the person has not the power of putting it in action, or of recalling it to rest, then it is necessary to avoid every thing that has any relation to this faculty, and to put in action quite different faculties. Thus this alternate state of action and rest would be impossible, if there were only one single organ.

As in the state of watching the same organ cannot be always active, but it must rest; so in the state of sleeping all organs do not remain inactive, but sometimes a particular organ enters into action, and this is the state of dreaming. Watching is called the state wherein the will can put in action the organs of the intellectual faculties, of the five senses, and of voluntary motion; but it is impossible to define watching as the state wherein all these organs are active; for it cannot happen that all faculties should be active at the same time. All organs being fatigued take rest, and this state of rest is sleep. But any particular organ, or even several organs, may be active while the other organs rest; then the peculiar sensations or ideas, which result from this particular activity, constitute that which is called *dreams*, which are more or less complicated according to the number of the active organs. Here it may be asked, whether the soul or mind can ever be without any idea? Formerly it was a general opinion that activity is the essence of the soul; and, in order to preserve this opinion, it was said, that in the deepest and most complete sleep, the soul continues nevertheless to act and to think, but that no one had consciousness of it. It may be asked, how are we sure of this action? And it may be reckoned merely supposititious. At all events it is evident that the state of dreaming proves the plurality of the organs of animal life; and it would be impossible to have a conception of particular dreams, or ideas and sensations, if the brain were one single organ, and if every faculty were not attached to a particular and independent organ.

The state of somnambulism equally proves the plurality of the organs. This is a state of incomplete sleep, wherein several organs are watching. It is known that the brain acts upon the external world by means of voluntary motion, of the voice, and of the five external senses. Now if in sleeping some organs be active, dreams take place; if the action of the brain be propagated to the muscles, there follow motions; if the action of the brain be propagated to the vocal organs, the sleeping person speaks. Indeed it is known that sleeping persons dream and speak; others dream, speak, hear, and answer; others still dream, rise, do various things, and walk. This latter state is called somnambulism, that is, the state of walking during sleep. Now as the ear can hear, so the eyes may see, while the other organs sleep; and there are facts quite positive which prove that several persons in the state of somnambulism have seen, but always with open eyes. There are also convulsive fits in which the patients see without hearing, and *vice versâ.*

Some somnambulists do things of which they are not capable in a state of watching; and dreaming persons reason sometimes better than they do when awake. This phenomenon is not astonishing. If we wish to reflect upon any object, we avoid the noise of the world and all external impressions; we cover the eyes with our hands, and we put to rest a great number of organs in order to concentrate all vital power in one or in several. In the state of dreaming and in somnambulism, this naturally happens; consequently, the manifestations of the active organs are then often more perfect and more energetic; the sensations are more lively, and the reflections deeper, than in the state of watching. Without knowing their danger, such persons do things which are possible to be done, but which they would not do, being acquainted with the danger they run. Therefore, somnambulists ought not to be awakened when they are exposed to danger.

Inspirations, visions, and similar phenomena, find their explanation only in the plurality of the organs; and consequently these phenomena contribute to demonstrate it. In order to understand visions, it is necessary to recollect the state of dreaming. In dreaming, the whole external world is represented inwardly to the mind. We see objects, our friends, or enemies; we speak with them, we walk, we eat, drink, sing, hear music &c., and all these things happen in the brain of him who dreams. Visions are only internal sensations or ideas, which are so strong and so energetic, that, though in the state of watching, the person refers them outwards and considers them as real; for instance, he sees inwardly some person, and he admits his outward existence. Visions are transitory or permanent. In the latter case, it is a true alienation of the mind.

This explains why visionaries fancy that they see beings, or that they are accompanied by demons; and why sorcerers have imagined they conversed with the devil. It is even known that sorcerers produced such illusions by external applications or frictions, with narcotic ointments composed of dulcamara, bella donna, stramonium, hyosciamus, opium &c.

The state of disease proves also the plurality of the cerebral organs. For how is it possible to combine partial insanities with the unity of the brain? One faculty may be deranged, while the manifestations of all the other faculties of the mind may be regular. To this belong all fixed ideas or monomaniæ. On the other hand, there are madmen who are reasonable only in one kind of manifestations of the mind. A chemist was a madman in every thing except chemistry. An embroiderer in her fits, and in the midst of the greatest absurdities, calculated perfectly how much stuff was necessary to such or such piece of work. It follows from all these considerations, that there are as many organs as there are special and independent faculties: consequently the brain cannot be considered as one single organ, but as composed of several. Before I determine the special faculties and their respective organs, I shall answer the most important objections against this principle.

Objection 1.—*Unity of Consciousness.*

Philosophers repeat incessantly that the organ of the soul cannot be complicated, because consciousness is single. This objection is very ancient. It was made to Boerhaave, Haller, and Van Swieten, who have commented on the duplicity, and consequently on the plurality of the organs. The duplicity of the brain was known even to Hippocrates, who said, the brain of man is double as well as that of animals. Van Swieten relates that, as we have two ears, and two eyes, and as the consciousness of the impressions of two similar organs is single, so the consciousness of the mind is single, though the brain is double. I suppose indeed that the explanation of this phenomenon may remain unknown for ever, but it is not therefore less true that the brain is double, and that each half is composed of different parts. Are there not many things which cannot be explained? Automatic life is one; but is it not composed of different functions, which are produced by different organs? It is always single, though it is more or less complicated in different kinds of animals. It is the same with animal life. It is more or less complicated in different kinds of animals; the different faculties are manifested by means of different organs; these organs exert a mutual influence, and as long as this mutual influence exists, the unity of animal life also exists; but if the mutual influence be deranged, the unity of animal life is deranged also. Hence it is not true that consciousness is always single, either in respect to the external senses, or in respect to the internal organs. There are patients who see objects double, and all monomaniæ have a complicated consciousness. Tiedemann speaks of one Moser, who was alienated on one side of his brain, and observed his madness with the other side. One of Gall's friends, a physician, often complained that he could not think with the left side of his head. The right side of his head is one inch higher than the left. Gall attended a gentleman who for three years, on his left side, heard peasants insulting him. Commonly he discerned his derangement and rectified his error; but if he had drunk a little too much, or had a fit of fever, he fancied that he really heard the voices of peasants. A great number of madmen hear angels sing, or the devil roar &c. only on one side. Thus, as both hemispheres may undergo a quite different state, so the organs of each side may be differently affected. In treating of the functions of the five senses, I shall examine the different explanations of this single consciousness; but whether the unity of consciousness may be explained or not, it is indubitable that all the organs of animal life are double.

Objection 2.

It is also objected that the unity of the organization is destroyed by the separation of the organs, and that all organic parts are dependent one on the other. It is impossible to deny the mutual influence and dependance of the different organs. Nobody can insist upon this truth more than we. But there is a great difference between saying that the different organic parts exert a mutual influence upon each other, and saying that each part does not exert its particular function. It is the same with both automatic and animal life. Digestion is necessary to the circulation of blood, and to the secretion of bile, but does the stomach produce the circulation of blood, or the secretion of bile? Nutrition depends on digestion, chylification, sanguification, respiration, circulation, and other auxiliary functions; but is not every function attached to some particular organization? We observe the same in animal life. Without the sense of hearing we cannot hear any language, but does hearing invent the vocal signs? We shall afterwards see that certain ideas cannot take place without the external senses, but that the external senses do not produce the conceptions of these ideas. All that which is necessary to the nutrition of the brain contributes to the production of this organization, as it does to that of the eyes, or ears &c.; and no organic part, when detached from the body, can preserve the perfect state of its organization, consequently it cannot perform its function; but can we therefore say that the eye does not see, or that the ear does not hear?

Objection 3.

It is often objected that the particular organs of the brain are not as distinctly separated, as the nerves of the five external senses. It is true the limits or lines of separation cannot be exactly determined between the different organs, but this also is not possible in respect to the five external senses. The nerves of motion and feeling have not yet been separated, though the nerves must be different. The structure of the skin must be different at different places, as is evident by the different exhalation arising from it, and the hair which grows on some parts of it; but the difference of the parts of the skin has not yet been demonstrated. Neither the limits of the olfactory nerve, nor those of the nerve of taste, are better known or more distinct than are the different bundles of the internal organs, separated one from another. Nay it is possible to demonstrate the relation between the developement of these bundles, and the respective manifestations of the moral sentiments and intellectual faculties. Anatomy shows that the bundles which form the convolutions situated in the forehead are smaller, but more numerous, while the posterior bundles are less numerous, but larger. In the same manner we shall see that the faculties of the forehead are numerous, but less energetic, while the faculties whose organs are situated in the posterior and superior part of the head, are less numerous, but very energetic.

Objection 4.

The comparison of the internal organs with the five external senses is rejected as a proof of the plurality of the organs, because the five external senses may be reduced to one single sense, namely, to sensation, in the same way as all the internal faculties may be reduced to the faculty of thinking. It is true that the five external senses only feel, or exert some sensation; but feeling or sensation in this sense is a general expression, and all general expressions must be specified, in order to indicate some particular thing. It is the same throughout all nature. Gravity, density, volume &c. are general expressions of physics; but is it not necessary to specify the physical qualities in order to indicate any determinate body, as gold, silver, copper, iron &c.? *Life* is a general expression, and its common phenomena, as birth, nourishment, increase, decrease, and death, are observed in all living beings; in plants and animals. Is it not however necessary to discriminate vegetation from animalisation, since nutrition is modified in plants and animals? Nay, every common faculty of plants and animals must be specified in order to indicate every determinate plant, every determinate animal. *Secretion* is a general expression; but in such a case the particular secretions must be indicated, and they actually are performed by particular organs. The secretion of bile is performed by the liver, that of urine by the kidneys &c.

It is the same in animal as in organic life: sensation is a general expression, but every kind of sensation must be specified. It is quite different to have a sensation of light or of sound, of taste or of smell. These particular sensations then are performed by particular organs. The thinking power is a common faculty; but thinking of space, of form, colour, tone, number &c., are particular manners of thinking; and these particular manners of thinking are manifested by particular organs. Hence this objection, instead of refuting the plurality of the organs, proves its necessity.

Objection 5.

Another objection is this: the nerves of the five external senses are homogeneous; their functions are only different on account of their external apparatus. The auditory nerve in the eye would see, the olfactory nerve in the ear would hear; but the internal organs are destitute of such external apparatus, consequently they are all the same, and they perform the same functions. This opinion is still pretty general. As a polypus may be divided into several pieces, and every piece become a whole. Cuvier applies this phenomenon to the nervous system. He compares the nervous system with a net, or with a broken loadstone, which originally are composed of homogeneous parts: he thinks that the different functions of the nerves must be attributed to the external apparatus, to their blood-vessels, their ramifications and combinations; in one word, to an infinity of secondary circumstances, rather than to the internal structure of the nerves. But it may be proved anatomically and physiologically, that not only the external apparatus, but also the internal structure of the nerves is different. I admit five kinds of nerves, and subdivide each kind: the first kind of nerves presides over automatic life; the second over voluntary motion; the third over the functions of the five senses; the fourth over the moral feeling; and the fifth over the intellectual faculties. The nerves of the first kind are soft, gray, or whitish red; the nerves of the second are white and firm. The nerves of the five external senses differ one from another in their consistence, colour, form, and texture. The fibres of the brain and cerebellum are white and delicate. Moreover, every nerve, even the different parts of any nerve, take origin in a particular quantity of cineritious substance. All these anatomical circumstances are always the same, consequently they must be essential to the structure and function of the nerves. Cuvier, therefore, is in contradiction with himself in saying * that, "whatever may be the position of the parts, and whatever circuitous ways the nerves must take in order to arrive at the parts to which they belong, the analogous parts constantly receive their nerves from the same pair. Similar nerves have always similar distribution. The smallest pairs which might be easily supplied by some neighbouring pair, as the fourth and sixth pairs, preserve their existence and their destination." From these anatomical proofs it seems natural to conclude that the nerves are not entirely similar, and do not conduct one identical fluid as the arteries do.

The difference of the nerves themselves is equally proved by physiology. The divers functions of automatic life, as the secretions of bile, saliva,

* *Loc cit.* p. 192.

tears &c., suppose organs essentially different: is it not the same with the nerves of the five senses? Their external apparatus are said to be different, because they receive different impressions; but how is it possible that different impressions should be transmitted to the brain by the same nerves? How can the impressions of light be propagated by the auditory nerve. If the manner of propagating the external impressions, and their communication to the brain, were essentially the same, and only weaker or stronger, the perceptions of these similar impressions ought also to be essentially the same, and only weaker or stronger. Hence, the difference of the propagated impressions requires a difference of the internal structure of the nerves which propagate them. Moreover, the internal structure of the nerves must be different, because the nerves perform their special functions by internal irritations alone. The sensations which we feel in dreaming are the same which are produced by the external impressions. A person who has lost his eyes dreams that he sees; another thinks he feels pain in an amputated limb. The increased flow of blood toward the eyes makes us see shining objects or flame; in the ears, it excites tingling and humming; towards the skin, it produces the dream that we are in a lukewarm bath. Finally, the illusions of the five external senses in different diseases are produced only by internal causes. We must infer from all these phenomena, that the organization of every nerve is particular.

It is replied that the difference of every organ cannot be demonstrated: I answer that the contrary also cannot be demonstrated. Hence the homogeneous structure of the organs is neither proved nor refuted by the five senses. However, there are many things which are similar in appearance, and which are really quite different in their nature. Many fluids look like water without being aqueous. Who can distinguish all the varieties of apple-trees by the difference of their ligneous fibres, which must be different since their flowers and fruits are so? Hence physiological proofs must supply what is deficient in anatomical proofs.

The identity of the nerves is principally supported by the phenomena of animal magnetism. An animal fluid is said to be diffused throughout all nature; it is called ether, and considered as the cause of all phenomena; it is communicated to other persons by the will of the magnetiser; and then it does not only excite the organs, but, according to certain magnetisers, it communicates also to the soul the different external impressions by means of each nerve; or, according to other magnetisers, this animal fluid is the leader of the external impressions. The will and its modifications are communicated by it; therefore the will of the magnetiser and of the magnetised person govern one another. I admit an animal fluid which is communicated to the nerves. However, I propose various questions to magnetisers, the answer of which should be interesting for me. I wish to know in what state it is communicated, whether it varies only in quantity, or whether being communicated from one person to another its quality is also modified; then whether this fluid acts immediately upon the soul of the magnetised person, or whether it acts only upon the organs, and by means of these upon the soul? Is it not proved that this fluid which is communicated varies in quality, because according to all magnetisers it is necessary to place every one in relation? It seems certain that this fluid acts only upon the organs; for children and idiots are not fit for such experiments, while the experiments are said to succeed principally with very delicate and irritable persons. I wish also to know with what the magnetised individuals can be acquainted? Why are they said to know more than the magnetisers themselves? According to common observations they are acquainted only with that which is known in the country where they live. I allow that this fluid may excite the activity of the organs, but I think it is impossible that it can render every nerve fit to perform all manifestations of the mind. This fluid may also contribute to the state of health, but it cannot produce all the phenomena of living beings and cure all diseases. It results from these considerations that the structure of the nerves is different, and that therefore their functions also are different.

Objection 6.

Plattner made the following objection: a musician plays with his fingers on all instruments, why should not the soul manifest all its operations by means of one and the same organ? This observation is rather for than against the plurality of the organs. First there are ten fingers which play; moreover, the instruments present different chords or holes. We admit only one organ for music; and all kinds of music are produced by this organ. Hence, this assertion of Plattner does not invalidate our principle.

Objection 7.

All voluntary motion is produced by muscles: consequently it is possible that all ideas and sensations are the result of the different motions of the cerebral fibres. Those who make this objection forget that the different motions are performed by different muscles. There are flexor, extensor, pronator, and other muscles; and every muscle is composed of many fibres which have different directions. Now in every position and in every motion of the body other muscles are active. In the same way it is conceivable that every kind of sensation or idea is attached to a particular organ.

RECAPITULATION.

In this article I have proved that it is necessary to make divisions and subdivisions of the beings and their functions, and that they have at all times been made. I have then considered in particular the divisions and subdivisions, into which philosophers and physiologists have divided the faculties of man. I have spoken of the different seats which have been assigned to the different faculties. I have mentioned the proofs, according to which it is evident that every faculty is manifested by a particular organ. I have supported this assertion by analogy; by the different qualities of different kinds of animals; and by the different number of their faculties; by the modifications of the faculties in both sexes and in the same individual; by the want of simultaneous manifestations of the faculties; by the alternate action and rest of the faculties; by the state of dreaming; by that of somnambulism, and of visions; by natural alienations; and finally by the refutation of all objections. Consequently, it is now to be examined which are the special faculties and their respective organs?

CHAPTER V.

ON THE MEANS OF DETERMINING THE FUNCTIONS OF THE CEREBRAL PARTS.

After having proved that the faculties are innate, that the manifestations of the mind depend on the brain, and that the manifestations of every particular faculty depend on some particular organ, it is natural to examine how the organ of every faculty may be determined. In the chapter on the principle that the brain is exclusively the organ of the manifestations of our feelings and intellectual faculties, I have refuted the different manners of measuring the faculties of the mind. I have proved that it is necessary to confine our comparisons to every faculty and its peculiar organ. In the preceding article we have seen that the idea of the plurality of the organs is very ancient, consequently it is conceivable that different organs have been looked for. Therefore let us first consider what means have been employed for this purpose, and examine why no one has succeeded.

ANATOMY.

Many natural philosophers have hoped to point out the organs of the intellectual faculties by anatomy in general, or at least by comparative anatomy. It is also pretty generally believed that the new physiology of the brain is the result of its anatomy: I shall make some reflexions in respect to anatomy in general, and to comparative anatomy in particular. There are very few cases where the structure of any part indicates its function; and such opinions are never more than conjectural. Before the motions of muscles were observed, it was impossible to infer from their structure that they were contractile. Who, in seeing the structure of the stomach, could conjecture its digestive power? Who can distinguish by the structure of the viscera, that the liver secretes bile, the kidney urine? The structure of the heart was known a long time before its function was discovered. Who among anatomists can determine, by the structure and form of the nerves, what kind of impressions they propagate? The deepest perspicuity would not have attributed the smell to the pituitary membrane of the nose, the taste to the nervous papillæ of the tongue, the sensation of light to the optic nerve &c.

It is the same with the brain. Let the direction of its fibres be known; let anatomists distinguish their greater or less consistence, their more or less white colour, their different size, length &c. what conclusion can they draw from these circumstances in respect to the functions? None. Moreover, it is known that even in plants the functions are extremely different, although it would be impossible to perceive any difference of the organization, which however must be different because the effects produced by it are so. Thus it is certain that the anatomical knowledge of any part does not indicate its function. It is therefore necessary to have recourse to other means in order to discover it. On this account, the physiology of any part precedes often its anatomy. It was generally known that we see by means of the eyes, before anatomists were acquainted with their structure. If it were possible to determine the functions of the organization according to its structure, we should no longer have occasion to refute many errors; for instance, that the moral sentiments do neither result from the viscera or nervous plexus and ganglia of the abdomen, nor from the temperaments &c. Indeed many organs of the brain were discovered before its structure was demonstrated, and these discoveries might have subsisted for many centuries without the structure of the brain being known.

When I say, however, that the function of any part is not discovered by the knowledge of its anatomical structure, I am far from maintaining that the structure of any part has no relation to its function. The structure of the heart has not shown its function, yet its structure is in relation to its function. It is the same with all the parts of automatic and animal life. A physiological system of the brain would be necessarily false, were it in contradiction with its anatomical structure. If an anatomist can prove that all nerves are only prolongations of the brain; that they terminate at one central point; that there is no difference between the brains of different animals though their faculties are different; that all parts of the brain increase and decrease simultaneously; that there is no difference between the brain of an idiot from birth, and that of a person endowed with great talent. In one word, if an anatomist demonstrate that the structure of the brain is in contradiction with physiological principles, or *vice versá*, he will undermine and annihilate our whole doctrine with all its consequences. Thus there is some relation between the structure and function of organic parts, but the structure of any part seldom indicates its function.

Let us now examine whether comparative anatomy has determined the functions of the brain. At the first view, it seems that comparative anatomy ought to afford important results; but there are, in this respect, obstacles which it is impossible to overcome. First, I have just said that it is impossible to determine the functions according to the structure of any part. Moreover, there is a great number of animals whose automatic life presents several organs of which man is entirely destitute. We may conjecture that it is the same with animal life; but how can we conceive any function if we are not endowed with a similar faculty? Although it is of the highest importance to know the gradation observed by nature in perfecting the brains of animals in order to multiply and ennoble their functions, we must allow that, notwithstanding the most assiduous labours relative to this end, comparative anatomy has only shown the mechanical form of different brains, but that these anatomical notions do not at all determine the functions of the cerebral parts.

There was not any principle to enable us to determine whether the same parts exist in different animals or not. Different parts were denied or admitted according to their similar or dissimilar form. The nerves of insects, crustaceous animals, and mollusca, are derived partly from ganglia, partly from the brain; but, according to our anatomical principles, no nerve can either be derived from another nerve nor from the brain. Every nerve has its own origin, and we call brain the nervous mass, which is joined to the nerves of motion and the five external senses, and which manifests the moral sentiments and intellectual faculties.

In the lower animals, it is extremely difficult, if not impossible, to determine whether there be a particular cerebral mass, which is intimately united to the organs of the nerves so that they seem to form one whole, the parts of which cannot be demonstrated; or whether this mass belongs only to the nerves of the five external senses, so that the external impressions are perceived without a brain. In fishes and reptiles, the nervous mass, situated in the skull, is divided into several ganglia. The anterior pair of these ganglia engenders the olfactory nerve; behind this pair are the hemispheres of the brain which are small, and composed of fibres whose functions are unknown. In birds the hemispheres of the brain are more considerable than in the animals of lower orders, but they do not yet present convolutions. We have rectified the error of all anatomists, according to which the brains of birds are said to be destitute of the commissures, thalami, and corpora striata. Their cerebellum is single, and consists of semicircular rings. In viviparous animals, the cerebellum ceases to be single, it has lateral parts. The brains of small quadrupeds, as of mice, rats, squirrels &c. present a smooth surface without convolutions. Cuvier however is wrong in saying that the brains of the rodentia in general have no convolutions, for in the beaver the convolutions of its brain are very distinct. In the greater number of quadrupeds, the brains present distinct convolutions; but neither in birds nor in quadrupeds has the function of any cerebral part been pointed out.

According to Cuvier the posterior lobes of the brain are wanting in mammalia, except in monkies. He supports this opinion by the observation that their cerebellum is not covered with the brain. This conclusion is very incorrect. It is true the cerebellum is not covered; but this particularity results from the horizontal position of quadrupeds. The posterior lobes cannot be denied, because their size and form are different in different animals; otherwise the cerebellum and the anterior and middle lobes ought to be denied also. Nay it seems to me that in animals the anterior lobes and lateral convolutions of their brains are proportionally much smaller than the posterior lobes. The posterior convolutions spring out of the pretended optic thalami; these are proportionally much larger in animals than the external half of their corpora striata. Consequently the anterior and middle lobes of the brains of animals do not present a greater analogy to those of man than the posterior lobes. It is to be considered that in general the position and form of the cerebral parts do not constitute the essential proof of their existence. In man, the ganglion of the olfactory nerve is covered by the anterior lobe of the brain; in animals this ganglion lies before the convolutions: the olfactory nerve of man is separated from his brain, and in the greatest number of animals it is united to the anterior convolutions &c. but are therefore the anterior lobes wanting in animals? Moreover, there are even men whose cerebellum is not entirely covered by the posterior lobes; these lobes however exist, and are only smaller. Thus the posterior lobes may be smaller in different animals, but the whole arrangement of their brain, the cavities of the hemispheres, the diverging and uniting fibres &c. prove the existence of the posterior lobes as well as that of any cerebral part. Finally, animals manifest the same functions which are performed by the posterior lobes of the brain of man, consequently it is also permitted to conclude physiologically that the respective organs exist.

Cuvier says also, in contradiction with himself, that the brains of quadrupeds have the same parts as the brain of man. By this saying he can only mean the large portions, as the cerebellum, the pons Varoli, the thalami, corpora striata, corpus callosum, anterior and middle lobes. Therefore this assertion must yet be rectified in another respect. The general type of the brains and cerebella of man and animals is the same; but they present many modifications, and many parts of the brain of man are wanting in the brains of animals. This may be conceived by some analogy. All plants and all trees have some common parts, as roots, stalk, trunk, boughs, branches, leaves; but can we say that all vegetables have the same parts? The general type is the same in all, but their modifications are infinite. The laws of vegetation are the same in all plants, but the elements, submitted to these laws, are different. In the same way, the laws of the nervous system are the same in respect to origin, increase in size and perfection. There exists the same type from the brains of insects to that of man, but the brains present as many modifications as nature intended to produce different functions. To this end the common parts are more or less complicated.

Cuvier thought that there is some proportion between the size of the tubercula quadrigemina and the food of animals. According to him the anterior pair of these tubercles is larger in herbivorous animals, the posterior in carnivorous. The wolf and sheep have the nates larger than the testes: hence the assertion of Cuvier falls to the ground. I pass different other errors believed and propagated by comparative anatomists. They belong rather to anatomy than to physiology. I think it results evidently from these considerations that comparative anatomy has not, more than anatomy in general, advanced the physiology of the brain.

MUTILATIONS.

Several natural philosophers hoped to determine the functions of the brain by its mutilations. They cut away different parts in order to see what faculty should be lost. But, first, these means could not be exactly employed, and therefore they must be entirely useless. They could not be exactly employed, and all experiments made to this purpose were very imperfect, because the duplicity of the organs was overlooked: besides the structure of the brain was not known. Therefore the mutilations have been made horizontally, while the direction of the fibres is vertical.—(*Pl.* III. *fig.* 1 & 2). Moreover, the special faculties of the mind were unknown, and the mutilated animals were said to manifest all faculties, if they manifested the common and general faculties.

These means were not only entirely useless, but they never could serve to determine the functions of the brain, for the organs are not confined to the surface, consequently every organ ought to be cut away, on both sides, from the surface to the medulla oblongata. But such a wound would kill any perfect animal. Let us even suppose that the animal could survive such mutilations, how should it manifest a sensation of which it has been deprived? And how should it indicate the want of this sensation? Moreover, such operations are too violent, and the animals might retain several faculties without manifesting them. A bird whose brain is violently injured will not sing, or build a nest &c. Finally, sometimes the derangements of parts, which are affected by sympathy, are more sensible than those of parts which suffer primitively or idiopathically. A headach is often the only result of some indigestible thing in the stomach, and this takes place without any feeling of pain in the stomach itself. Hence it is impossible to determine the functions of the cerebral parts by their mutilation.

OUR MANNER OF PROCEEDING.

As the structure of any part does not indicate its function, and as the manifestations of the mind nevertheless depend on the organization, it must be examined on what other material conditions of any part its function depends. In every function, we may distinguish the energy or quantity, and the modification or quality. It is very difficult to examine the modifications, it is more easy to consider the different energy of the functions. It is then to be examined on what conditions the energy of the faculties depends. There is a general law that the energy of the functions of any part depends on its size, and on its organic constitution; that is, on its extensity and intensity. It is also certain that, in order to judge the degree of activity of the faculties, it is necessary to consider, besides the extensity and intensity of the organ, the exercise of every faculty, and the mutual influence of the faculties upon each other. Now among these conditions the most easy to be observed is the size of the organs. Consequently as the energy of the function depends on the size of the organs, and as the size of the organs is the most easily distinguished, it results that these means are the most proper for the discovery of the organs.

There is indeed a general law throughout all nature, that the properties of bodies act with an energy proportionate to their size. A large loadstone attracts a greater mass of iron than a small loadstone. The fermentation of the same fluid is more energetic if its quantity be more considerable. A great muscle of the same kind is stronger than a small one. If the nerves of the five external senses are larger on one side of the body the functions are also stronger on the same side. Why should it not be the same in respect to the brain? Those however who object that we neglect the internal organization are entirely wrong.

In order to judge exactly of our inquiries it must be considered that we do not endeavour to determine every degree of activity of any cerebral part, but only the nature of its functions, and to this end its size is sufficient. Gall, though he mentioned this difference in his lectures, was not careful enough to insist upon it. The internal constitution, though very important, is not easily distinguished. On account of its influence, however, we never compare the individuals of different kinds, not even the individuals of the same species, but, in order to conceive the first idea of any organ, we confine our observations to each individual in particular. I admit even the possibility that, in the same individual, the internal constitution of the different parts of the brain varies in the same way as the optic nerve may be more irritable than the auditory or olfactory nerve. It may, however, be observed that a great difference in the size of the cerebral parts produces a difference in the manifestations of the mind. Indeed the divers parts of the brain are differently developed: one is larger, another smaller; and according to a general law we are convinced that the functions of the parts, which are much developed, manifest themselves with more energy, while the small organs are less active. It results that, in persons endowed with partial genius, the organs are the most easily discovered. In fact, each organ has been discovered in persons who manifested one kind of function in the highest degree.

CHAPTER VI.

ON THE POSSIBILITY OF DETERMINING THE DEVELOPEMENT OF THE BRAIN IN GENERAL, AND ITS PARTS IN PARTICULAR.

If the functions of the moral feelings and intellectual faculties are more or less energetic according to the size of the organs, it is to be examined whether it is possible to distinguish the developement of the cerebral parts in man and animals during life? This question, Is it possible to know the size of the cerebral parts by the form and size of the head? must be distinguished from another question, What is the cause of the form and size of the head? This latter question is important in respect to physiology in general, but it is indifferent in respect to the practical part of the organology of the brain. This requires only the possibility of knowing the size of the organs without examining the causes of their developement. With respect to the first question we must answer, that there is a great difference between the different kinds of animals; that it is impossible to compare animals with animals, or animals with man; that it is even necessary to consider, in animals and in man, the different periods of life; that in mankind in particular it is sometimes possible to determine the organs of the brain with exactness and facility; that several other circumstances render it difficult; and, finally, that in certain cases it is impossible. Let us begin with the examination of the cause which produces the form of the head.

THE BRAIN IS THE PRINCIPAL CAUSE OF THE FORM AND SIZE OF THE HEAD.

It is asked, whether it is the skull or the brain which determines the form of the head? It is to be remarked that I here speak only of mankind in particular, but that these researches, in respect of both these questions, may be extended to every kind of animals. It may seem that the skull, which is hard, must determine the form of the brain, which is soft, rather than the brain that of the skull. I shall consider, on this account, man in his healthy and diseased state. After conception, the brain exists before it is confined to the skull. It is covered with a fourfold membraneous coat: the pia mater, which closely adheres to the substance of the brain; the tunica arachnoides or arachnoid coat, which bears this name on account of the extreme tenuity of its texture; the dura mater, which consists of two separable membranes; and lastly, a cartilaginous membrane in which the ossification is formed. This fourfold membraneous coat, enveloping the brain, represents exactly its form.

The ossification begins at different points, called points of ossification; from these points then the ossification extends in a radiant direction according to the size and form of the cerebral parts. The elongations of the bony radiations are sooner or later aggregated, and form the bones, the regular assemblage of which forms the skull. In new-born children, there are commonly eight bones, which contain the brain and represent its size: these bones are—two frontal, which latter commonly unite and form one bone, yet there are grown-up persons whose frontal bone is divided into two; two parietal, two temporal, one sphenoidal, one occipital, and one ethmoidal bone. These different bones have connexions called sutures or articulations; and these bones together form the skull. In new-born children, in general, the corners between the two frontal and the two parietal bones are not yet ossified. This membranous part is called fontanel. The bones are, till this age, very thin, and accommodated to the form and size of the cerebral parts. It may here be asked, whether any difference of skull and brain is already perceptible in fœtus? Soemmerring has elucidated this object; we have repeated the same observations; and it is indubitable that the heads of fœtus are as different as those of grown-up persons.

Then birth happens, and it must be ascertained whether the form of the heads of new-born children is changed by birth; it may also be asked, whether it is possible that a midwife, or an accoucheur, can give to the head an arbitrary form, by compressing the head or impressing certain parts? Before I answer this question, I shall consider natural delivery. Sometimes the head of the fœtus is retained during difficult birth. In these cases the head is compressed. Nature however has taken particular care of the preservation of the brain enclosed in the cavity of the cranium: the dura mater, which envelopes the brain, is attached to the skull more firmly than in adults, and prevents the bones from riding over each other. The prolongations of the dura mater, known under the names falciform process, and tentorium, contribute equally to secure the parts of the brain. The bones themselves are flexible, elastic, and articulated in their connexions. Moreover, the skull forms an arch, and this form offers the greatest resistance. The brain is also a living part, and its natural elasticity is supported by its continual elevation and falling, produced by the circulation. The tumours which are commonly observed in the top of the heads of new-born children result from the accumulation of blood, the circulation of which is interrupted; but after a few hours or days the humours are absorbed, and the tumour disappears. Consequently, a transient pressure, which does not act very violently, does not change the primitive form of the brain. A violent compression will derange the organization; a less violent but permanent compression, which changes the natural form of the brain, and hinders its developement, will always do harm to the manifestations of the mind. If such individuals do not become idiots, the manifestations of their faculties are at least injured.

It happens sometimes that the bones of the skull do not at birth touch one another. In this case the head is compressed, and children die during birth. This circumstance should be considered, when an unfortunate woman is accused of having murdered her child. It is also obvious, that though in the ordinary state great violence must be employed to compress the skull and the brain, yet in delivering the fœtus by means of the forceps, it may easily happen that the brain is compressed and the organs injured. But in this case the manifestations of the mind will be injured also. Thus it follows from these observations, that in new-born children the form and size of the head depend on the brain.

It is objected that, in America, several tribes of savages give an arbitrary form to the heads of their children. I do not pretend that such reports are false. I admit that engines of this kind, which are preserved as curiosities in cabinets, have been employed with the intention of flattening the head, but I am not convinced of the effect which is attributed to these machines. I have seen five skulls of Caraibes; they were low and laterally extended, particularly at the temporal bones. Every one however presented some modification as distinctly as four skulls of any European nation could do. I have even seen skulls of Europeans which were lower and wider. This form of skull therefore is not merely the effect of artificial pressure. Moreover, the upper surface of each of the five Caraibean skulls was differently vaulted, and not at all modelled according to the pressure of an equal board. It even seems to me that this manner of flattening the head is refuted by itself: according to the preceding observations, great violence must be employed to compress the skull and brain; now this cannot take place from above, without an equal counterpressure from below, or from another part; and if the pressure produce an effect, it must be the same with the counterpressure. Hence I think that Americans, as well as Europeans, who endeavour to give an arbitrary form to the brain, make an incorrect calculation. It may be replied that the effect of pressure is evident by the feet of Chinese women. I certainly do not deny the effect of pressure; but the feet of the Chinese are compressed from all sides; there is pressure and counterpressure, and their effect is every where visible. This might also be the case with the head, but I argue only against the inexactness of observations, according to which the head is depressed on one side alone.

I continue now the elucidation of the natural developement of the skull. By degrees it grows hard. It may therefore be asked, whether the hard skull must yield to the soft brain? If we compare the skull of a child with the skull of an adult person, it is obvious that the skull of the adult is larger than that of the child, consequently, the skull increases in proportion to the brain. Moreover, all the cerebral parts do not increase simultaneously; and this partial developement is equally observed in the skull. The forehead, for instance, which at birth is narrow and flat, grows wider and prominent from the age of three months, to that of eight or ten years. After this period, the middle part of the forehead is less developed in proportion to the other parts. The neck of children is very small, for the cerebellum, whose developement takes place very late, is situated in the inferior occipital fossæ; but in proportion as it increases, the skull grows prominent from without. It is the same with all other cerebral parts which increase successively.

Some explain the growth of the skull in a mechanical way by the action of the brain. This explanation is quite incorrect; for if the brain were exposed to the least compression, its functions would be deranged. The phenomenon of growth results from the continual change which our body, as well as every organic being, undergoes. The parts of our body are continually decomposed and composed again; the matter which constitutes our body to-day is evacuated by excretions, and it is replaced by another matter, furnished by alimentation. The brain and skull are submitted to this decomposition and composition like all other parts of our body, and, according to the natural law established between the skull and brain, the brain commands at all ages the directions in which the bony mass is deposited in order to form the skull. If the whole brain, or some parts, increase or decrease, the ossification of the skull follows always the size and form of the brain.

It is not only the case in respect to the head, that a hard part is formed according to the form of a soft, but it is general that the hard parts which inclose soft ones are formed according to the form of the soft parts. If in consumption, one side of the lungs alone be affected, the corresponding side of the thorax is diminished. If we push out the eye of an animal, the orbit becomes smaller; on the contrary, if an eye grow carcinomatous, the orbit is extended in proportion as the eye-ball grows. In the same manner, the skull follows the different size and form of the brain.

Let us now consider what happens with the brain and skull in old age. Then the cerebral parts diminish by degrees; the convolutions, which are plump and well nourished in young persons, sink down and diminish in size; and they are no more near one another. In the same proportion as the brain or its parts decrease, the internal table of the skull is changed according to the law of nutrition I have just spoken of. Ordinarily the external table of the skull preserves in old age the same form and size which it had at the age of maturity. Then the skull, if the brain diminish in size, becomes thicker; and the two tables are sometimes very distant one from the other. The superior portion of the orbit is ordinarily very thin and transparent, but it happens sometimes in old persons, whose brain has diminished in size, that the two tables are separated and very distant one from another. The external preserves its position, but the internal follows the size of the brain, and diminishes much the cavity of the skull. Thus it results from this exposition of ages, in respect to the changes produced in the brain and skull, that the form of the skull is always the result of that of the brain; that the internal table of the skull is moulded according to the brain from the beginning of ossification till death; but that in old and decrepid age the two tables are often separated, and the skull is thicker than it was at the age of maturity.

The diseased state of the brain also proves our assertion relative to the form of the skull. There is no skull without brain. If monsters are born without brain, their skull is also wanting. If in idiots from birth the brain be hindered from increasing, the skull remains small (*Pl.* IV. *fig* 1); on the contrary, if the brain be distended by water accumulated in its cavities, the skull participates of this extension, whether in general, or in particular places.—(*Pl.* V. *fig.* 1 & 2.) The resistance of the brain is also demonstrated by wounds of the skull, wherein bits of bones are impressed by any external violence, and put again in the right position by the action of the brain. Moreover, this resistance of the brain is proved by the fungus of the dura mater; these fungous tumours act upon the skull, destroy and pierce it. Consequently all concurs to prove that the form and size of the brain regulate the form and size of the skull. However, I do not deny that in some diseases of the skull, the ossification may be altered primitively, and the developement of the brain injured by the influence of the skull upon the brain; but in this case the functions of the brain are unavoidably deranged.

It is incorrect to think that the impressions which are correspondent to the convolutions, and those which the blood-vessels of the dura mater make on the internal surface of the skull, are the result of a mechanical pressure. The grooves of the internal surface of the skull are the effect of the absorbent vessels, and the impressions called digital take place when and where the dura mater is very thin; this happens commonly in the greatest number of animals, as in the roe, sheep, cat, dog &c., and in man at the basis of the skull, and sometimes all over it in individuals who die of consumption, and whose dura mater had become thin.

There are several other opinions relative to the size and form of the head, which are quoted as objections against our assertion, according to which the brain determines the form of the head. A great number of anatomists and physiologists maintain that the form of the head is modified by the muscles, and that several elevations attributed to the brain are the effect of the action of the muscles which are attached to the outside of the skull. There are indeed bony tumours on the outside of the skull, which are neither the effect of the brain nor of muscular action: these elevations are either bony excrescences or bony elevations of different forms, destined by nature for the insertion of the muscles. But I speak here only of the form of the skull, or of its protuberances, which we consider as the result of the brain. Those who defend the influence of the muscles upon the form of the head do not agree about their effect. Some maintain that muscles depress the organs, others think that they produce elevations. But it is easy to prove that the muscles have not the least influence upon the form of the skull.

If the muscles determined the form of the skull, they ought to act in the direction of their insertion; the protuberances of the occiput, and of both sides of the head, ought to be directed downward, and not backward and sideward. In this supposition there ought to be a proportion between the size of the protuberances and the strength of the muscles which are inserted into them; but often large protuberances are corresponding to weak muscles, and *vice versâ*. Negroes have larger and stronger masticating muscles than Europeans, and the heads of the former are narrower at the temporal region than those of the latter. There are anatomists who therefore think that the muscles compress the skull. But, in opposition to this, we see that in children the lower region of the head, covered with muscles, is narrower than the upper region, while it is quite the contrary in adult persons. We have observed Europeans who had very weak masticating muscles, and whose heads were large or narrow, and others who had strong muscles and narrow or large heads. It is the same with animals. The heads of lions, tigers, hyenas, dogs, are much narrower at the the temples than those of oxen, horses, stags &c., however the former animals have stronger masticating muscles. The seal has a large head and weak muscles, while the badger has strong muscles and a narrow head. Other animals have strong muscles and a large head.

Moreover, the muscles ought to act upon the external table of the skull, and both tables ought to recede one from the other, while they are nearest at the places where the muscles are inserted, so that there the skull is transparent. On the contrary, both tables of the skull are the most distant one from another at the places where no muscles are inserted. Sometimes it happens that the skull grows thick even in young persons: this thickening then takes always place at the internal surface, as is evident by the spina cruciata of the occiput. If in old persons, or in chronic diseases of the brain, the skull grow thick, and if both tables be distant one from the other, the internal plate always diminishes the cavity of the skull, while the external plate preserves its usual direction.

The protuberances or depressions of the skull ought to be not only in proportion to the strength of the muscles, but also to the time during which the muscles have acted, which however is not observed. Moreover, the protuberances or depressions produced by the muscles ought to be conformable to their points of insertion; but what muscle can produce the form of the determinate organs, for instance, that of construction, of covetousness &c.? The form of the protuberances is always corresponding to the form of the organs.

There are many protuberances where no muscles are inserted, as the protuberances which indicate firmness, veneration, benevolence, self-love and circumspection. What muscle can draw the skull upwards? In many animals, as in the hog, ox, elephant &c., both tables of the skull are separated one from the other, but the cells are irregular and never corresponding to the insertion of the muscles. If in animals the muscles be placed in the interior of the skull, for instance in the tortoise, the head ought to be small and contracted. The orbit ought to grow smaller by degrees, on account of the muscles, which are inserted on its internal surface.

Finally, in fœtuses, muscles do not act with strength enough to determine the form of their heads, which however are as different as those of adult persons. Consequently, it is evident from all these proofs, that the muscles do not at all determine the form of the skull.

Professor Ackermann, at Heidelberg, thought that the frontal sinuses of man, and the cells between both plates of the skull of animals, were produced by the inspiration of the air, which according to him distends the cells by degrees. He maintained that, from that cause, individuals who are very active, and much exercised in walking and running, have larger sinuses, and that animals which live in the open air and which inspire a great deal of it, present the greatest number of cells. Several considerations prove the error of this assertion, which is not grounded upon experiments, but only hypothetically advanced.

The possibility of drawing in the air supposes already a space between the two tables of the skull; but how has the space first been produced? Let us admit that the air is drawn into the sinuses, what may be its action? Ackermann fancies that the air is warmed, and distends the cells by its expansibility? But is it not more probable that the air, in its state of expansion, goes out through the same aperture through which it entered, instead of acting with violence against the walls of the cells? Even in the supposition that the air acts against the walls of the cells, ought not the cells to be distended like bladders: why then are they angular? Moreover, all the cells of the skulls of animals do not communicate one with another. There are also cells in the interior of other bones; for instance, in the bones of the extremities, in both maxillæ, even in the fœtus: then, why should cells not be formed originally between both the tables of the skull?

Finally, the opinion of Professor Ackermann is a mere supposition. We know individuals who lead a sedentary life, and have great sinuses, and others who live always in open air, and have no sinuses. It is the same with animals. The ox and hog have larger cells than the stag, roe, and reindeer. The lazy owl has greater cells than the active eagle. The skulls of the stork, wild duck, wild goose and swallow, have no cells, notwithstanding the steady and rapid motions of these birds. Consequently, the opinion of Ackermann, that the inspiration of the air produces the frontal sinuses and the cells between the two plates of the skulls of animals, is erroneous and falls to the ground.

Hufeland, of Berlin, made the observation that perhaps in countries where the inhabitants bear burdens upon the heads, the form of their heads is changed and modified. First, very young children do not bear any burden upon the heads; consequently when they begin to carry burdens their skulls are closed and offer resistance. This resistance is greater on account of the vaulted form of the bones; and the brain itself contributes to resist. Then those who bear burdens upon their heads make use of cushions or rolls, so that the burden cannot press upon the top of their heads, but upon the lateral parts; consequently the head cannot be flattened by these means. Moreover, they do not bear their burdens continually. Their heads are free from burdens for the greatest part of their lives, and in these intervals they might increase. Finally, this opinion is not only refuted in theory, but also by experience. We have examined many individuals who have borne burdens upon the head for their whole life, and whose heads were much higher than the heads of other persons who never bore any burden.

Walter, of Berlin, Rudolphe, and several others, have maintained that the forming power determines the ossification and the shape of the skull. I have already said that the ossification of the skull is not the result of the brain; the bony mass is secreted by particular vessels, and according to the state of these blood-vessels the internal constitution of the skull is modified: however it is also certain that the bony mass is deposited according to the form and size of the brain.

Thus it follows from all that I have said in respect to the skull, that its form is the result of the form of the brain. Let us now examine the circumstances wherein it is certain and easy to distinguish the size of the cerebral parts; afterwards I shall mention divers difficulties which must be removed; finally, I shall consider the cases wherein it is impossible to determine exactly the size of the brain and its parts.

POSSIBILITY OF DISTINGUISHING THE SIZE OF THE BRAIN.

I have already mentioned that for the practical part of the physiology of the brain, it is indifferent to know the cause of the form and size of the head; that, in this respect, it is only necessary to distinguish the size of the brain, and its particular parts by the exterior of the head. This *knowledge* requires a just idea of the difference between the size of the head and that of the skull. All dimensions of the skull are much smaller, but the whole shape of the head is preserved in its details. It is only with this restriction that we can make use of antique busts and heads. For it is certain that the antiques do not present the natural size of the head. They are colossal, but it is remarkable that their form and size are very different; for instance, what difference between the heads of women and men; between the form and size of the heads of gladiators, sacrificators, of philosophers, of great poets, or generals?

In respect to the size and form of the head, it is also necessary to know the common size of heads, whether in general or at their different regions, in order to distinguish at the first view whether any head is too large (*Pl.* V. *fig.* 1 & 2), or too small.—(*Pl.* IV. *fig.* 1). It is also necessary not to confound bony excrescences and irregular elevations with the protuberances which present the developement of the organs. Moreover, it is necessary to known the bony protuberances which belong to the natural state of the skull, and which have some particular destination, as the mastoid process behind the ears, the spina cruciata of the occiput, and the zygomatic process.

It is certain from experience that the skin, muscles, and coverings of the head in general, do not prevent us from distinguishing the form of the skull; and that the dimensions of the skull are only smaller; but it is still to be examined whether the form and size of the skull indicate those of the brain? To this end I repeat, that the skull is composed of two tables, one external and the other internal; and that between these two tables a cellular spongy mass, called diploe, is deposited.—(*Pl.* III. *fig.* 1 & 2). These two tables are scarcely perceptible in children, they are distinct in adults, but their distance one from the other is not very considerable. In general, from birth to the period when the brain begins to diminish in size, it is possible and easy to distinguish the size of the brain by considering the size of the skull. For there never is an empty space between the skull and the brain, and both tables are not distant enough to invalidate our assertion.

It is objected that both tables are not parallel, and that for this reason it is impossible to measure the size of the brain and its parts according to the size and form of the skull. This objection falls to the ground as soon as our method is known. It is not necessary to appreciate the minute difference of size, in order to distinguish the developement of the organs. These occupy a large surface, and they present a very different size from the lowest to the highest degree of developement.

It is also to be considered that we only intend to distinguish the size of organs, and that it is essential not to confound this idea with that of protuberances. If one organ be much developed, and the neighbouring organs very little, the developed organ presents an elevation or protuberance; but if the neighbouring organs are developed in proportion, no protuberance can be perceived, the surface is smooth. Now this may happen if the organs are much or little developed. Every individual has all organs; and it is only to be determined whether the whole brain, or one or several parts, are more or less developed. It is also to be remarked that, in order to distinguish the developement of the organs, it is not always necessary to touch the head; in many cases the eye is sufficient. It is even more easy to distinguish the size of the organs, situated in the forehead, by sight than by touch. It is only necessary to touch the organs which are covered with hair.

Finally, it is to be considered that the developement of the organs is different in respect to their length, and in respect to their breadth; for the fibres which compose the organs are sometimes thick and short, sometimes slender and long, or slender and short, or long and thick. This difference of developement must produce some difference of the manifestations of the faculties. My observations are not yet matured enough to determine this point. It seems that long fibres produce more activity, and large fibres more intensity? It follows that the size of the brain in general, and of its parts in particular, may be determined from infancy to the commencement of decrease, consequently at the ages in which the faculties are the most active. Let us now consider the difficulties which must be removed in the physiology of the brain.

DIFFICULTIES OF DISTINGUISHING THE SIZE OF CERTAIN PARTS OF THE BRAIN.

Plattner, of Leipzig, said, that it is impossible to determine the organs situated in the middle line of the head, on account of the longitudinal sinus. But this receptacle of blood, or this canal, is not large enough to hinder us from distinguishing the size and developement of the neighbouring organs, the elevations of the organs being much larger. Sometimes the hemispheres of the brain are a little separated in the middle line along the longitudinal sinus; this happens most commonly between the organs of philoprogeny, of self-love, and of perseverance. Then there is a groove on the outside of the head; but he who knows organology cannot be mistaken.

Those who begin to practise our doctrine find another difficulty in the frontal sinus. Many adversaries even maintain that it is impossible to distinguish the developement of the cerebral parts situated behind it. They say that on account of the frontal sinuses, the organ of space cannot be distinguished. The developement of this organ, however, and the frontal sinuses, present quite different forms: the frontal sinuses only form a bony crest, and the isolated protuberance, which indicates the particular developement of the organ of space, is round and large. Sometimes the organ of space is very considerable, and at the same time there are frontal sinuses; then the bony crest is perceived, and at the same time this part of the forehead is prominent.

The cerebral parts, situated behind the orbits, require some exercise on the part of the organoscope, in order to be exactly determined. Their developement is perceived by the configuration and position of the eyes, and by the circumference of the orbits. It is therefore necessary to examine whether the eyeball is prominent or hidden in the orbit, whether it is depressed or pushed sideward, inward, or outward. According to this position of the eyeball, we may judge that such or such part of the brain, which is situated against such or such part of the orbit, is more or less developed.

It may be questioned whether all organs reach the surface, so that the organs of all faculties of the mind may be determined by the size and shape of the head? There are many convolutions in the middle line of the brain between the two hemispheres; there are still some others at the basis of the brain, and between the anterior and middle lobes, which do not reach the surface of the skull; but it seems to me that at least a great part of every organ lies at the surface, and that, if one part of any organ be well developed, the whole participates of this developement. The whole cerebellum does not touch the skull, but it is possible to determine the size of the cerebellum according to the part which reaches the surface. The cerebral parts, situated in the middle line between the two hemispheres, seem to be proportionate to the superincumbent organs; at least I have always observed a proportion between these cerebral parts in the vertical direction. Now as there is a proportion between the constituent parts of any organ, and as the other organs have been determined although all their parts do not reach the surface, it seems to me that it is possible to determine all organs, though all their fibres do not terminate at the surface.

The greatest difficulty for beginners is, when any organ is extremely developed, and pushes the neighbouring organs out of the places which they commonly occupy. There are two cases of this kind. Either one single organ is extremely developed, or several are very voluminous, but in such a proportion that the surface is almost smooth. In the first case the difficulty is not very great, for every organ has its own form and its particular direction. Therefore it is only necessary to look at the most prominent point which is corresponding to the midst of every organ. It requires more exercise if several neighbouring organs are almost equally developed.

However the most prominent point, and the direction of the protuberance, facilitate our examination and decision.

It is still objected against organology, that though it be possible to measure the form and size of the brain according to the form and size of the head, it is impossible to determine the size of the organs according to the size of the head or skull, because the organs are not confined to the surface, or to the convolutions of the brain. It is true the organs are not confined to the surface of the brain; they extend from the surface to the great swelling of the occipital hole, (medulla oblongata,) and probably to the commissures; for the whole mass of the brain constitutes the organs: but as the peripheric expansions of the five senses indicate the developement of the respective nerves, so the convolutions of the brain denote a larger or smaller developement of the whole cerebral mass. This will be understood by analogy. Animals which have a large external apparatus of smell, large nostrils, large turbinated bones, a large expansion of the pituitary membrane, consequently a very considerable nervous expansion, have the whole olfactory nerve very much developed; and it is possible to measure the developement of the nerve in general according to its peripheric expansion. In the same manner the retina, or the expansion of the optic nerve, is in proportion to the nerve itself; and it is the same with the organs of the moral sentiments and intellectual faculties. The convolutions are the peripheric expansions of the internal nervous bundles, and they are in proportion to them, so that it is possible to determine the whole mass of the organs according to the convolutions. Therefore though the organs are not confined to the surface of the brain, and though only their peripheric expansions are perceived at the surface, it is however possible to determine the size of the whole organs.

IMPOSSIBILITY OF DETERMINING THE SIZE OF THE BRAIN.

It remains still to speak of the cases wherein it is impossible to determine the size of the brain in general, and of its parts in particular, according to the form and size of the head. If the brain begin to diminish it is impossible to determine its size. According to a general law of organic parts the brain decreases by degrees, the convolutions which, at the age of maturity, were plump and prominent, sink down, and are separated one from the other; in one word, the composition is no longer equal to the decomposition, the latter prevails, and the size of the brain diminishes. Then often the external form and size of the head remain the same, but the internal table of the skull follows the surface of the brain, and both tables are more or less distant one from another, and separated by the diploe. In this manner the skull of old decrepid persons of both sexes is commonly thicker, more spongy, and less dense. The diploe is not only more considerable, but the tables are also less solid. Sometimes there are, in the skulls of old persons, parts which are very thin, while the rest remains thick; sometimes the whole skull grows thin. Consequently the decomposition, or absorption, is not always equally strong at all places of the brain. This absorption is most commonly observed in the middle of the parietal bones. It is then to be remarked that the least blow may depress such thin skulls of old persons, while a much stronger blow would not have done to it the least harm at the age of maturity. Thus old and decrepid persons do not serve to confirm the doctrine of the organology, because it is impossible to judge exactly of the size of the brain from the size of the head. Moreover, the organs do not continue to be very active at this age. It is therefore evident that, in order to establish the physiology of the brain, we confine our observations to young and grown-up persons in the flower of their age.

Another circumstance which prevents from determining the size of the brain, according to the form and size of the head, is certain cases of chronic insanity. For in this state the brain diminishes in size like the other nerves if they are diseased for a long time; the internal table always follows the size of the brain, while the external table preserves its usual position; on this account the skulls of fools and madmen are often very thick; but their texture is not very spongy, but hard and dense like ivory. Indeed it is remarkable that a great number of madmen have the skull hard and dense like ivory, and very heavy. The skulls of many madmen are also thicker than usual, and if they are not thicker they are at least dense and heavy. This phenomenon is probably an effect of some alteration of the brain, and it furnishes a new proof of the influence of the brain upon the skull.

It would be very interesting to denote the madmen whose skulls are dense, and those whose skulls are not so, or whose skulls are dense and thick. It seems that the inflammatory state of the blood-vessels of the dura mater contributes to the density of the skull. Does the greater afflux of blood towards the skull augment the ossification? In idiots from birth, who live long, the skull is often thicker, but less dense than in furious madmen. A child of nine years of age felt a permanent head-ache; he became indifferent to his lesson, then stupid, and, after a few years, he was affected with convulsions; he died at thirteen years of age, and his brain was covered with a false membraneous mass, which indicated a chronic inflammation of the arachnoid coat; the skull was very dense, and the frontal bone thick at the same time. It is a known fact, that in fractured bones being cured, the ossification at these places is more solid than that of other parts. We have seen several skulls which, being injured, had suffered from inflammation; and they were thicker or at least denser and heavier than natural. Gall preserves in his collection the skull of a soldier who, at the battle of Ozakow, received severe blows with the but end of a gun; he became mad, and lived for thirty years in that state; his skull is like ivory. A stone fell upon the head of a person, and deranged his mind; the person died a long time after, and his skull is dense and heavy.

This observation, relative to the density and thickness of the skulls of madmen, is disputed. Some anatomists deny the facts. We support our assertion by experience. I find similar skulls in different cabinets, but it is seldom that the proprietors are acquainted with the history of those to whom these skulls belonged. However there were anatomists, and natural philosophers before us, who have made the same observations. Greding, at Waldheim in Saxony, has opened several hundreds of skulls of madmen, and he found that the greatest number of their skulls was thick and dense. We have opened a great number, and among them many who died at the Salpetrière and in the Bicêtre: we found their skulls dense and often thick. Dr. Goergen, at Vienna, has in his collection many skulls of this kind. Thus it is indubitable that the skulls of many mad persons are dense and thick.

We have also observed that the skulls of individuals, who for a long time had a propensity to suicide, are commonly dense and sometimes thick. But it is then necessary to distinguish those who kill themselves in a fit of momentaneous despair, or by a short melancholy, or by this disease. It is impossible that the state of the ossification should be changed in a few days. These researches relative to the skulls of alienated persons, though important for physiology and pathology in general, and immediately connected with organology, are not essential to it as far as we intend to determine the functions of the brain. We admit even that in these individuals, who were diseased for a long time, it is impossible to measure exactly the size of the brain according to the shape and size of the head.

RECAPITULATION.

It results from that which I have said, in respect to the possibility of distinguishing the size of the brain in general, and of its parts in particular, according to the size of the head, that it is indifferent what cause determines the form and size of the head, but that it is sufficient to distinguish the size of the brain. I have considered various opinions about the cause which produces the form of the head. Moreover, I have indicated the ages wherein it is possible, in living persons, to determine the size of the brain. I have examined the difficulties we meet with, and I have developed how they may be removed. Finally, I have spoken of the cases wherein it is impossible to determine the size of the brain, wherein our judgment is at least very uncertain. Thus if these researches are made according to these considerations, it is obvious that they require inquiry; but those who endeavour to repeat them will be convinced that some difficulty does not exclude the possibility of success.

CHAPTER VII.

ON OUR METHOD OF POINTING OUT THE FUNCTIONS OF THE BRAIN.

After having considered the principles of the physiology of the brain, that is, after having demonstrated that all faculties of the mind are innate; that their manifestations depend on the brain; and that the manifestations of every faculty depend on some particular part of the brain: finally, after having examined the means which have been employed in order to determine the functions of the different cerebral parts, and after having proved that the functions must be determined according to the developement of the respective organs, I shall now develope our peculiar mode of examining the functions of the brain. In treating of the plurality of the organs, we have seen that a great number of philosophers, physicians, and ancient and modern physiologists, have divided the functions of animal life; and that they have attributed different faculties to different parts of the body; but before Gall, no special organ of the faculties of the mind has been discovered. I think the reasons are the following:— First, the seats of the moral sentiments have been looked for in the viscera of the abdomen and thorax, or in the temperaments; consequently in parts where they do not reside; or in conditions on which their existence does not depend. The intellectual faculties have been placed in the brain, but it was impossible to point out any organ, because organs have been sought for faculties which have no organ, namely, for common and general faculties. In order to understand this assertion, it is necessary to consider the difference between the faculties. I admit three kinds of faculties: general, common, and special faculties. This division of faculties is quite general throughout all nature.

In inorganic bodies, there are general qualities which must be specified in determinate bodies; for instance, size, figure, weight and consistence are general qualities of all bodies, and in order to indicate any determinate body, as gold, silver, iron, copper &c., the general qualities must be specified. Moreover, several qualities are common to metals, or to salts, or to earths, and these common qualities must also be specified in order to distinguish every sort of metal, salt or earth. It is the same in vegetables. There are general properties of vegetation; for instance, to be produced by its like, to be nourished by intussusception, to assimilate the food, to increase, decrease, and die; all these phenomena must be specified in designing any particular plant, as an apple-tree, a rose-bush. There are also qualities common to various orders of plants. It is still the same in animals both in their automatic and animal life. Their phenomena generally analogous bear also a general name; and their phenomena common to a certain order of functions are designated by a common name. But it is to be considered that general or common phenomena never have any particular organ. Secretion, for instance, is a common name, and secretion in general has no particular organ; but the particular secretions, as of saliva, bile, tears &c., are attached to particular organs. Sensation is an expression which indicates the common function of the five external senses; therefore this common faculty has no particular organ; but every determinate sensation, as of sight, hearing, smelling, taste or feeling, is attached to some particular organ.

Before Gall, all philosophers and physiologists have only spoken of general or common faculties of the mind. For instance, it is generally said that animals act by instinct, and man by understanding. *Instinct* however is a general expression, and denotes every inclination, every internal impulsion: now instinct or internal impulsion in general has no organ, but the determinate impulsions or instincts, as the instinct to migrate, to gather provisions, to build or to sing, are attached to particular organs. Moreover, it is said that man acts by understanding in opposition to the instinct of animals. We must here observe two things: first, it is to be known whether animals act only and always by instinct; and whether understanding has a particular organ.

As instinct denotes any internal impulsion, many actions of animals, as the industrious labours of insects, are certainly the result of some internal impulsion or instinct; but many animals modify their actions; they choose even among different motives. These actions then are not the effect only of an internal instinct. A dog is hungry, but he does not eat because he fears the blows of his master; certainly this dog does not act only by instinct, but shows a certain degree of understanding. For understanding is the knowledge of our faculties and the power of modifying their actions. Thus all actions of animals are not the result of mere instinct. On the other hand, if new-born children cry, and suck the finger, they do not act by understanding. If men of great genius manifest their talents without knowing that such manifestations exist; if they calculate, sing, or draw, without having seen or heard of such things having been done, does it not happen by some internal impulse or instinct, in man, as well as in animals which sing, build, migrate, gather provisions, by a mere internal impulse or instinct? Hence understanding is not a prerogative of man in opposition to instinct in animals. Let us now examine whether understanding has an organ.

Understanding being an expression which designates a general faculty has no particular organ, but every determinate species of understanding is attached to a particular organ. Finally, it is the same with all common faculties of the understanding; of which philosophers and physiologists speak, namely, with *perception*, *memory* or *recollection*, *judgment*, and *imagination*. These expressions are common, and the respective faculties have no organs, but every peculiar perception, memory, judgment and imagination, as of space, form, colour, tune and number, have their particular organs. If the common faculties of understanding were attached to particular organs, the person who possesses the organ of any common faculty ought to be endowed with all particular kinds of faculties. If there were, for instance, an organ for instinct in general, an animal which should have one instinct ought to have all instincts. If there were an organ of perception, of memory, of judgment or of imagination, any one who has the organ of perception, of memory, of judgment or of imagination, ought to possess all kinds of perception, of memory, of judgment or of imagination. Now this is against all experience. One has a great memory of one kind, and a very little memory of other things. A poet possesses one kind of imagination in a high degree, but has he therefore every kind of imagination, as that of inventing machines, of composing music &c.? Therefore, natural philosophers were wrong in looking for organs of common faculties. A speculative philosopher may be satisfied with vague and common expressions, which do not denote the particular and determinate properties of the different beings; but these general or common considerations are not sufficient for a naturalist, who endeavours to know the functions and the faculties of every organic part in particular. Throughout all natural history the expressions are the less significant the more general or common they are; and a distinct knowledge of any being requires a study of its particularities.

Moreover, organs have been sought for the *af-*

fections and *passions*, but I shall explain hereafter, that affections are only the different modes of action of the particular faculties, and that passions are the highest degrees of activity of the organs; consequently, neither affections nor passions can have particular organs. Another obstacle was in the division of the faculties of the mind into natural and factitious. For it is evident that no organ was sought for any faculty which seemed to be factitious. Finally, many philosophers thought that the soul is utterly independent of the organization, though the ideas were derived from the five external senses; they considered however reflection and judgment as manifestations of the soul, independent of any organization. Instead of examining the relation of the brain and its parts to the manifestations of the soul, philosophers lost themselves in mere metaphysical abstractions concerning the nature of the soul. I think that these considerations, and the means employed by other physiologists, prove evidently that it was impossible to point out the function of any cerebral part.

Gall himself for a long time participated in these errors of the schools; he followed this false way, and did not leave it till he perceived that all his researches were useless. At the beginning he compared the form and size of the whole head only with the general faculties of the understanding, without thinking that the moral sentiments reside also in the brain. He looked for particular organs of memory, judgment, and imagination. Not succeeding in this way, he left all the notions of philosophy, and compared the form and size of the whole head with the favourite occupations of every person. It is commonly known that certain persons are endowed by nature with particular faculties. Some are from birth fit for mechanics, or for music, for painting &c. Gall compared individuals who excelled in any one kind of functions, and examined the whole form of their heads; he believed for some time that great mechanicians may be distinguished by a face enclosed between two parallel lines, that is equally wide at the forehead and at the jaw-bones; and that the forehead of great musicians is triangular. However, he met with exceptions; consequently he was aware that he had not yet found the truth; for nature makes no exceptions in her laws. If the eye be the organ of sight, vision can never exist without the eye. It is the same with the internal organs. If any faculty be attached to some organ, this organ can never be wanting if the faculty manifest itself. This assertion is as evident as that no effect can take place without a cause. Therefore Gall was obliged to give up his former method of proceeding, concerning the general configuration of the head, to which he had devoted several years. He maintains however that this kind of observation was not entirely useless for him, because he acquired a great habit of distinguishing the slightest differences of the divers forms.

Considering his first observations, where he distinguished a good memory by the developement of some particular part of the brain, *viz.* by prominent eyes, he then looked only for particular organs, in comparing them with the natural vocations of different persons: that is, when he was acquainted with any individual who manifested any function in a high degree; if, for instance, he observed any mechanician, musician, sculptor, draughtsman, mathematician, endowed with such or such faculty from birth, he examined their heads to try whether he might point out a particular developement of some cerebral part. In this way, he found in a short time, in musicians and mechanics, the developement of particular cerebral parts. He indeed observed that the respective organ is always much developed, if the same great talents are innate, while the rest of the head presents quite different shapes in the same individuals. At the beginning, he confined his observations to men of partial genius; such individuals were indeed most proper, not only because their organs are easily pointed out, but also because these persons alone resist the influence of external circumstances and of education. These individuals are also the most proper for confirming the organs and convincing beginners: the organ is the most easily distinguished, and the relation between the developement of the cerebral parts and the particular manifestations of the mind is the most evident. It is also important to observe the characters of uncultivated people, who are least capable of dissimulation. Being physician to the Establishment for the Deaf and Dumb at Vienna, Gall was well circumstanced for this purpose; he could observe the natural state of their manifestations, and their different degrees of susceptibility of education. To this end he also called together in his house common people, as coachmen and poor boys, and excited them to make him acquainted with their characters.

Gall investigated particular organs according to the principal actions of men, and he named the organs according to these actions. He observed, for instance, individuals who are born mathematicians, mechanicians, musicians, philologists, metaphysicians, poets &c., and if he found that some part of their brain was always more developed than the rest, he called these cerebral parts, organ of mathematics, of music, of philology, of metaphysics, of poetry &c. In the same way he observed individuals who from birth were stubborn, proud, courageous, thieves, murderers, religious &c., and if he found that the size of some cerebral part was corresponding to these actions, he called these parts of the brain, organ of pride, of firmness, of courage, of theft, of murder, of religion. Not being acquainted with the special faculties, Gall could not proceed in any other way; he ought only to have suspended the denomination of the organs: he was obliged to observe man only in action, but as the actions of man and animals are seldom the result of one single faculty, and as many actions are the effect of the abuse of the faculties, it is conceivable that the nomenclature established by Gall is very defective. It is true that in individuals who have stolen from infancy, notwithstanding the most careful education, and the severest punishment, one part of the brain is particularly developed; but all persons in whom this organ is much developed are not thieves. It is the same with the organ of murder: those who from infancy were charmed with murdering, present some part of the brain much developed, but all persons who have this organ much developed have not murdered.

It is evident that no organ should be named according to the abuse of its faculty. Greediness and drunkenness depend on some organization, but it is not said that there are organs of drunkenness and greediness: the abuses of physical love depend on a certain organization, but nobody speaks of an organ of the abuses of this faculty. I shall show below, that it is the same with the organs of theft and murder. These functions are abuses which result from the highest degree of activity of certain organs, which are not directed by other faculties. Therefore Gall, who distinguished only the organs if they were extremely developed, while the other organs were very small, observed a certain organization in inveterate thieves. This will indeed be always the case, and Gall, as I mentioned above, was wrong only in naming this organ according to its abuse. Moreover Gall, in his proceeding, has only observed the particular actions which accompany the different organs, but he has not determined their special faculties. Hence his complaint in respect to every organ, that he does not know its sphere of activity. His manner of observing was necessary, and has prepared the way for several philosophical considerations, which elucidate this doctrine and render it conformable to all other physical and moral truths.

Before I treat of these considerations, let me relate the means fit for determining the organs of the manifestations of the mind. Gall compared all energetic actions with the greatest developement of any part of the brain; and if he found that a greater developement of any cerebral part corresponded with any given energetic action, he supposed that this part of the brain might be the respective organ. The probability then increased in the same proportion as the number of observations was multiplied. Moreover, if any individual presented on his head any protuberance, which evidently was the result of the developement of some cerebral part, Gall endeavoured to be acquainted with the talents or the dominant character of this person. If it were an organ which he had determined according to the actions, and if the actions or inclinations of this person were concordant, the probability increased. If it was a new organ, he compared in other individuals similar actions or inclinations with the developement of the respective part of the brain. In these two ways he determined all the organs he discovered: for instance, he pointed out the organs as they were called by him, of propagation, of murder, of theft, of mechanical arts, of music, of mathematics, and of metaphysics, by determining the organs according to energetic actions; and he discovered the organs of philoprogeny, circumspection, and religion, by determining the actions according to the protuberances.

On the other hand, if energetic actions are attached to large organs, and if large organs produce energetic actions, it unavoidably follows that weak actions are indicated by small organs, and that small organs produce weak actions. On this account, Gall compared the weak functions of individuals who were almost destitute of a particular faculty with the determinate organ, and a determinate organ with the respective actions; and if weak actions were corresponding to small organs, or small organs to weak actions, these proofs in a negative way confirmed the first conclusion. A great number of circumstances have contributed to multiply these positive and negative observations. To this end it is necessary to live in large towns, and to frequent all classes of society. Gall was professionally acquainted with many families; he was physician to the director of the schools, and could examine every child who excelled. He had himself no children, and was not obliged to spare expense for their sake. He was also bold enough to speak to every person in whose head he observed any distinct protuberance. In our travels, we have been able to obtain much information; to observe a great number of distinguished persons, and to compare their organization; in one word, to collect innumerable facts in our visits to establishments for education, in hospitals for idiots and madmen; in the houses of correction, in prisons, and in our intercourse with different nations and with all classes of society.

It is known that, in general, physical truths improve in proportion as observations are repeated. We continue therefore to multiply our observations, and in respect to several organs the number of these observations is immense, and we consider the respective organs as determinate. We shall insist on our opinion as long as we are not convinced, by experience, of the contrary. Several organs however are still conjectural, and require a greater number of observations in order to be determined with the same degree of certitude as the others which are supported by the most satisfactory proofs. It is objected that the organs cannot be verified, because our conclusions are drawn only from individual facts. But is this not the case with all physical truths? No physician has observed all facts; no anatomist has seen the viscera of all persons. Yet according to the stability of natural laws, physical truths are admitted, and the structure and position of the viscera are supposed to be the same in individuals who have not been opened. It has also been objected that our observations might be true only at one place; and that it is necessary to repeat them elsewhere. Our travels have refuted this objection, because we have every where had opportunities enough of multiplying and confirming the same observations.

Gall felt soon the necessity of making a collection of the busts of individuals remarkable for any quality, whether talent or moral sentiment. He modelled them in plaster without hair, and imitated as exactly as possible the whole configuration of their heads. By these means it was possible to multiply and rectify the observations; he could compare at the same time different individuals endowed with the same faculties; he could examine them at leisure, which was a very important circumstance; for our mind does not act always with the same energy and acuteness. Gall allows that he often placed together the busts of individuals who excelled in the same functions without distinguishing any difference in the shape of their heads; sometimes he looked in vain at them for several weeks; and sometimes he pointed out an organ, so to say, without thinking of it. Those who have not experienced similar things may have difficulty in conceiving this assertion; but those who have made similar observations know how long it is necessary to exercise the eyes in order to perceive every difference of form and size. The collection of busts procured still another advantage. Many of these individuals were remarkable in several points of view, whether in an affirmative or negative manner. They therefore presented different points of comparison. At the same time Gall made a collection of skulls, especially of those persons who were remarkable for any quality, and if possible of those whose busts he had modelled in plaster. In this manner he learned to compare the heads with the skulls. Moreover, he could verify the forms of the organs.

As the arrangement and position of all parts which are common to man and animals are the same, it is very useful to compare animals which are endowed with the same faculties one with another, and with animals which are destitute of these faculties. In this way the points of comparison are extremely numerous, and the observations, in respect to faculties common to man and animals, may be repeated to infinity. However, no organ has been discovered in animals, but all were pointed out in man. The reason is, because, in order to be sure, the observations must be confined to the individuals of the same kind, and chiefly to individuals of great genius. Some physiological discoveries relative to the physiology of the brain, and made upon animals by countrymen, agriculturists, hunters, and jockeys, have been found in different individuals of the same kind. Peasants, for instance, know that horses with a large forehead are more docile than those with small foreheads. Therefore they put them at the head of the team. Some jockeys distinguish biting and stubborn horses by the configuration of the forehead. They made these observations in distinguishing the different forms of the head without knowing the ground of them, which really depends on the greater or smaller developement of the cerebral parts. Thus, the comparative anatomy and physiology of the brain may contribute a great deal to determine the organs. Many animals are mutilated by nature, and it is not necessary to make them undergo violent mutilations. In fact, comparative anatomy shows that in lower animals the brain is more simple, and in perfect animals more complicated. In the same way it is observed that the faculties multiply in proportion as the parts of the brain are more numerous.

The anatomy of the brain in particular confirms us in the determination of the organs. First, the bundles which constitute the organs are distinct, and no central point is perceived. The plurality of the organs then are as evident as the plurality of the faculties. Moreover, some faculties have a great sphere of activity, while the actions of others are very weak; and it is observed that the size of the respective organs is in direct proportion. It is known, for instance, that the moral sentiments act with greater energy than the intellectual faculties; and anatomy shows the same difference in respect to the natural size of the respective organs. Anatomy shows also that the different cerebral parts are not developed simultaneously, in the same way as the manifestations of the mind do not take place at the same time. In short anatomy is always corresponding to physiology and *vice versâ*.

The diseased state of the brain and its accidental injuries may be taken advantage of, in order to determine the particular organs; but I have already considered that these kinds of observations are very uncertain. They are only secondary, and not at all decisive; they are however interesting, if combined with other direct and evident proofs. In treating of the particular organs I shall mention similar observations, without maintaining that it is possible to point out the organs only by them.

Mental alienations, chiefly partial insanities, monomania, and the state of idiotism, are much more conducive to this object than the accidental injuries of the brain. In idiots from birth, the whole brain is small or distended by water. In madmen with partial insanities, the respective organs are commonly more developed than the rest, and their external signs are easily perceived. It is conceivable that persons who manifest a certain sentiment or intellectual faculty with peculiar energy, show, in a state of greater irritation, this faculty in the highest degree. I never saw a fool by pride without a great developement of the organ of self-love; however it seems to me that very great developement is not indispensably necessary to every partial insanity, for every part of our body in general, and of our brain in particular, may grow more irritable than the rest, and therefore the energy of every cerebral organ may also increase and produce partial insanity.

It is of great importance to consider the heads of different nations. Several anatomists and physiologists have endeavoured to point out the particular shape of the heads of different nations. Though all observations of this kind are very defective, they are yet rather for than against the physiology of the brain. The foreheads of negroes, for instance, are very narrow, their talents of music and mathematics are also in general very limited. The Chinese, who are fond of colours, have the arch of the eyebrows much vaulted, and we shall see that this is the sign of a greater developement of the organ of colour. According to Blumenbach the heads of the

Kalmucks are depressed from above, and very large sideward about the organ which gives the disposition to covet. It is also admitted that this nation is inclined to steal &c. In the same way, the manner of thinking and feeling of different nations may be compared with their most developed organs. It is obvious that I speak only of the greater number of individuals in every nation; and only of any general type of their heads; for the modifications are infinite in all countries, but, generally speaking, there are nations whose heads are longer or shorter, higher or lower, narrower or broader &c.

There is still another means of pointing out or of confirming the organs: mimickry. Every internal sentiment is manifested outwardly by certain motions of the head, body, and hands. These external manifestations are constant, and commanded by the internal faculties. They are essentially the same in all nations and at all times. I do not intend at present to detail the principles of the doctrine which explains the external manifestations: this consideration belongs to the practical part of anthropology; therefore I shall treat of it afterwards. Here I mention only one principle relative to the seat of the organs; namely, the motions are conformable to the seat of the organs. If, for instance, a faculty, the organ of which is situated in the posterior part of the brain, be active, the motions are backward; and if its organ be in the forehead all motions are in this direction.

By all these means, which we employ continually in order to multiply our observations, every organ may be determined, and those which are pointed out may be confirmed. The number of facts we have collected is immense, but it is impossible to quote them all. I can speak only of their results or general deductions. Moreover, no one will have personal or individual conviction before he has made the same observations. Gall admonishes his auditors not to practise this doctrine because it is so difficult: I, on the contrary, invite every inquirer to repeat the observations in order to obtain self-conviction. Therefore also every inquirer ought to consider it as his duty to be well acquainted with this doctrine, before he endeavours to make any application of it. It is true that it requires examination, and I can show only what is to be observed and how it is to be done; but I shall never advance any thing that cannot be observed by every other person. I do not then listen to any objection grounded upon mere reasoning, and destitute of every kind of observation; one fact well observed is more positive and decisive for me than a thousand mere metaphysical opinions. We flatter ourselves that every one who will take the trouble of examining and repeating our observations, without any prejudice, will be convinced of the solidity of these principles of the physiology of the brain.

CHAPTER VIII.

ON THE PARTICULAR ORGANS.

I HAVE mentioned that Gall, unacquainted with the special faculties of the mind, sought organs for the actions of man; that the actions do not always indicate the special faculty; and that there are very few actions which are the result of one special faculty. However, the proceeding of Gall is conducive to determine the special faculties, and their sphere of activity. I shall not treat of the organs in the order in which they have been discovered, but according to their situation in the brain, beginning from the most inferior.

Before I examine the special organs, I shall consider whether the faculties which manifest themselves by the cerebral parts may be divided or not. Before Gall, all physiologists and philosophers sought only the organs of the understanding in the brain, and the moral sentiments elsewhere: Gall was the first who showed that the organs of the moral sentiments are also situated in the brain. Moreover, opinions in respect to the faculties of the mind have hitherto been extremely vague. Even at the present day, the most common division of the faculties of the human mind is into will and understanding; *will* is subdivided into different modifications, as into inclination, propensity, desire, and passion; *understanding* into perception, memory, judgment, and imagination. All the functions of animals were considered as the effect of *instinct*. I have already explained * that all these expressions are general or common, and that these general and common faculties have no particular organs. I have also demonstrated that it is wrong to call the faculties of animals *instinct* in opposition to the understanding of man; and that many actions of animals are accompanied with understanding, while many actions of man are the result of mere instinct. It remains to be proved that the division of human faculties into will and understanding is very inexact. I shall afterwards elucidate that it is a great mistake to consider will as a generic expression of every propensity, inclination, and desire. Here I maintain that will, as a generic name, indicating every propensity, cannot be considered as a particular class of functions different from the intellectual faculties. For every faculty, whether moral sentiment or intellectual faculty, desires, or has some propensity, as soon as it is active. The faculty of space, that of colour, tune, of comparison &c. being active, desire. Even every faculty desires more or less, from the weakest propensity to the highest degree, called passion. Thus the division of the human faculties into understanding and will, in the ordinary sense, is incorrect. Gall therefore rejects all divisions of the faculties manifested by the brain. He admits in every

* Pages 272, et seq.

organ all modes of action. However it seems to me that different divisions of the cerebral faculties may be admitted. It is true all faculties desire, but all faculties of man do not present the modifications of action of which the intellectual faculties are capable. The moral sentiments have no memory, no judgment, they produce only feelings, while the intellectual faculties have not only propensity, but also peculiar modifications of action of which the other faculties are destitute. Moreover, it seems to me that there is some difference between the different moral sentiments. Several of them produce a mere propensity, while others produce some sentiment which is not only propensity, but a particular mode of feeling which must be felt in order to be known; for instance, self-love, justice, compassion &c. All faculties which I call propensities are common to man and animals; but the faculties which produce propensity, together with a peculiar feeling, and which I call sentiments, may be subdivided into those which are common to man and animals, and those which are proper to man. Certain other faculties are destined to know the external world, and the qualities of external bodies: I name them knowing faculties. Still other faculties compare the relations between different external bodies, the relations between external bodies and the internal faculties, and those between the internal faculties themselves: I term these reflecting faculties.

Thus I divide and subdivide the class of the mental faculties, according to the common principle of natural philosophy, into orders, genera, species, and varieties. The expression *Mind* designates the class of faculties. I divide it into two orders: into feelings (*gemueth*, in German) and intellect. The feelings are subdivided into two genera: into propensities and sentiments. The propensities begin with that of eating and drinking. Many instincts of animals belong to this genus, while other instincts of animals, as those of singing and migrating, belong to the knowing faculties. The second genus of feelings consists in sentiments, some of which are common to man and animals, and others proper to man. The second order of mental faculties and intellect is subdivided also into two genera, into knowing and into reflecting faculties. Moreover, there are different species of propensities, of sentiments, of knowing, and of reflecting faculties. There are varieties in the different species; and we observe even monstrosities in the manifestations of the peculiar faculties.

Before I consider the internal faculties and their respective organs, it is necessary to examine the intermedia, by means of which the external world acts upon the internal faculties, and these upon the external objects. The former takes place by means of the five external senses; the latter by means of the five external senses and voluntary motion. Those who compare this chapter with that which we have published on the five senses, in the first volume of our large work, will find not only another arrangement of these considerations, but also several corrections and many additional elucidations.

I have already demonstrated that many faculties attributed to the external senses cannot be considered as their effect. I have also answered the objection that the five external senses may be reduced to one—sensation; and I have proved that it is necessary to treat of every sense in particular. I shall now show the special functions of the external senses, but before I consider every sense in particular, I shall enter into some general considerations relative to every sense.

On the Generalities of the Five External Senses.

DUPLICITY OF THE ORGANS.

The organs of every sense are double, as the organs of animal life in general. There are two eyes, two ears, two nerves of smell, of taste, of feeling. Some authors have denied the duplicity of the cerebral organs, but they confounded the doubleness with symmetry. It is true both organs are seldom symmetrical, but is it not the same with both eyes, ears, and other double parts? Thus the want of symmetry does not annihilate the doubleness. Indeed the nerves are commonly larger on one side than on the other; and it may be asked on what side they are commonly larger? In the greatest number of persons the right side of the whole body is stronger than the left. This is known in respect to the hands and feet, and it is commonly maintained, that it is the case on account of the continual exercise of the right hand. But it may be replied, Why is the greatest number of new-born children right-handed? For of ten children perhaps seven are right-handed from birth, and they take or hold with the right hand without being taught; and the three others, whose right hand is exercised from infancy, feel more strength on the left side, notwithstanding all exercise of the right side. Moreover, if the strength of the right hand be only the result of exercise, why is the rest of the whole right side stronger than the left? Why is the right eye larger than the left? Why are the right breast, the right hemisphere of the brain, larger than those of the left side? The greatest number of diseases attack the left side much more frequently than the right. The greatest number of hump-backed persons have this deformity on the right side, because the muscles of the right side are stronger, and draw the spinal vertebræ on this side. Thus the organs of animal life are double, while the organs of automatic life are mostly single; and the organs of the right side are commonly stronger than those of the left.

THE CONSCIOUSNESS OF EVERY SENSE IS SINGLE.

Another common consideration of the five senses is, that every one has two sentient apparatus; that therefore the impressions are double; the consciousness however of both impressions is single. Different explanations have been given of this phenomenon, and the sense of sight has generally been considered by those who endeavoured to explain it.

TOUCH.

Many writers explain the single consciousness by the sense of touch. They say, at the beginning, vision is double, but touch rectifies this error. Buffon was of this opinion. He supported his assertion by the following experiment: If we look with both eyes at two objects, which are in the same direction with us, and if we fix the eyes upon the nearest object, we see it single, but at the same time we see the farthest object double; on the contrary, if we fix our eyes upon the farthest object we see it single, and the nearest object double. This experiment is, according to Buffon, an evident proof that we see the objects double, but judge them single, being rectified by the touch. But as in this experiment the same object now appears double, then single, how is it possible to infer from it that the sense of touching has corrected sight? Why is this correction only relative now to the nearest, then to the farthest object. It seems to me that quite another conclusion may be drawn from this experiment; namely, that sight has no relation to touch; sight, its modifications and illusions, are only the result of the organization and position of the eyes, and of the laws of the refraction of light.

Moreover, nobody recollects to have seen objects double in his infancy. No person born blind, who has recovered the sight by the operation for the cataract, has seen objects double. We also have never observed, nor heard, that animals take single objects for double ones. The butterfly does not confound the flower with its image, and the lamb distinguishes very well its mother from its mother's shadow. Animals which live a short time, and which never can rectify their vision by touch, are not deceived by the number of objects. Sometimes in morbid affections of the eyes, or in squinting, man sees double, notwithstanding all preceding experience. Consequently it is evident that the cause of single vision does not reside in the sense of touch.

CORRESPONDING POINTS.

Others explain single vision in another manner. They say, if the images of any object fall upon corresponding points of the retina, that is, upon points which are always affected at the same time, the object appears single, but if the images fall upon different parts of the retina, which are not affected ordinarily at the same time, the object appears double. This explanation is very common. Cuvier and Richerand admit it. But it is rare that corresponding parts of the eyes are affected at the same time. If we look at any object sideward, opposite parts of the retina of both eyes are affected, yet the object appears single.

INEQUALITY OF THE EYES.

Several authors maintain that the inequality of the eyes is the cause of the single consciousness of sight.

According to them the strongest impression alone is perceived. It is true that very few persons have both eyes equally strong, consequently the impressions do not produce the same effect in both eyes in respect to energy. But if only one impression be perceived, why do we see better with both eyes, and hear better with both ears?

DECUSSATION OF THE OPTIC NERVES.

Ackermann explains the single vision by the decussation of the optic nerves. But such an arrangement cannot be demonstrated in respect to the auditory nerves. And it is beyond doubt that the single consciousness of sight, hearing, smell, and taste, must be explained in the same manner.

ACTIVE STATE.

Gall ventured to give another explanation. He distinguished two states of the five senses; he called one active and the other passive. The functions are passive if they take place independent of the will; for instance, we must perceive the impressions of light which fall upon the retina, or the impressions of sounds which shake the auditory nerve. Gall says, we perceive *passively* with both organs, we see with both eyes, hear with both ears, but the active state of the functions of the five external senses takes place only in one organ, and commonly in the strongest. We see with both eyes at the same time, but we look with one eye alone; we hear with both ears, but we listen with only one ear; we feel with both hands, and touch only with one &c.

There is no doubt that we look with one eye alone. If we place a small stick, a pencil, a goose-quill, or another thin body between our eyes and a light, if we keep both eyes open, and point out the right line between our eyes, the stick, and light, then if we looked with both eyes the stick should occupy the diagonal, and its shadow should fall upon the nose. But the shadow falls always upon one eye, upon that of which the person, who repeats the experiment, ordinarily makes use in looking with attention. If the person keep the stick in the same position, and shut the eye with which he did not look, the direction remains the same for him, but if he shut the eye with which he looked, the stick appears removed far from its direction. Let any one look at a point at a little distance from his eyes; both eyes seem to be in the same direction toward the object. Then let him shut his eyes alternately. If he shut the eye with which he did not look, the other stands without the least motion; but if he shut the eye with which he looked, the other eye makes immediately a little motion inward in order to fix the point. Moreover, in many animals the eyes are placed entirely sideward, and they cannot be directed at the same time toward the same object. Finally, even the gestures of man and animals prove that they look with one eye, and listen with one ear; they direct one eye or one ear toward the object to be seen or heard.

Walther and Ackermann have objected an experiment which has been invented, believed, and repeated according to an erroneous supposition. It is known that green colour is composed of yellow and blue. They inferred from it that if we look through spectacles one glass of which is blue, and the other yellow, we perceive the mixed colour, green. We have often repeated this experiment, but we never saw green. If you behold green coloured objects, as meadows, you see them green; for the coloured glasses do not destroy this colour. If you behold other objects, and both glasses of the spectacles are equally thick, you will perceive the colour of that glass, which is before the eye, with which you look. If the glasses are of different thickness you perceive the colour of the thinnest glass.

It may be asked, with which eye men ordinarily look? Le Cat thought that the eyes change every day. Borelli maintained that the left eye is the strongest, but Le Cat mentioned that sometimes the right, sometimes the left eye shows the greatest energy. We have observed that as in general the whole right side, and the right eye in particular, are stronger, that the greatest number of persons look with the right eye. However it is to be observed that every one does not look with his strongest eye.

It nevertheless seems to me that also this explanation is not satisfactory. Indeed it is very remarkable that passively we perceive, at the same time, the impressions of both organs of any sense, not only if one object make impressions upon both eyes or both ears &c. but also if different objects make impressions upon both organs of any sense. Even different impressions of different objects may be perceived by both organs of different senses. You may see, for instance, with both eyes different objects, and, at the same time, hear different sounds with both ears; but as soon as you are attentive, as you look or listen, you perceive only one impression at the same time. It is impossible to attend to two different discourses at the same time. A musician, who directs the orchestra, hears passively, and he cannot be attentive to different instruments at the same time. The rapidity with which the mind acts deceives several persons, and makes them think that it is possible to pay attention to different objects at the same moment. It follows that there is a difference between the active and passive state of the five external senses. But it is another question, whether this difference explains the single consciousness of every sense? I think not.

First, this explanation would only be applicable to the active state of functions, and not at all to their passive state. But the cause of single consciousness must be the same for both states of functions. Moreover, it must be considered that the active state is not at all produced by the external senses themselves, any more than voluntary motion is the effect of the muscles themselves. Some internal activity provokes the active state of the five senses; the five external senses are always passive; they only propagate the external impressions, and they only appear active if some internal cause employ them to receive the impressions and to carry them to the brain. Therefore, it is probable that the same internal cause which puts only one organ of the five senses in action is also the cause of the single consciousness of different impressions. Thus, the explanation given by Gall of single consciousness, according to the active and passive state of the five senses, is not only grounded upon a defective notion, but it is also far from being satisfactory, even if the supposition were true.

COMMISSURES.

Still another explanation may be ventured by the commissures or uniting fibres of both organs. For though the constituent parts of every organ are double, all similar parts of both sides are united in the middle line by an uniting apparatus. It is possible that the impressions of both organs are combined by this arrangement. This arrangement would explain the single consciousness of both organs of any given sense, but it does not explain the single consciousness of the impressions received by different senses.

CENTRAL POINT.

Many philosophers and physiologists speak of a central point at which all nerves terminate. But the anatomy of the brain proves evidently that such a central point is quite impossible. Moreover, if all impressions arrived at the same point at the same time, they would produce the greatest confusion, as Van Swieten and Tiedmann have already observed. Thus it follows from that which I have said of the explanations of single consciousness, that we are not yet acquainted with its true cause.

EVERY SENSE HAS ITS OWN NATURE.

A third common consideration of the five senses is, that every one performs its functions by its own power. A great deal has been said of the mutual rectification of the five senses and of their habit. But it is a general principle that the power of every sense is innate and inherent in the sense itself. The relations of every sense to the external impressions are determinate, and subjected to positive laws. As soon as any odour makes an impression upon the olfactory nerve, this impression is either conformable and agreeable to the smell or not, and according to this relation between the external impressions and the five senses, the manner of acting of man and animals is different. No preceding exercise or habit is necessary in order to acquire the special power of every sense; but the functions of every sense depend only on its organization. If this be perfect, the functions are perfect also, and if the organization be diseased, the functions are deranged notwithstanding all preceding exercise. If the optic apparatus be perfect in new hatched birds, their sight is perfect; for instance, in chickens, young ducks, partridges and quails: on the contrary, if in new-born animals the organization of their eyes and ears are imperfect, their seeing and hearing powers manifest themselves imperfectly. If in adult persons the eyes are diseased, the vision is deranged. In old persons the functions of the five senses lose their energy, because the vital power of the organs decreases.

Indeed it would be ridiculous if nature had produced any sense, which could not perform its functions without being supported by another different sense; for example, if we could not see without feeling, or if we could not hear without seeing. However we must make this consideration. It is certain that no sense acquires its faculty by any other sense; but it is also evident that every sense cannot produce the same sensations; that different senses may distinguish the other beings, and that one sense is more fit than another to make us acquainted with different bodies and their qualities. The laws of sight are determinate, and a straight stick plunged in water appears crooked, because we must see according to the laws of the refraction of light. Touch however will prove that the stick is straight. This is a kind of rectification; but this kind of rectification must not be confounded with the idea according to which one sense acquires its faculty by the rectification of another sense: touch may show that a stick which is plunged in water, and which looks crooked, is straight; the eyes however will always see it crooked. This rectification of the senses is mutual, but not the prerogative of one sense. In this respect, the eyes may rectify the sense of touch. If, without knowing it, a thin paper be placed between two of our fingers, for instance, between the thumb and fore-finger, we shall not feel it, but we may see it. Even smell and taste may rectify the sense of seeing and that of touching. Many fluids look like water; it would be impossible to distinguish them by the sense of touch, but it is easy by smell and taste. Thus every sense has its faculty by itself; its manifestations are subjected to constant laws, and depend on the respective organization; but every sense perceives impressions of which another is not susceptible, and in this respect the external senses rectify one another.

EVERY SENSE MAY BE EXERCISED.

It is also a general observation that no sense acquires its faculty by exercise, but that the functions of every sense are strengthened by exercise. The sense of feeling, if it be exercised, may acquire a very high degree of perfection. Blind persons feel the proximity of external objects by the impression of the air upon their faces. Le Cat speaks of a blind-born person of Poiscaux, who distinguished the distance of the fire by the degree of warmth or heat. Saunderson, though he was blind, in handling a series of medals, discerned the false from the true more exactly than many connoisseurs. Le Cat mentions a sculptor, Ganibasius of Vottera, who, being blind, groped the faces and modelled them in potter's clay. The deaf and dumb, in the Institution of Mr. Eschke, at Berlin, read with facility what was written on their back covered with clothes. Boyle and others relate that the touch of blind persons was so acute, that they distinguished the different colours and their shades. The same thing is told of the blind Weissenbourg, of Manheim. This man had about thirty pieces of cloth, and he indicated with precision the colour of every piece. But he was often mistaken in determining the colour of the clothes of strangers. The cards with which he played were pricked with needles, consequently marked. Those who were not acquainted with it, thought that he distinguished the colours of the cards by touch. Many other blind persons have assured us that it is impossible for them to discern colours. A few discern white from black, because the surface of the white colour is more smooth. In general, if blind persons distinguish the colours, they feel only a more or less smooth surface; but they do not acquire any idea of colour itself.

The sense of taste is fortified by exercise as well as every other sense. At the first, several dishes appear tasteless or unpleasant, for instance, oysters, or truffles; but after having eaten of them several times, we distinguish their particular savour. It is a common opinion that the sensibility of taste is blunted early in life by the spicy dishes and by all the refinements of luxury that are daily invented. But is it possible to maintain that our cooks and dainty mouthed persons have a more obtuse taste than savages, who distinguish the flavour of some roots which are insipid to us? Do not the frequent poisonings by vegetables, as by hemlock, bella donna, or poisonous mushrooms, prove that the taste of the sober country-man is not surer than the taste of the voluptuous citizen? We must admit in respect to the sense of taste what happens in respect to every other sense. If the impressions are too strong its sensibility is blunted, but the functions grow more energetic by a conformable exercise.

The sense of smell is also susceptible of being exercised. Several physicians, at the entrance into a room, distinguish the kind and state of certain diseases. It is related that some negroes follow other persons by their track as dogs do, and discern the traces of a negro from that of a European. In the same way, the smell is blunted by the use of too strong and penetrating odours, but a conformable exercise strengthens its functions.

The sense of hearing is like the other senses, cultivated by exercise. The blind Weissenbourg, of Manheim, judged exactly of the distance and size of persons who in an erect posture spoke to him. The blind Schoenberger, of Weide, in the Upper Palatinate, had the sense of hearing so acute, that it was sufficient to indicate, by striking, the place where the nine pins were put up, or the mark to be shot at, and he often hit the aim. Blind persons find often a pin or piece of money which make some noise in falling.

Finally, the eyes acquire by exercise a very high degree of activity. Le Cat mentions a deaf woman of Amiens, who distinguished what other persons said by the motion of their lips. In order to tell her something it was sufficient for others to move the lips as if they were speaking. She observed immediately if foreigners spoke a strange language. We saw the same phenomenon at Berlin, and elsewhere, in several deaf and dumb. They distinguished by the motions of our lips what we told them. Several understood us even when we kept the hand before the mouth. The motions of the face in general were sufficient. They read with facility what was traced in the air with the fingers. It follows, that though exercise does not produce the faculties of the five external senses, the functions of every sense yet grow more energetic by exercise.

A fifth common consideration of the external senses is, that their functions are not only modified in different kinds of animals, but even in different individuals of the same kind. The taste and smell of carnivorous and herbivorous animals are indubitably modified. The ox and horse find hay savoury, while the dog and wolf find flesh well tasted. The senses change also at different ages, and according to our habits; they even participate of the different states of health. In this manner are to be explained the different longings of pregnant women, of hypochondriacal and hysteric persons. This explains also why we are sometimes disgusted at what we formerly liked. Moreover, several substances, inodorous to man, make a great impression upon the smell of certain animals. Some animals are much excited by certain odours, to which others are quite indifferent. One odour is agreeable to one individual and repugnant to another. In the same way, the eyes and ears must be modified in animals which live under water, or in the air: the eyes are different in animals which see in the night or during the day. One individual likes one colour or sound with which another is displeased. Therefore, it is certain that the functions of the external senses are modified, not only in different kinds of animals, but also in different individuals of the same kind.

THE EXTERNAL SENSES DO NOT PRODUCE THEIR ENJOYMENTS.

The five external senses can only perceive the impressions which are given; they are agreeably or disagreeably affected by them; but they cannot produce their enjoyments: consequently, animals are confined to the use of impressions which are presented to them. They prefer the taste of one thing to another, one odour, one colour, one sound to others, but they cannot produce the agreeable impressions. Man alone is capable of this. Man alone, in order to enjoy his smell, cultivates fields and constructs manufactories of perfume; he alone plants flowers in order to gratify both smell and vision. Man however has not conceived these ideas by his smell; for this sense is much stronger and finer in the ox, horse, and dog, which do not cultivate any flower-gardens, and which have no rose-water. In the same way animals have no cookery; and they cannot charm their eyes or ears. We shall afterwards see that man possesses these advantages on account of some superior façulties which produce these enjoyments, while the external senses only perceive them.

IMMEDIATE AND MEDIATE FUNCTIONS.

Still another common consideration of the external senses is relative to the nature of their functions. These are immediate or mediate, that is, every external sense perceives one particular kind of impressions, and excites, by means of its organization alone, one kind of sensation. This sensation is then the immediate function of every sense. The external senses are also intermedia for the internal faculties; and all functions of the external senses, which are necessary to the accomplishment of the functions of the internal faculties, are *mediate*. The immediate perceptions depend on the external senses; but in the mediate functions the five senses are only auxiliary, and they merely contribute to the acquisition of the determinate ideas, which are conceived by internal faculties.

EVERY SENSE HAS ONLY ONE KIND OF PERCEPTION.

Finally, it is certain that every sense produces only one kind of function. I cannot enough repeat this axiom, that no organ can manifest two kinds of function, or that two kinds of perception never take place in one organ. Therefore, as soon as I observe that the same conception may be manifested by several senses, I am certain that the conception belongs to some internal faculty, which makes use of different external intermedia in order to act upon the external world. The conception of form, for instance, is performed by an internal faculty, but this internal faculty may examine the determinate forms by means of touch or sight. After having considered the generalities of the five senses, let us consider their particularities.

ON THE PARTICULARITIES OF THE FIVE EXTERNAL SENSES.

The external senses are destined to bring man and animals into communication with the external world. By means of two senses we are acquainted with external bodies, if they touch immediately the sentient organs. This is the case with touch and taste. The other senses perceive remote bodies. I do not say, that perception or sensation can take place in any sense which is not affected by some immediate impression. This is an indispensable condition. It is certainly different when I say, we are acquainted with remote bodies and their qualities, or we perceive, without impression. This latter phrase would be contradictory and absurd. We perceive remote bodies either by some particles which are detached from them, and carried to our sentient organ as to the olfactory nerve, or by some intermedia as by light and air. In both cases, it is certain that man and animals are acquainted with remote bodies and their qualities.

In general only five external senses are spoken of.

But it is necessary to speak with more precision. Therefore I separate the expression, sensation in general, from the determinate sensation of hunger and thirst; from voluntary motion to which voice belongs; and from the sense of feeling; as well as from touch. I consider the word sensation as quite a general expression. Every consciousness or perception of any impression, whether external or internal, is sensation. Hunger and thirst constitute a particular class of sensations, attached to particular nerves; moreover, voluntary motion ought not to be confounded with the sense of touch as is generally done. It seems to me that the nerves of motion and feeling are quite different. In the descriptive anatomical part, I have already mentioned the reasons which induce me to think so.

Finally, touch must be distinguished from feeling. Touch is the effect of some internal faculty, which makes use of the nerves of motion and feeling, in order to be acquainted with some quality of an external body. Feeling is properly the external sense, of which I here speak.

On Feeling in particular.

OF THE PREROGATIVES ATTRIBUTED TO THE SENSE OF FEELING.

It is often observed that without touch man would not have any consciousness of the external world. It is said that man moves and finds limits and resistance to his motion, and that therefore he is advertised of some external existence. But our eyes are limited, as well as our desire to move; consequently it would be possible to perceive the external world by sight, as well as by touch. Moreover, the sentient power does not reside in the external bodies, but in the mind. Now I cannot conceive why the sentient being should not be acquainted with the impressions which happen upon it indistinctly, as well as with those impressions which are made upon it only at the moment when it endeavours to act, and is prevented from it. In both cases there are only external impressions. And for what reason does the sentient being, which has no consciousness of the external world, make any motion? Why do insects and many animals act as soon as they are born? The young tortoise and young duck, scarcely hatched, run toward the water without ever having touched it. How do they distinguish water from solid bodies? How can young birds be acquainted by touch with the branches upon which they sit down, at the first time they leave their nest?

All observations, and nature itself, are against this philosophical opinion. Two things are here to be observed. First, man and animals are from nature much more disposed to transfer their internal sensations, relative to the external objects, into the outward world, than to concentrate external nature within themselves. We see and hear from without, at least it seems so to us. The young child, without any instruction, turns his head towards the place whence come the sound and light, which make impressions upon his ears and eyes. The afflux of blood toward the optic nerves makes us see flames from without, and toward the auditory nerves it makes us hear the sound of bells. In dreaming we see landscapes, persons, coaches, we hear music, we walk in the parks, we see and fear enemies, and a thousand similar things. Madmen hear heavenly choirs, and see angels; visionaries consider their internal sensations as realities, they distinguish the figures of their genii &c. All these and similar phenomena take place inwardly, but they are transferred by the mind into the external world.

It is also to be observed, that the faculty of separating the external impressions, consequently the external world, from the internal sentient power, cannot be attributed to any external sense; this faculty is much superior, and is internal as well as the faculty which says, I feel, hence I am. It is quite another thing to perceive any impression and to know this faculty, and to reflect about it. This internal faculty of knowing the existence of external objects acts by means of all the external senses; and the sense of touch has, in this respect, no preference. Tracy * has very well demonstrated that the sense of touch has not the prerogative of producing the idea of the external world. He says, the nerves are only agitated by different impressions. This is the case in respect to the auditory, optic, and olfactory nerves, as well as in respect to the feeling nerves. Consequently for what reason should touch alone excite the idea of some external cause?

The second prerogative, attributed by Buffon, Condillac, Cuvier, Dumas, and others to the sense of touch is, that it alone produces the ideas of space, dimensions, extent, distance, figure, number, motion, and rest. But it is only necessary to examine the functions of animals in order to prove that this assertion is incorrect. Animals which acquire no, or at most a very defective, instruction by their touch, judge however of distance, figure, and plurality. If the swallow and bat catch flying insects with incredible swiftness, do they not measure the distance? When young birds leave their nest for the first time, do they run with their heads against houses and trees, instead of sitting down upon some branch? Do we observe that young animals, which have not yet left their native place, run away indifferently in perceiving an enemy far off, or near them? Animals which are born with imperfect eyes, or blind, can neither see external objects, nor measure distance; but those which are born with perfect eyes see immediately, and measure exactly, distance, figure, motion, and plurality; for instance,

* Ideologie, Tom. i. p. 114.

the young partridge, quail, and duck, avoid from birth every object which lies in their way. Therefore it is evident that the sense of touch has not the prerogative of producing the ideas of extent, distance, form, and motion. Locke has already demonstrated this truth; and it is certain that not only touch and vision, but also hearing and smell may excite the ideas of distance, direction, motion, and plurality. Animals turn toward the wind, and judge of the direction whence impressions come.

The observation that the ideas of extent, form, distance, motion, and plurality, are excited by different senses, is an evident proof to me that none of these ideas can be attributed immediately to any external sense. For I have already mentioned, that I consider it as an axiom that no special faculty shows its manifestations by means of two or several organs, but that the manifestations of every special faculty are attached to some particular organ. My reasoning is also confirmed by facts and direct proofs. The faculties of knowing and measuring space in general, of distinguishing distance, forms, number, motion, and rest, are not in proportion to the five external senses to which they are attributed, either in animals or in man. Moreover, these faculties, which are internal, act and produce respective sensations without being excited by the sense of seeing or touch; for instance, in birds which migrate; in dogs and pigeons which find again the ancient places to which they are attached, without being acquainted with the interjacent objects; in birds which build their nests conformable to those of their parents without having been instructed: and these faculties act from within without any external excitation of touch or sight. Finally, the physiology of the brain shows particular organs for these faculties, and proves that the manifestations of these faculties are in proportion to their respective internal organs; consequently these faculties must be separated from the functions of the external senses, and attributed to particular internal organs.

The third prerogative, attributed to the sense of touch is, that it is the surest sense, and that it rectifies and corrects the other senses. In treating of the external senses in general, I have demonstrated that no sense acquires its faculty by another sense, but that every sense has its faculty from nature by itself; that every sense is subjected to its particular laws; and that its functions are perfect or imperfect according to its proper organization. Thus it follows from this consideration that touch does not rectify the errors of the other senses in the organization, that it produces not the faculties of the other senses. Indeed it is easy to prove by the healthy and diseased state, that the sense of touch is not surer than any other sense, and does not rectify the other senses any more than these rectify the sense of touch.

If we cross two fingers, and touch a round body, for instance, a pebble, a pea, we seem to feel two bodies. If we place a thin flexible paper between the forefinger and thumb of any person, he will not feel it. In different diseases, the patients think that they receive impressions from without, they feel warm, hot, cold, various pains, some itching &c., in the same way as they hear voices which are produced by some internal cause. Those who reflect on these considerations, combined with those I have made above in respect to the rectification of the different senses, will be convinced that the sense of touch is not surer than any other sense, and does not rectify the other senses any more than these rectify the sense of touch.

Many physiologists and philosophers have maintained that the sense of touch produces a great number of instinctive labours in animals, and has invented the mechanical arts in mankind. But in treating of the origin of the moral sentiments and intellectual faculties, I have proved that they are not at all the result of the external senses or of muscular motion; and that the muscles and external senses are only instruments given by nature in order to perform different functions which are dictated by internal faculties. I have shown that the instruments are confounded with the internal faculties. Indeed if we examine the instinctive labours of animals, and the mechanical arts of man, we shall observe that they are not in proportion either to the acuteness of touch, or to the perfection of the external instruments. Those who recollect all the proofs, which I have mentioned above, will be convinced with me that the ancient doctrine of Anaxagoras, that the hand of man is the cause of his understanding, falls to the ground. It will be evident that the wisdom of Solomon, Solon, Plato, all the master-pieces of Homer, Euclid, Raphael, and others, are not at all the result of their hands; and that the surprising instincts of animals are not the effect of their antennæ, of their feet, teeth, probosces, or tails.

It must however be allowed that the external instruments cannot be in contradiction with the internal faculties, though they are not in proportion to them; and that the internal faculties perform their functions with more facility and more perfection, if the external instruments are more perfect. Therefore the hand of man, which is divided into several moveable parts, capable of changing its form at every moment, and of surrounding closely the surface of external bodies, is more fit for appreciating their tactile qualities, than the feet of birds invested with scales, or the feet of quadrupeds covered with a horny substance. But it is always certain that the external instruments are not the cause of the internal faculties.

From these considerations it follows, that the sense of touch has no prerogative superior to the other senses. It manifests its particular functions, and assists different internal faculties as well as the other senses. It is also necessary to consider the question, whether the feeling of man is more acute than that of animals? This opinion is generally believed, because the skin of man is destitute of hair, and only covered with a thin epidermis, while the hair of quadrupeds, and the feathers of birds, diminish their feeling. But there are animals destitute of hair, as the elephant, the Turkish dog, snails &c.

and their feeling is very acute. Other animals, though covered with hair, as the horse, dog &c. feel immediately the insects which sit down upon their hair. Finally, it is even impossible to conclude that, because the skin is covered with hair, the feeling is less acute. Sometimes in diseases, the hairy scalp of man grows extremely sensible, and the least touch of the hair produces great pain: the epidermis at the anterior part of our fingers is the thickest, however the feeling of these parts is considered as the most acute. Consequently the feeling nerves of animals, though covered with hair, might be more sensible than other nerves which are destitute of hair; and it is not obvious that the feeling of man is more acute than that of animals.

It is still to be asked, whether feeling produces the ideas of consistency, of hardness, softness, of solidity, and fluidity, of weight, and resistance? I think it does not. For in order to examine these qualities of external bodies, the mind employs the muscular system rather than the sense of feeling properly so called. There is also no proportion between the faculty of measuring these qualities of external bodies, and the sense of feeling or the muscular system. Moreover, the sense of feeling may be lost, but if the muscular power remain, we may perceive the weight and consistency of external bodies. Hence muscles are necessary in order to measure the qualities of external bodies just mentioned, but feeling does not contribute to it. Now the muscular functions are excited by internal causes, therefore the ideas of weight, resistance, and consistency of external bodies, are the result of some internal faculty. I make once for all the general observation that, as soon as any function is the result of the active state of any external sense, we may be sure that the faculty, which conceive the ideas, is internal. For the same reason we have seen above, that the faculties which conceive the extent and size, the form and number, of external bodies, are internal. In this manner it is also conceivable how the internal faculties make use of different external senses if it be possible, and how sometimes they can only make use of such or such external intermedium. The mind, for instance, wishes to move the body from one place to another, this can only be done by means of the muscular system; the mind wishes to perceive music, this also can only be done by means of the auditory nerve; but the mind wishes to perceive the size or form of a body, this may then be done by the sense of sight or feeling. Notwithstanding these modifications, it remains always certain that every reaction of the mind upon external bodies is grounded upon some internal faculty, while the sensations, which result from the passive state of the five external senses, constitute their immediate sphere of activity?

Now which are the immediate functions of the sense of feeling? The sense of feeling is the most extensive, and is continued even over the intestinal canal. It produces the most general perceptions of pain and pleasure, and the sensations of temperature, and those of dryness and moisture. All other functions are only mediate. Even the ideas of roughness and smoothness belong to some internal faculty; namely, to that of form. In respect to the mediate functions, the sense of feeling may be called touch, and its sphere of activity is very considerable and important; it is principally combined with voluntary motion, and these two kinds of nerves then may assist all internal functions, both the moral sentiments and intellectual faculties. Therefore it is evident why the connexion of the nerves of motion and feeling, with the organs of the moral sentiments and intellectual faculties, is the most intimate. For it is a principle conceivable by itself, and proved by experience, that the five external senses are in connexion with the cerebral organs which they assist; and as the nerves of motion and feeling may assist all internal faculties, they also are connected with all the internal organs, in the same way as the nerves of motion are connected with the nerves of feeling.

ON THE SENSE OF TASTE.

Taste is the second sense by means of which man and animals are acquainted with external bodies, if they touch immediately the sentient organ. After feeling, this sense seems to be the most general and the most indispensable in living beings which take their food with consciousness. It seems also that this sense is active very early in life. The fifth pair of nerves, several branches of which are distributed to the papillæ of the membrane, which covers the palate, the velum pendulum, the pharynx, and chiefly the tongue, is much developed in new-born children, in the same way as are the nerves of motion and feeling.

It is a common opinion that the acuteness of the taste depends not only on the nervous papillæ of the tongue, but also on its flexibility, softness, and moisture. Ackermann, who derives the perfection of the human mind from the acuteness of the five senses, asserts that the nerves of taste are proportionately more considerable in man than in animals; that the tongue of man is the most flexible and soft, and that his nervous papillæ are covered with the finest skin. However in many animals, as in dogs, monkies &c. the skin of the tongue is as thin and fine, and the structure as flexible, as in that of man. As to the mobility of the tongue it has less relation to the taste than to the function of speech. The principal requisite of an acute taste is certainly the largeness of the gustatory nerves, and of the surface which they supply; but, in this respect, many animals surpass man. In many animals, the lingual nerve, as well as the whole of the fifth pair, is much larger than in man; the nervous papillæ of the tongue are more numerous, and their apices more extensive. Though the tongue of several animals is covered with a rougher skin, these animals distinguish and select certain plants which are conformable to their taste, and reject other vegetables which are contrary to it. Moreover, if it be considered that eating procures to animals the most exquisite and permanent pleasure; that a great number of animals, while awake, pass almost all their time either in eating or in ruminating, it will be difficult to deny that the taste of many animals is more perfect than that of man. Hence if any one expect more considerable intellectual faculties from a more perfect organization of the organ of taste, he ought at least to show that such animals as the dog, horse, ox &c. have employed those intellectual faculties to perfect the methods of gratifying that sense.

We cannot adopt the opinion of those naturalists who maintain that the taste of birds is very obtuse. It seems at least that this is not generally the case. Blumenbach has shown that the organ of taste is large, and the sense very exquisite in ducks. For this reason a great number of birds do not swallow their food suddenly. The titmouse, for example, laps it. The greater number of birds which live upon insects, grains, and berries, crush and bruise them. If you present to the canary-bird, to the bulfinch, nightingale &c. different sorts of food, each of them will choose that sort of food which is the most agreeable to it. If we present ant's eggs to young nightingales, many of them will rather die of hunger than use them, because they are unacquainted with that sort of food; if we put these eggs into their bill they commonly throw them away, but if we break the eggs they swallow them with the greatest avidity. Hence it is evident that their taste is very fine. Even the birds which swallow their food suddenly, as the cock, hen, pigeon &c. distinguish different berries and seeds by touching them with the extremity of their bill. If we mix the seed of vetches with that of robinia caragana, pigeons and hens will take them indiscriminately in their bills, but they will throw away the latter. These kinds of birds prefer therefore, like others, one sort of food. If we tame storks and accustom them to catch with their bills rats and mice thrown to them, they throw them several times in the air, and catch them every time; then crush and swallow them greedily. But if we fling at them a toad they catch it, and they throw it away immediately. They eagerly eat bees and great flies; but if they catch any insect with which they are displeased, they throw it also away. It is the same with swallows, and all birds which live upon insects.

These observations render it improbable that every insoluble body is insipid, or that every body, in order to affect the organ of taste, must be soluble in the mucus which covers the tongue. In many physiological writings, the axiom of chemistry, *corpora non agunt nisi soluta,* is applied to the organ of taste. " The tongue," says Richerand, " is covered by a mucous, whitish, yellow, or bilious slime. This covering, more or less thick, prevents the immediate contact of sapid particles, and we have only a false idea of tastes. All aliments seem bitter if a bilious disposition exist, or insipid if there be a superabundance of mucus." But it seems that the tongue may perceive many spirituous, oleaginous, or other impressions produced by seeds and insects, without being dissolved and mixed with the mucus which covers the tongue.

Dumeril, Professor of Physiology at Paris, maintains (in an essay on the smell of fishes) that fishes are destitute of the sense of taste, which, according to him, is replaced by the sense of smell. Fishes, says he, have not the hypoglossal nerve, and the continual pressure of the lingual nerve by the water must blunt the sensibility of the tongue. In the supposition that fishes are destitute of the hypoglossal nerve, it does not follow that they have no taste. For the hypoglossal serves only for the motion of the tongue, while a branch of the fifth pair, which exists also in fishes, is the organ of taste. The tongues of many fishes are covered with numerous nervous papillæ, and the anterior part of their tongue is even moveable, flexible and soft. Hence there is no anatomical reason to deny taste to fishes. It is in consequence of their possessing this sense that fishes are taken with bait. On the other hand, if the pressure of water blunt the taste, why should not the same pressure blunt also their smell? But pressure produces no such effect; for some persons walk during the greatest part of their lives, yet the soles of their feet do not lose their sensibility. In short, it seems that this opinion of Dumeril is more remarkable for singularity than for any foundation in anatomical and physiological observation.

The lower animals also must have the nerves of taste. Insects, for example, prefer different food; but their gustatory nerves have not yet been discovered. Neither in man nor in animals can taste be considered as an infallible guide to the wholesomeness of the thing which is tasted. Repugnant aliments may be wholesome, while others which are eaten with pleasure act sometimes like poison upon the stomach, or upon the intestines. The taste of patients is often an indication conformable to the nature of their disease; but no reasonable physician will have an unbounded confidence in it. The sense of taste, however, has necessarily the most intimate relation to the whole system of digestion and nutrition. I have already mentioned that the sense of taste is modified in different kinds of animals, and in different individuals of the same kind, even in different ages, and in the healthy or diseased state. As the organ of taste is the first developed, so it seems to be the last which loses its activity. Old persons commonly esteem good food which is also necessary for them. When their sight is extremely weak, when they are almost deaf, when their skin is wrinkled, stiff, and almost insensible, they drink and eat as heartily and with as much pleasure as their grand-children.

The sphere of activity of this sense is confined to the sensations of taste; that is, it perceives only impressions of savour. *Mediately*, it gives assistance to nutrition. The nerves of taste have the most intimate connexion with the nerves necessary to the motion of the jaws, with the nerve of the organ of voice, and with the glossopharyngeal nerve. It is also known that the organs on which these nerves are expanded exert the greatest influence upon one another.

ON THE SENSE OF SMELL.

By means of smell the external world begins to act upon man and animals from a distance. Odorous particles are here detached from bodies, and inform man and animals of the existence of the bodies to which they belong. Several physiologists consider smell as a completion of taste, that is, as a finer and higher degree of taste. But the olfactory nerve constitutes a particular system. It is the explorer and the guide of the sense of taste. This sense must exist in lower animals as in insects, because they are attracted by odorous objects, yet their olfactory nerve has not yet been discovered.

Dumeril, according to whom fishes have no taste, thinks that their smell is its substitute; and in order to support his opinion, he maintains that odoriferous particles cannot be transmitted by water. We have already seen that the organ of taste exists in fishes, and it is not probable that nature has produced any organic apparatus without an object. It is besides strange to maintain that odoriferous particles cannot be transmitted by water, as fish and craw-fish are taken by bait.

It is remarkable that this sense does not exist in cetaceous animals which occupy so high a place in the scale of being. Dumeril thinks also that their taste takes the place of the sense of smell. It is generally admitted that many animals excel man in respect to the acuteness of smell. Their whole olfactory apparatus is larger. It is the same in the most stupid as in the most skilful animals—in the ox and hog, as in the horse and dog. It is known that the subtile smell of hogs and dogs serves to detect certain roots, truffles, for instance, which are buried in the earth. These animals are led to the place where the truffles are suspected to be, and they burrow into the earth in which the truffles are concealed.

Cuvier maintains that the olfactory nerve is larger in carnivorous than in herbivorous animals. But there is no relation between the acuteness of smell, and the instinct of eating flesh or vegetables. Man who is omnivorous, and the sea-calf which lives only upon fish, have both very small olfactory nerves. The fish, turtle, mole, sheep, ox, horse &c., however different their food is, have proportionally a larger olfactory nerve than the wolf, dog, tiger &c. Comparative anatomy therefore opposes Cuvier's opinion. Comparative physiology proves also the contrary. Herbivorous animals take many hundreds of plants for food, while carnivorous animals live commonly upon a smaller number of animals. In order therefore to distinguish their food, the organ of smell in herbivorous animals must be larger than that of carnivorous. Moreover, if nature endowed carnivorous animals with a very acute smell in order to trace and find out emanations from animals destined to be their prey, it is improbable that nature should have refused to the weak victim the advantage of an acute smell, in order to detect its enemies and to escape them.

Odoriferous impressions act powerfully upon the brain. This circumstance induces us to apply to these nerves stimuli, which are proper to revive sensibility when life is suspended, as in cases of weakness and suffocation or asphyxia. I have already shown that this sense does not produce the surprising faculty possessed by different animals, of finding their dwellings at a very great distance. It remains to be determined what is the sphere of activity of this sense. The immediate functions of smell consist in perceiving the odoriferous particles of external bodies, and in informing man and animals of the existence of their aliments. All its other functions are mediate. It assists the faculty which conceives the existence of external bodies; it indicates to animals the proximity of friends and enemies; and it leads those which live solitary to their companions, when they are commanded to propagate their species.

It seems that the olfactory nerve has a greater connexion with the anterior lobes and with the convolutions of the brain, which are situated sideward and outward. This sense assists chiefly the knowing faculty of individuals. The nose is also near the mouth, certainly on account of their necessary relation one to another.

ON THE SENSE OF HEARING.

Hearing is the second sense which makes man and animals acquainted with remote objects, and it is the first sense which perceives external objects by an intermedium, namely the air. The auditory nerve is found from man down to the cuttle-fish, below which the organ of hearing has not been distinguished, though several animals, lower in the scale of gradation, are not destitute of this sense. The auditory apparatus becomes more complex in proportion as animals are more perfect. This is the case with the external and internal ear. Except Ackermann, all physiologists know that many animals surpass man in the faculty of hearing. Ackermann, who derives the superiority of human understanding only from the external senses, asserts that the hearing of man is the most perfect on account of the cochlea of his ear, which, according to Ackermann, is the most essential part, and wanting in animals. But the assertion of Ackermann may be refuted anatomically and physiologically. First, it is certain that the hearing apparatus is more perfect in many animals than in men. The external ear is larger and moveable in many animals, so that it can be moved in all directions and opposed to the soniferous undulations. The muscles destined to this function are large and strong in animals. Moreover, the hearing apparatus of many animals presents large cavities, which increase the sonorous vibrations, and which cannot be confounded with the mastoid process of man; they are sometimes empty; in other animals they are divided into a greater or less number of compartments; in the ox they are composed of many concentric partitions. The auditory nerve is also much larger in many animals, as in the ox, horse, stag, sheep &c. than in man; also the cochlea does not only exist in many animals, but it is even more perfect in many animals than in man. Hence, it is anatomically proved, that the hearing apparatus is larger and more perfect in many animals than in man. The same may be demonstrated *physiologically*. In observing the functions of animals, we may convince ourselves that many animals perceive sounds which are imperceptible to man. It therefore must be admitted that many animals surpass man in the sense of hearing.

In new-born children, this sense is not yet active, but it improves by degrees and in proportion as its respective organ is developed. In the same way the auditory power decreases in proportion as the vigour of the hearing apparatus decreases. Several authors maintain that the deafness of old persons depends on the blunted sensibility of the auditory nerve; they think that the repeated impressions exhaust sensibility. It is true, sensibility is blunted and exhausted by too great activity; but in the ordinary state of health, I think that hardness of hearing in old persons depends on the decrease of the auditory apparatus. In young and sound persons the auditory nerve is expanded in a humour that occupies the cavities of the internal ear, in old persons this humour diminishes at the same time that the nerve itself decreases. Therefore Pinel, who during the severe winter of 1798, at the hospital Salpetriere, caused the skulls of several women to be opened, who died at an advanced age and had lost their hearing for several years, found the cavities of the internal ear perfectly empty, while they were filled with a cake of ice in younger persons who had possessed the faculty of hearing.

With regard to the immediate functions of the sense of hearing, it is confined to the perception of sounds; but it assists a great number of internal faculties, which are commonly attributed to it. It is, for instance, a quite common opinion that this sense produces music and the faculty of speaking, but I have already refuted this error. I have shown that hearing produces neither the one nor the other of these faculties, but that hearing is only a means of executing or putting in action these two faculties. It is conceivable that in different beings the sense of hearing must be modified, and in relation to the internal faculties which act by it; in the same way as also the external objects are calculated for the internal faculties, or the internal faculties for the external objects; in the same way as, for instance, the laws of vibrations, though they exist without, in the external vibrating objects, must be conformable to the laws of the internal faculty of tone; or in the same way as the relations of size, of number, of succession, which exist in the outward world, are calculated for their respective internal faculties. Hence, hearing is only a means of communication for the internal faculties of speaking and music.

There are yet other internal faculties which act upon the outward world by means of hearing. All these internal faculties therefore were commonly attributed to the sense of hearing. In this respect I must consider an error which formerly was very common, and in which even Kant and Herder participated, namely that it is impossible to communicate any abstract notion to the deaf and dumb. Le Cat says, that deaf persons are more unfortunate than the blind, because many truths are heard, and very few are seen. Herder, thought that a deaf and dumb person imitates all he sees done, whether good or evil. All the erroneous opinions relative to deaf and dumb persons result partly from the common error that our notions and sensations are produced by the external senses, and that nothing exists in the mind but what comes by the five senses, and partly from the error that the arbitrary vocal language produces sensations and ideas. But it is certain that all internal faculties may exist without hearing, consequently, that deaf persons in whom the sense of hearing alone is wanting, may manifest all other faculties. They are only destitute of this means of communication, and they are obliged to make use of some other means. Therefore they speak, that is, communicate their sensations and ideas by gestures.

The sense of hearing principally assists the moral sentiments, as well as the faculties of space, of individuality, of tune, of speaking, and thereby all intellectual faculties and sentiments. The auditory nerve has a nearer connexion with the organs of the moral sentiments than with those of the intellectual faculties; it embraces the nervous bundle of the cerebellum, and is connected with the vocal nerves. Therefore the voice, as natural language, is more energetic in sentiments than in intellectual faculties.

2

ON THE SENSE OF SIGHT.

This is the second sense which informs man and animals of remote objects by means of an intermedium—light. Those who attribute the perfection of the intellectual faculties of man to the perfection of his senses maintain also that man has a more perfect vision than animals. They consider this perfection of sight as resulting from the more distinct manner in which man sees objects, and they ascribe this peculiarity first to the exact coincidence of the refraction and reflection of the rays of light; then to the transparency of the diaphanous parts of the eyes of man, to the irritability of the iris, and to the position of the crystalline lens. Richerand even believes that the pigmentum nigrum must impede and disturb the distinctness of vision; and that perhaps on this account animals have false and exagerated ideas of the power of man. Experience answers these errors. The iris of many animals is very moveable, and they see both in the day and at night. In general if similar reasoning were true, the falcon would not perceive the heron at a distance at which the heron is imperceptible to the eye of man; the eagle hovering in the air would not perceive a mouse on the earth; the turkey-cock would not recognize a falcon or other birds of prey, and warn the individuals around it, when it is impossible for man to distinguish the enemy; and tigers and other fierce animals would not attack man. It must therefore be allowed that many animals have the sense of sight more acute than man.

No sense has more occupied physiologists and philosophers, than the senses of sight and touch; but the greatest number of errors are also relative to these two senses. Many erroneous opinions have been, and are still, maintained in respect to vision. It has been said that this sense acquires its faculty either by touch or by habit. But I have already proved in speaking of the generalities of the five external senses, that no sense acquires its faculty, neither from another sense, nor from habit. Vision depends on the organization of the eye; it is weak, energetic, perfect or imperfect, according to its organization. Some animals come into the world with perfect eyes, and these animals see perfectly from the beginning. The butterfly and honey-bee fly at the first attempt through fields and flowery meadows; the young partridge and chicken run through stubbles and corn, as soon as they have left the shell; while other animals, which are born blind, distinguish size, shape, and distance of bodies by slow degrees. This latter is also the case with new-born children. I cannot insist enough that every sense has its own laws, and that its functions depend on the healthy and perfect sfate of the respective organization. We see in the looking glass ourselves and other objects enlarged, diminished, lengthened, shortened, multiplied, near, distant &c., according to the laws of the refraction of the rays of light.

It is also maintained, that without the sense of touch, the eyes would see all objects in a reversed situation, and double; and that all objects would seem to be in the eyes, because the objects are painted on the retina. The reversed impressions of the objects in the eyes really exist, but, as Berkley and Condillac have elucidated, the objects are not painted on the retina; the retina is only agitated by the impressions of light. However, the difficulty why we see the objects upright is not resolved. I formerly spoke of the internal faculty which makes us acquainted with the external world. I then showed that man is more disposed to transfer all internal sensations and ideas, which are relative to external bodies, into the outward world, than to concentrate external impressions inwardly. According to a law of nature, the impressions of the five senses are not only transferred into the external world, but even to the place and distance whence they come. If animals take wind they do not look for the received impressions in an opposite direction. We think that the sonorous body is in the direction from whence come the vibrations of the air. In the same manner, the impressions of light are referred to the place from whence they come. Consequently, the impressions of light which come from above are referred upwards, and those which come from below are referred downwards, and the object is seen in its right position.

Nobody recollects to have seen in his infancy any object reversed, and natural history does not show any example of this sort in animals. According to these philosophical absurdities, young birds ought to take the root of a tree for its top. It is to be observed in general, that natural philosophers and physiologists, in examining the five external senses, have entirely forgot animals in restraining their reasoning only to man. I have already spoken of single vision, although the impressions are double, in treating of the generalities of the external senses. I have also spoken of the possibility of distinguishing distance by means of the eyes, and I have shown that animals are unable to measure exactly the distance between themselves and external bodies, only when their eyes are imperfect. Thus the apparatus of seeing possesses its proper faculty; the manifestations of this faculty depend on the state of the respective organization; and vision is subjected to its invariable laws, in the same way as every other sense has its own laws. A straight stick plunged in water must appear crooked. If a vessel is filled with water, we see a stone or other body at the bottom, which we cannot see in the same situation if the vessel be empty. The deepest philosopher and the most learned man, notwithstanding all contrary conviction, see their pictures behind the looking-glass, like parrots, monkies and children. We see our persons reversed in the bottom of a spoon which we keep upright, and our right hand appears on the left side, and the left hand on the right side; but in a conic looking-glass which is convex in the circumference and concave from the basis to the top, we see our persons also reversed, but the right side opposite to our right side, and the left side opposite to the left, as in an ordinary plain looking-glass. We know that in two rows of trees the last trees are as far distant one from another as the nearest, however the distance of the two rows appears narrower at the farther end. A square tower at a great distance appears round; and very large trees which are distant do not appear larger than small bushes which are near. All these and similar judgments are unavoidable and accord with the laws of optics.

Those who reproach the sense of sight with the errors we have refuted support their assertions by the experiments observed by Cheselden upon persons blind born. First, in the description of the experiment made by Cheselden, there is no mention of a double or reversed vision during the first moments after the operation. Le Cat said, therefore, that these persons were acquainted by touch with the situation of the bodies, consequently their mind could not so easily be misled by sight. But we ask why was not their soul acquainted with the size and shape of the bodies? On the other hand, their soul was informed by touch, that the bodies were not applied to the surface of our body, however it appeared so to their eyes. This was the case even with the blind-born individual who underwent the second operation twelve months after the first; consequently he was acquainted by the other eye with external bodies, with their size and shape; yet neither his touch nor his sound eye were sufficient to persuade his other eye that pictures were not elevated bodies.

Diderot has very well answered this reproach made against sight. Pictures, says he, produced the same effect upon savages when they perceived them for the first time. They took paintings for living persons, spoke to them, and were much astonished that they did not give any answer. We ought to consider, continues Diderot, that vision cannot be perfect before the organization is perfect. The humours of the eye must be cleared, the iris must be conveniently dilatable, the retina neither too little nor too much sensible; the whole eye-ball must be fit for exerting all the particularities necessary to vision. He also said very well: sight is not necessary in order to be sure by touch that any figure exists; why should touch be necessary to sight in order to be sure by sight that the same thing exists?

The sphere of activity of the immediate functions of sight is confined to the perception of light. All its other functions are mediate. I have already demonstrated that the eyes do not produce the art of painting; this faculty is internal and only assisted by the eyes. These also may assist all the other external senses, all the moral sentiments, and all the intellectual faculties, and principally the latter of these. The connexion of the optic nerve with the other parts of the brain also shows that sight assists chiefly the posterior, lateral, and anterior organs of the brain.

It results from all I have said of the five external senses, that their spheres of immediate activity are very limited; that feeling perceives only dryness, moisture and temperature; that taste perceives savours; smell odours; the ears sound; and the eyes light: hence, that all the other functions are only mediate, that is, the internal faculties by means of the external senses perceive the different impressions, and conceive the peculiar ideas; they are acquainted with the existence of the external bodies and their qualities, and they act again upon the external world, by means of the external senses and voluntary motion.

A fact mentioned by Darwin * proves that the five senses are only intermedia, and that their actions must be propagated to internal operations. An old man who suffered a stroke of palsy preserved hearing and vision perfect, but he could call up a train of ideas only from the latter. When he was told it was nine o'clock and time for him to eat his breakfast, he repeated the words distinctly but without understanding them. But if his servant put a watch into his hand, he said Why, William, have I not my breakfast? On almost every occasion, his servants conversed with him by visible objects although his hearing was perfect.

* Zoonomia, 3d Edit. vol. iv. p. 295.

ON THE INTERNAL ORGANS OF THE MIND.

Before I examine the special faculties of the mind and their particular organs, I shall answer a question which may be put with respect to every organ, *viz.*, *Why do you admit a particular organ for this, and not for another function?* In speaking of actions alone, it is difficult to conceive the necessity of such or such organ. The answer however is decisive if we can say, Experience demonstrates it. But, as I look for special faculties and their organs, the necessity of every organ may be demonstrated even by reasoning, that is, by the proofs which demonstrate the plurality of the organs. Consider these proofs in respect to every organ, and it is impossible to be mistaken. Consequently, it is necessary to point out a particular organ for every faculty,

1. Which exists in one kind of animals and not in another:

2. Which varies in both sexes of the same species:

3. Which is not proportionate to the other faculties of the same individual:

4. Which does not manifest itself simultaneously with the other faculties, that is, which appears or disappears earlier or later than the other faculties:

5. Which may act or rest alone:

6. Which alone is propagated in a distinct manner from parents to children: and

7. Which alone may preserve its proper state of health or disease.

Gall did not determine any organ in conformity with this reasoning. He followed only the empirical method, that is, he looked for organs according to the active functions of man.

ORDER I.—Feelings.

Genus I.—*Propensities.*

I. ORGAN OF AMATIVENESS,* *(physical love.)*

Dr. Gall did not originally think that there was an organ of this propensity in the brain. He discovered its existence by chance. Being physician to a widow who was subject to very strong hysterical fits, during which she drew her head backward with great violence, Gall sometimes supported her head with his hand, and observed that her neck was very large and hot. He was acquainted with her character, and knew that she was extremely fond of sensual pleasure. Gall considered this magnitude of her neck, the consequent developement of her cerebellum, and her excessive passion for physical love; and he was naturally led to inquire, whether there might not be some relation between the magnitude of the cerebellum and this particular propensity. Indeed it is impossible to unite a greater

* The reasons which have induced the author to make new names, and to choose the termination *iveness*, for his nomenclature of the propensities, are mentioned in the Preface, to which the reader is referred.

number of proofs to demonstrate any natural truth, than may be presented to determine the function of this organ.

First, none of the causes which are commonly admitted is sufficient to explain the existence of physical love. The sexual parts, or the testes and uterus in particular cannot produce it; for many children manifest this propensity before their testes secrete. Besides, many eunuchs, although deprived of their testes, preserve this propensity. In the same manner, there are women entirely destitute of the uterus, who yet manifest this inclination. Therefore, certain adversaries of our doctrine maintain that the semen is contained in the blood, and that it may produce the desire of sexual intercourse. In this case, the semen should also be contained in the food we take. Such objections are against all physiological knowledge, and scarcely deserve to be noticed. It is also said that the prostatic fluid produces this propensity. But sometimes in old persons the secretion of the prostate gland is very copious, and we do not in them observe that this mean produces the inclination in question. Let us now consider the relation between this propensity and the cerebellum.

Organised beings which are propagated without copulation, as by buds, by slips, or by cuts, have neither brain nor cerebellum. But those animals which present a nervous mass corresponding to the cerebellum generate by copulation. This observation alone, if it could be verified in all natural beings, would be sufficient to prove the existence of this organ. Yet this is impossible: some animals are too small to admit of any demonstration of this kind from dissection.

In new-born children, the cerebellum is to the brain as one to nine, to ten, to thirteen, twenty and more; and in adults as one to five, six, or seven. Professor Ackermann maintains that the cerebellum is perfectly developed at the end of two years. But we have compared the heads and skulls of children of two, three, four, six, eight, ten, till sixteen years of age, and we have always seen that the cerebellum is not yet perfectly developed at these ages. In proportion as the cerebellum is developed this propensity appears. It has been said that the cerebellum is developed in proportion as this propensity is active, but other proofs show evidently that the developement of the cerebellum always precedes the manifestation of this faculty. In adult persons, the cerebellum is perfectly developed, and then this propensity exists in its greatest energy. The activity is even proportionate to the particular developement of the cerebellum. It is known that men vary in respect to this propensity. In some individuals, this propensity is almost wanting; in others it is moderate; in others again it is very violent. In the first the cerebellum is very small (*Pl.* VI. *fig.* 2. I.); in the second it is of a middling size; and in the third class it is very prominent.—(*Pl.* VI. *fig.* 1. I.) We have met with different persons confined in prisons for the crime of bestiality, rapes, and unnatural crimes, and we have found that their neck was large and prominent.

Farmers and breeders of cattle have for a long time past made the observation, that stallions, rams and bulls, which have a large neck, have a more energetic power of propagation. It is also known that vigorous pigeons are distinguished by the size of their necks.

It is indubitable that men and male animals (*Pl.* VIII. *fig.* 1. & 3. I.), in general, have a larger cerebellum than women (*Pl.* VII. *fig.* 1. I.) and females.—(*Pl.* VIII. *fig.* 2. I.). Now it is known that men and males, in general, have a greater desire of venery than women and female animals.* In many kinds of animals, one male has many females, but females never live in polyandry. A great number of male animals are disposed to love at every moment, while their females are restricted to certain periods. Even among animals which live in family, males are generally more amorous than females. It is not, however, a law that the cerebella of males are uniformly larger than those of females. There are exceptions; and more of these in mankind than in animals. If women have a stronger propensity, their cerebella are also larger.

It has been objected that the brain, in general, is larger in men than in women, and that consequently it is not astonishing that the cerebella of men are also larger than those of women. But many individuals have large brains and small cerebella, and *vice versâ*. Consequently there is no proportion between the brain and the cerebellum; and the propensity to physical love is never in proportion to

* In venere exercenda longe minorem quam vir voluptatem mulier percipit, vir vero etiam diuturniorem. HIPP. De Geniturâ.

the size of the brain, but always to that of the cerebellum.

In order to distinguish externally the developement of the cerebellum by the shape and size of the neck, it is necessary to be acquainted with the different structure of the cerebellum in mammiferous animals and in birds. The cerebella of birds are single, and are similar to the vermiform process of the cerebella of quadrupeds, which present lateral parts in addition to the vermiform process. It even seems that the configuration of the cerebellum is, in every kind of animals, relative to their instinct of propagation. For both sexes of the same kind are more attached one to another than to the sexes of other kinds of animals. The manifestations of this propensity in man and animals are disordered only when this faculty is too energetic.

In erotic madness, the cerebellum has often acquired a large developement, but it cannot be maintained that all madmen, with an erotic delirium, have a large cerebellum; for the cerebellum may become diseased as well as every other organic part. The mutual influence of the cerebellum upon the genital parts, and of these upon the cerebellum, proves also the destination of the cerebellum. Castration produces some influence upon the developement of the cerebellum. In castrated animals and men, the cerebellum ceases to increase. Therefore animals which have been castrated when young, and eunuchs who have suffered the operation before the cerebellum was developed, have a narrow neck, a small cerebellum, and no propensity to sexual intercourse. Oxen and horses, for instance, which are castrated when young, have a small neck in comparison to bulls and stallions. On the other hand, if animals and men are castrated when the cerebellum is developed, they feel this propensity still after the operation, and this is an evident proof that physical love does not result from the testes.

At the age of maturity, the mutual influence of the genital parts and the neck is most considerable. The beard grows, the voice suffers great changes, because the larynx is much developed; and the developement of these, of the genital parts, and of the cerebellum, is always simultaneous.* Animals, at rutting time, have the neck swollen and warmer than at other times, and the voice hoarse. This intimate and direct influence of these parts upon each other was known, but till the present time inexplicable. For the same reason it seems that castration produces also certain changes in the skulls of animals, and in the excrescences of their skulls, as in their horns. Oxen have greater horns than bulls. If the testes of stags be injured, their horns are of a defective growth; they are crooked, spongy, and present various excrescences. Moreover, if the horns of stags be sawed off some time before the rutting season, they less certainly propagate their species. However there are examples where, although their horns were sawed off, yet their generative functions being stimulated by good food, deers have engendered.

* Non illam nutrix orienti huc revisens
Hesterno collum potuit circumdare filo. CATUL.

If the cerebellum or neck be wounded, the genital parts are affected by sympathy. Gall attended two officers, at Vienna, who were wounded in the neck, and became impotent. One of them departed, and was no more heard of; the other, after two years, recovered the procreative power and had children. Formey, at Berlin, informed us, that a man being wounded in the neck an inflammation of the genital parts and a priapism followed, and the person remained impotent for six months. Baron Larrey, at Paris, showed us several individuals who had been wounded in the neck, and whose genital parts had diminished in size. A soldier, for example, was wounded in the neck at the age of seventeen years. His testes and penis withered and diminished in size. This person remained without a beard, and preserved the voice of a girl. In ancient times it was a common opinion that the seminal fluid is secreted in the cerebellum, and that it descends along the spinal marrow. Therefore it is said in the apocryphal work of Hippocrates, "De Genitura," iii. sub fine: *Quibuscunque juxta aures venæ sectæ sunt, hi coëunt quidem et genituram emittunt, verum modicam et debilem ac infœcundam. Nam plurima genituræ pars a capite juxta aures in spinalem medullam procedit.* In another book, Hippocrates says: *Atque mihi sane videntur ea medicatione seipsos perdere. Venæ enim retro aures sunt, quas siquis secet, sterilitatem inferat his quibus secantur; quare id etiam ipsis ex earum incisione accidere certum est. Quando igitur postea uxores adeunt, impotentesque se factos vident, cum illis coire* *primum quidem nihil molestius cogitantes quiescunt* (*Scythæ*).*

Schoell cites a passage of Apollonius Rhodius, in which, speaking of the love of Medea, he says: "The flame which consumes her pervades all her nerves, and is felt even behind the head in that place where pain is the strongest when extreme love takes possession of all the senses." † Professor Reinhold, at Leipzig, put a seton in the neck of a boy who suffered by an ophthalmia. A continual priapism was the result of it, and Reinhold was obliged to take away the seton. In mumps the patients are often subjected to different affections of their genital parts. Strangulated persons commonly suffer erections and emissions. There are several examples in which menstruation has been re-established by a blister on the neck. Spirituous frictions on the neck in hysterical fits are very useful. In erotic delirium, the genital parts are often inflamed, but this inflammation is only secondary and sympathetic. The inflammation of the cerebellum and brain is primitive, and requires the necessary remedies. The lascivious fury of man and stallions has been cured by castration, but it is better to cure this disease by some treatment applied to the inflammation of the cerebellum. In such cases, topical remedies applied to the genital parts are almost entirely useless; but the inflammation of the genital parts and priapism disappear if the inflammation of the cerebellum be removed by bleeding behind the ears. All these

* Lib. de acribus Aquis et Locis, Sect. 1.

† Histoire Abregée de la Litterature Grecque, vol. i. p. 99.

observations relative to the mutual influence between the neck and the genital parts demonstrate the function of the cerebellum.

In lunatic hospitals, there are often idiots who have lost all their intellectual faculties, or whose intellectual functions are very weak, while they manifest an irresistible erotic desire. Their state of idiotism is commonly attributed to self-pollution. It cannot be denied that the abuse of venery, and a too frequent loss of semen, weakens extremely the intellectual faculties; but the greater number of these individuals are given up to their vice by weakness, or want of the superior faculties: they are more or less idiots from birth. Their masturbation is the consequence of their imbecility and not the cause. These unfortunate creatures have the neck and the posterior part of the head large and much developed, while the fore and superior part of their heads is narrow and small. Therefore these persons are not susceptible of superior motives. They are given up to their dominant propensities like other animals. It is the same with certain Cretins who are given up to Onanism. In these individuals, the developement of the brain is very defective, while that of the cerebellum is often very considerable. But it is an error to maintain that all Cretins have large genital parts, and a great propensity to physical love. In many of them, the cerebellum and the genital parts present a great developement, and they are very lascivious. But we have also seen many others who, though grown-up, do not feel the least excitement of the genital parts, and do not manifest any propensity of this kind. These individuals do not present the large developement of the neck and cerebellum, which, even from infancy, is observed in the former. Many idiots and hydrocephalic persons are lascivious without presenting an extraordinary developement of the cerebellum and genital parts. This may easily be explained. The cerebellum constitutes a particular system, consequently the functions of the brain may be deranged or suppressed, while the cerebellum, which is secured by the tentorium, performs its function. Such individuals follow their inclination, because all opposite motives, as honour, shame, and other principles of a higher order which direct reasoning persons, are wanting. In these unhappy beings, the ordinary developement of the cerebellum acts unresisted and irresistibly.

Even the position of the cerebellum proves its destination. After hunger and thirst, no propensity is more necessary than that of propagating the species. This function is the most common in animals after nutrition, and the cerebellum is in the inferior part of the head. Hence it is probable that it is destined to the propensity of propagating.

Finally, the mimickry of this propensity proves that its organ is situated downward and backward in the head. I shall in future treat of this matter with more detail. Then I shall demonstrate that the gestures and manifestations, which accompany the different internal propensities and sentiments, are modified according to the position of the organs, by means of which the faculties manifest themselves.

Even now, however, I may remark that when this propensity is active, the head and body are drawn backward. In many birds and quadrupeds, the males tickle the necks of their females in order to excite this instinct. Many persons carry their arms and hands involuntarily behind the neck during the erotic state. Many artists, in their paintings and statues of man and animals, have thus presented different modifications of the mimickry of this propensity. Thus if we consider together all the facts which I have quoted to prove that the cerebellum is the organ of physical love, it is impossible to doubt of the determination of this organ. It is objected that it is impossible to admit in animals an organ of the instinct of propagation, because their erotic instinct is restrained to determinate periods. This difficulty will be the same whatever may be the cause of this instinct, for instance, the genital parts or the blood. Besides, it is certain that organs may exist without being active and producing their functions; for example, the mammæ of women do not always secrete milk, yet they exist continually. The cerebellum may be excited at different periods in the same way as other organs are more or less active at different times. We have no observations to decide whether the size of the cerebellum increases like that of the testes at the rutting period, or whether it is only more excited. We know positively that the necks of bitches are warmer at this period than at other times.

It is also objected that it is not necessary to admit an organ of propagation in the brain, because there are other distinct organs of propagation; and it is added that plants also are propagated without any brain. The first part of this objection is refuted by the observation already mentioned, that this instinct may exist without the genital parts, and that there is no proportion between the propensity and the power of satisfying it. In the comparison of animals with plants, the reproduction of the species, or propagation itself, is confounded with the propensity to do so. In plants this action is only an organic or vegetative function, a simple fructification; while in animals there is, besides the organic function, a certain propensity, and it is for this propensity that there exists a particular organ in the brain. In order to elucidate this matter very clearly, I shall compare the reproduction of individuals, and the preservation of the species, in plants and animals. For these two kinds of functions are common to both.

Nutrition exists in plants and animals. In plants it is automatic. Plants take food, their roots are directed toward it, but they do not feel the want of taking food as animals which are hungry and thirsty. Consequently animals must possess some organic apparatus which apprises them of the necessity of taking aliments. Besides animals distinguish their food, and prefer one kind to another with consciousness. Hence in animals there are three kinds of organs which contribute to their nutrition: the digestive and assimilating organs, the organs which produce the feeling of hunger and thirst, and the organ which distinguishes and chooses the aliments.

It is the same with the reproduction of the species. Plants are propagated by germs in an automatic way. In animals there are also organic apparatus relative to the automatic functions of propagation, for instance, the testes and the uterus. But there is still some organic apparatus which is necessary to the manifestation of the propensity. Finally, coition takes place with consciousness, and an organic apparatus produces the perception of pleasure in the exercise of this function.

It is to be observed that the different organs destined to the whole of any function have a mutual influence; for example, hunger excites taste, taste excites hunger, and both excite the digestive power, and this again excites hunger and taste. In the same way, the propensity to propagation excites the secretion of semen; this function excites the propensity to physical love; both have an influence upon the organ which perceives the act of coition; and the irritation of this latter organ excites the secretory organ and that which produces desire. Notwithstanding this mutual influence there is no direct and constant proportion between the particular parts necessary to the whole of one and the same kind of function. For example, the digestive power is not always in a direct proportion with appetite and the taste, and *vice versâ*. In the same way, the propensity to coition is not always proportionate to the secretion of semen, or to the state of the genital parts. I have already stated the same principle in respect to the external senses, the muscles and the internal faculties. One part has an influence upon others, but there is no proportion between the external intermedia and the internal faculties.

According to these considerations, it may easily be conceived how the abuses of physical love are possible. They are explained in the same manner as those of hunger and thirst. Food is taken in order to replace the lost parts; but the desire of eating and taste are sometimes more active than is necessary for the preservation of the individual: they sometimes excite men and animals to take what is even unwholesome. Hence gluttony and drunkenness. These abuses are, beyond doubt, the result of the organs of hunger and taste, but shall we say that the organs which contribute to the preservation of the individual are organs of gluttony and drunkenness? Certainly not. It is the same with the erotic propensity. This propensity is destined to the preservation of the species. This preservation, as I said before, results from several functions together. Now if the organ which produces the propensity to propagation, and the organ which is sensitive during coition, are more active than is necessary for the preservation of the species, or more than circumstances permit, or greatly exceeds the productive power, there result abuses.

Thus, according to all I have said, it seems to me that this organ and its special faculty are fairly established. I think the object of this propensity is to contribute to the preservation of the species. Its abuses are masturbation, pederasty, tribady, bestiality, adultery, and incest. The want of this propensity produces passive chastity, continency, and celibacy. It remains to be examined what name must be given to this propensity. Gall, as I observed, not knowing any special faculty of the mind, considered the actions of man, and, in general, named the organs according to those actions, which he observed proportionate to the organs. He called this the organ of sexual love or of propagation. Certainly it is impossible to choose a name according to any abuse of an organ; and as there is no organ of gluttony and drunkenness, there can be none of libertinism or adultery. Moreover, I hink that the name cannot be chosen according to the object of the faculty, nor according to any function. For it frequently happens that several organs contribute to one action, as I have ascertained in respect to nutrition and propagation. It seems to me that every organ must be called according to its special faculty. As we do not say, nerves of nutrition, but nerves of hunger and thirst, so we cannot say organ of propagation, because the name must only express the propensity. I propose the name AMATIVENESS.

In order accurately to observe and to substantiate the organs in general, it is necessary to know their places. This particular organ is situated in the neck. Discover the mastoid process behind the ear, and the protuberance of the occipital spine above the middle of the neck, the space between these two elevations indicates the extent of this organ. Consider then its size in all dimensions, and compare its developement and the propensity to erotic actions.

II. ORGAN OF PHILOPROGENITIVENESS, *(love of progeny.)*

I shall endeavour to prove by reasoning, according to the method mentioned above, that it is necessary to admit a particular organ of philoprogenitiveness: I shall afterwards state the circumstances which led to its discovery. In some kinds of animals neither male nor female take care of their progeny; the eggs are resigned to chance, and to some external influence: this is the case with insects, reptiles and fishes. Even among birds, the cuckoo gives a striking example of it. This bird has a great propensity to physical love, but it neither builds a nest, nor hatches its eggs: it deposites its eggs in the nests of other little birds which live on insects, placing only one egg in any individual nest; and the other birds hatch and nourish the young cuckoo with particular attachment. In some other kinds of animals, the females alone take care of their progeny. Bulls, stallions, dogs, cocks &c. are indifferent about their young; while the cow, mare, bitch, hen &c. are extremely attached to them. In other animals again, the males and females form an attachment for life, and both sexes take care of their progeny; this instinct however is more energetic in the females. The fox, which so much resembles the dog, differs from him in this respect. The fox is attached to its female for life, and partakes of the same cares with her; and if the female be killed he seeks for food for his young ones. Philoprogenitiveness, however, is stronger in the female than in the male; for, if they be pursued, the male leaves the young ones sooner than the female. Many birds are paired, and both males and females take care of the young. These differences are constant: does not each of them, even on the slightest consideration, seem to require peculiar organization?

In the human race, this propensity is, in general, stronger in women than in men. This difference is not only perceptible between fathers and mothers, but also between the sexes in general. A male servant seldom takes care of children as well as a woman. Besides this difference is not only sensible in grown-up people, but even in children. Present to children playthings indiscriminately, boys will choose horses, whips, drums &c.; girls, on the contrary, will prefer dolls, cradles, ribbons &c.

In every species of animals, which take care of their progeny, there are some females which do not feel this propensity, while certain males of these kinds excel in this inclination. Even certain women consider children as a heavy burden, others as their greatest treasure and happiness. This is not only the case among wretched persons, but indiscriminately among rich and poor, among persons of good and bad breeding. In general all the proofs which have been adduced of the plurality of the organs may be applied to the organ of philoprogenitiveness in particular. Therefore its existence is necessary.

Dr. Gall observed a distinct protuberance on the posterior part of the skulls of women (*Pl.* VII. *fig.* 1. II.); and in comparing the skulls of his collection, he found a similar elevation on the skulls of children and on those of monkies. Consequently it was necessary to point out a faculty common to all of them. During five years he was occasionally occupied with this consideration. He thought for some time, that it might indicate the greater irritability of women and children; but this supposition he did not long entertain, because irritability is a common quality of every organ. He was in the habit of suggesting his difficulty, relative to this protuberance, to his auditors; and a clergyman, who attended him, observed that monkies have much attachment to their progeny. Gall examined this idea. In fine, he found that this protuberance, which is situated immediately above that of physical love or amativeness, and corresponds with the general protuberance of the occiput, is the organ of philoprogenitiveness. The developement of this cerebral part always coincides with the energy of this propensity. Species, sexes, individuals, which are endowed with a great deal of maternal love, have this organ much developed. In women and females, this organ is, in general, larger. Gall possesses the skull of a woman who, being sick, had the confirmed notion of being pregnant with five children. The corresponding organ in her is extremely developed. There are nations which excel in this propensity, and the developement of the respective organ is proportionate. Negroes manifest this propensity in an eminent degree, and this organ is much developed in them. These are facts which every one may verify.

It is objected that love of children is the result of moral sentiments, of self-love, or of the desire of suckling, and not at all of a particular propensity. These causes, so commonly admitted, cannot produce love of offspring; for in many animals which love their progeny these causes do not exist. No animal, below man, has any idea of duty or religious sentiment: birds do not give suck, yet they love their young. This is also the case with men and males in general. Many mothers do not give suck, and yet they love their children much. Moreover, in mothers there is no proportion between moral or religious sentiments, and philoprogenitiveness. Consequently we must admit a particular organ for this propensity.

I have already mentioned that in mankind, and in those species of animals where females take care of the progeny, certain individuals are quite indifferent to their progeny.—(*Pl.* VII. *fig.* 2. II). In mankind this phenomenon must be considered as an indirect cause conducive to infanticide. We have examined the shape of the head in twenty-nine women who were infanticides. Twenty-five of them had the organ of philoprogenitiveness very small. The want of this organ does not excite a mother to destroy her child, but a mother destitute of this propensity is less able to resist those external circumstances which provoke her to commit this crime. Such a mother will not resist as much as she would have done if her mind had been influenced by the powerful energy of philoprogenitiveness.

The aim of this faculty is obvious—care of the progeny; its activity may be too energetic, and do harm to children in spoiling them; and if it be very small there must follow indifference about progeny. The protuberance which indicates the developement of this organ, placed in the posterior lobes of the brain, is commonly single, although the organ is double, that is, one on each side. It is single when the posterior lobes of the brain are very near to each other, and double when the posterior lobes are somewhat separate. This difference of form is common to all organs situated in the mesial plane of the head.

By this and the preceding organ, it is very easy to distinguish the skulls of males and females of the same kind, and consequently those of men and women. It is peculiarly worthy of notice that throughout all animals a striking similarity is preserved in the skulls of both sexes. The skulls of men and males are generally shorter and larger, those of women and females longer and narrower.

III. ORGAN OF INHABITIVENESS.

Dr. Gall observed in animals which have a great propensity to elevated stations, as in the chamois and wild goat, a protuberance which he identifies with the organ that in mankind produces pride and haughtiness.—(*Pl.* IX. *fig.* 1. X). I think that the instinct to assume physical height, and the sentiment of self-love, cannot be ascribed to the same organ. First, it is certain and must be conceded, that animals which dwell upon mountains, or which are fond of high regions, have one part of their brain more developed than the varieties of the same kinds which live in low countries or in plains. This difference is sensible, for instance, in roes, hares, rats &c. One variety of rat lives in canals, cellars, and the lower parts of houses; another dwells in corn-lofts, and in the higher parts of the houses. The difference of their organization is very sensible. But it seems to me that this does not authorize the supposition that this faculty, which leads animals to elevated stations, is essentially the same with that which makes man proud and haughty.

Dr. Gall thinks that the place where both organs are situated, *viz.* the organ of self-love in man, and the instinct to physical height in animals, is in the same place in the head. Moreover, he says that this faculty is not the only one which, although physical in animals, is somewhat moral in man. He quotes the physical love of animals which grows moral and Platonic in mankind. He supports also his opinion by the natural expressions by which the sentiment of pride is manifested, that is, the mimickry of this faculty is allied with physical elevation. From the earliest infancy proud children are pleased with mounting upon chairs in order to be on a level with adult persons. Adults of little stature often do the same in order to gratify their self-love. Proud persons keep their body upright, their gait is haughty. In general all expressions of pride and superiority are combined with some physical elevation. Kings and emperors sit upon elevated thrones &c. Is it then surprising that the same organ presides over physical and moral elevations, if there be so many relations between them? Such is the reasoning of Gall.

It seems to me that these proofs are insufficient to demonstrate the identity of these two faculties, *viz.* of that which leads animals to physical elevation, and that which gives to man the sentiment of self-love and pride. I draw my proofs from anatomy and physiology. Anatomically I maintain that the place of an organ does not prove any thing as soon as animals of different kinds are spoken of. For if different animals are endowed with different faculties, their organs, although different, may occupy corresponding places of the head. Let us suppose three kinds of animals whose faculties are quite different: their organs fill up the skull; yet it is impossible to maintain that their faculties are the same because the same number of places on the head are conspicuous. It is true, if animals possess the same faculty with man, the respective organ is situated in man and animals in the same part of the head. Now to me it does not even seem that the place of the protuberance, which indicates that animals like physical height, corresponds with that of man, which produces self-love and pride. In animals this protuberance immediately follows the organ of philoprogenitiveness, but the corresponding cerebral part in man is unknown.—(*Pl.* IX. *fig*. 1 & 2. III.) Consequently, the comparison of the places of both faculties is rather against than for the assertion of Gall.

The physiological proofs stated above do not seem more to be relied on. Gall says that different faculties which are merely physical in animals become moral in man. He supports his assertion by the example of physical love. I think that no faculty, in so far as it is physical in animals, changes its nature in man by itself, but that all physical faculties common to man and animals preserve their nature in man: consequently, the faculty of physical love, according to my opinion, is always in itself the same. But it is obvious that this propensity may be accompanied by other sentiments. Indeed it is so accompanied not only in man, but also in animals. We may observe that many males prefer one female to another, and many females show a similar preference. This is evident in birds and quadrupeds. Sometimes the bull is particularly attached to one individual amongst a herd of cows. I saw canary-birds which could not live with certain individuals, and though separated they remained attached to their former mates. Moreover, if the organ of physical love alone be active in man, it acts always without morality, for instance, in hydrocephalic persons and idiots from birth. The physical love of these individuals entirely resembles that of animals in general: consequently, all that which is moral in physical love depends on other faculties which may accompany this propensity. And indeed it is observed that man and animals modify the manifestation of this propensity, in proportion as they are endowed with other faculties. If a man or an animal be prone to attachment and physical love together, both faculties will act together, and physical love will be modified by attachment, and attachment by physical love.

It is replied, that Platonic love finishes ordinarily by physical love. I agree with this; but is it possible to conclude that Platonic love is the same as physical love? I am not hungry because I have a taste or smell. But if smell be stimulated by any odour, and if thereby the sense of taste and the feeling of hunger be excited, and independently of my first intention I eat, will it be maintained that smell and the desire to eat are the same? If you examine Platonic or moral love, you will find that all the sentiments which you feel at the same time with the propensity to physical love, may be attributed to the other special faculties and their respective organs. In the same manner it seems to me, that it is impossible to confound the instinct of physical height, with the moral sentiment of self-love and pride: I believe it possible to have a great opinion of one's own person in all regions and countries.

Finally, the expressions or external manifestations of haughty persons, for instance, their mounting upon chairs in order to be higher and greater; this behaviour of children in order to be on a level with adult persons; the haughty gait of proud persons &c. do not at all prove the identity of both mentioned organs. Examine what kind of proud children mount upon chairs and tables in order to show their height. I am sure that they are children to whom certain things have been interdicted because they are still little, or, in general, children who have observed the advantages of grown-up persons, or in whose presence adult age has been praised. Say to such individuals that those who are placed at the head of the company, or at its lower part, occupy those places by way of distinction, and they will endeavour to occupy the place which is praised. All other external manifestations of proud persons are explained according to the general principle of mimickry, which shows that our gait and all the motions of the body in general, and of the head in particular, are conformable to the seat of the organ which is active. The organ of pride is situated upwards and backwards; hence all motions of pride take place in this direction.

Thus, I separate the instinct which carries animals to physical elevation from the sentiment which produces self-love and pride, and I seek for two different organs. It is denied that animals which like elevated situations, are led there by an internal instinct which is attached to some particular organ. It is said that these animals go to these places in order to look for their food. But these animals sometimes like situations where there is no food: for instance, the chamois and wild goat dwell upon the tops of rocks which are entirely barren. They are obliged to descend into the middle regions in order to find their food. There are still other animals which like the higher regions of the air, and which seek their food upon the earth. Eagles and hawks hover high in the air, and catch mice upon the ground. Does the lark need to ascend into the air in order to sing? In treating of the innateness of all the faculties, I have shown that it is very unphilosophical to attribute the origin of any faculty of man or animals to external wants, though it is necessary to allow that external wants excite internal innate faculties. Consequently, we must admit some particular propensity which leads animals into higher regions.

In examining the habits and manners of living of different animals, it is obvious, that different kinds of animals are attached to some particular region and country. Nature which intended that all regions and countries should be inhabited, assigned to all animals their dwelling, and gave to every kind of animal its respective propensity to some particular region. If we place any animal in another region, it leaves it and returns to its natural dwelling. Some animals seek the water from the first moment of their existence, for example, turtles and ducks. As soon as they are hatched they run towards the water; other young animals stay upon dry land. Some of these like high regions, some the low countries and plains, and others the marshes. Among the inhabitants of the air, some species live in the higher and others in the lower regions. The power of flying does not produce the instinct of hovering in the high regions of the air, for many kinds of animals, although their power of flying is great, are destitute of this instinct. Some birds build their nests on the top of trees, some in the middle parts, and others in holes of trees, on the earth, or on the banks of rivers &c.

According to all these considerations, it seems to me that there is a particular faculty, and a special organ, which determines the dwelling of animals. But it is difficult to point out the seat of this organ. First, it is impossible to compare in this respect land and water animals, because both orders must have some organ of their particular instinct. It is with this organ, as with the senses of smell and taste in carnivorous and herbivorous animals. Both orders possess these two senses, but they are modified. So it is with the propensity of inhabitiveness. It must exist in land and water animals. Consequently, it is necessary to compare only different varieties of animals which inhabit the same element or region, and chiefly individuals which excel in this respect. This organ must be verified in the same way as every other organ. This propensity is common to the greatest number of animals, hence its organ must be deep-seated in the brain, and must be looked for in the region of the other propensities; while self-love is a sentiment, and its organ occupies a higher place in the head.

IV. ORGAN OF ADHESIVENESS.

Friendship has long been considered as the result of reflection, as the consequence of some analogy between the faculties, or as an effect of mutual interest. But it is necessary to admit some particular instinct, which produces different manifestations of attachment in animals in whom no moral argument, nor any interest, can take place. This seems to be evident from certain examples among dogs. All dogs are not susceptible of the same degree of attachment, though their external treatment ought to exite it: some dogs, on the contrary, are attached in opposition to their interest. Sometimes they are ill-treated, and yet they remain attached to their master. Moreover, there is something involuntary in this sentiment. Its manifestations are too early and too sudden to result from any reflection. Even criminals have sometimes a great degree of attachment to their accomplices. Some among them have been known to destroy themselves rather than denounce their companions. A highway-man confined in the prison of Lichtenstein, near Vienna, hanged himself in the prison that he might not be forced to betray his accomplices.

These considerations prove the necessity of some organ of attachment. It is difficult however to point out its seat in man. The actions in men are not sufficiently free, but are sometimes only embellished by the appearance of this sentiment. Gall seldom speaks of it. He examined the head of a woman at Vienna, who was known as a model of friendship. She suffered different changes of fortune; she became alternately rich and poor; but was always attached to her former friends. Gall found the part of her head situated upward and outward from the organ of philoprogenitiveness, very prominent, and called it the organ of friendship. Our observations are not multiplied enough to enable us to decide positively on this organ; yet its seat seems to me more than probable. It must be inferiorly, because this faculty exists in the lower animals and is a propensity. For this reason it belongs to their region of the head; and according to its mimical signs and the motions of the head when it is active, it lies laterally and backward.—(*Pl.* IX. *fig.* 1 & 2. IV.)

Now what is the special faculty of this organ? In considering the actions of man and animals, it may be observed that there is a great difference between different species, and even between different individuals of the same kind, in respect to attachment. Suppose animals have a propensity to physical love, they like their progeny, and have a determinate dwelling. Then we see that in several kinds of animals, males and females are attached one to another, and live domestically. This, for example, is the case with the fox and with many birds. The fox, which resembles the dog in so many circumstances, lives with its female, while the dog lives in polygamy, like the cock, bull and stallion. Without some particular attachment, males and females would leave one another as soon as the instinct of physical love was satisfied, but nature by another instinct prevented this separation. There is still another modification of attachment, that is, society, in which individuals of one kind are attached one to another and live together, while other animals live isolated. Here it is to be observed that the instinct of being attached for life, and that of living in society, are not mere degrees of energy, so that a lower degree produces attachment for life, and a higher degree of society. For there are animals which live in society without being attached for life, as the bull, dog, cock &c.; others live in society and in family, as starlings, raven, crows &c.; others again are attached for life without living in society, as the fox, magpie &c. Consequently, the instinct of living in society, and that of living in family, are modifications of their proper nature, in the same way as smell and taste are modified in carnivorous and herbivorous animals. Man belongs to the animals which are social and attached for life. It results that society and marriage are not at all the effect of human reflection, but of original nature.

It seems to me that this special faculty extends its sphere of activity still farther, and that it gives us attachment to all around us, to inanimate beings, plants, animals and man, in short to all that we possess, whether animate or inanimate. It produces also the sentiment of habitude. Friendship consequently is only a part of this faculty. If attachment for life belong to some portion of this organ, it must be the nearest to the organ of philoprogenitiveness. According to all preceding considerations, it seems to me that the name adhesiveness or attachment denotes this special faculty, which presents several modifications, and its objects are friendship, marriage, society, and attachment in general. Abuse results from its too great energy in nostalgia, or in regretting too much the loss of a friend &c. Without attachment men become anchorites and hermits.

V. ORGAN OF COMBATIVENESS.

I have mentioned above, that Dr. Gall, having called together boys from the streets, made them fight each other: there were some who liked it much, and others who, on the contrary, were peaceable and timid. In the former, that part of the head which corresponds to the posterior inferior angle of the parietal bone, behind the mastoid process was prominent (*Pl.* IX. *fig.* 1. V.), and in the latter the same place was flat or depressed.—(*Pl.* IX. *fig.* 2. V.) The prominence was also found in the heads of brave and valiant officers, of quarrelsome students, of duellists, and of those whose greatest pleasure consisted in fighting and making themselves feared. Gall therefore at first called this organ that of courage. Considering afterwards that it is possible for a man to have courage to do any thing of which he thinks himself capable, for instance, to dance, play on an instrument, or sing, when he may possess no propensity to fight, he called this the organ of quarrelsomeness. At present he calls it the organ of self-defence.

This propensity is active in different degrees, not only in mankind but also in different species of animals. There are animals which never fight; others are fond of it. Rabbits, for instance, are more courageous than hares. Even individuals of the same kind differ entirely with respect to this faculty. One dog incessantly looks for an opportunity of fighting, another always flies away. The courageous animals have the head between and behind the ears very large.—(*Pl.* X. *fig*. 1 & 3. V.) This is an unfailing sign to distinguish or recognize, if a horse be shy and timid (*Pl.* X. *fig*. 4. V.), or bold and sure.—(*Pl.* X. *fig*. 3. V.) The same difference is observed in game cocks and game hens, in comparison with the domestic cock. Horse-jockies, and those who are fond of fighting cocks, long ago made the same observation.

It is objected that this propensity is the result of bodily strength. But there are several species which, though weak, like much to fight, while others, though large and strong, avoid all fighting. You may find striking examples in dogs: the fighting cock is less than the dunghill-cock: hares are stronger than rabbits, but less courageous. Among men, and even among delicate women, you find individuals who are very weak, but intrepid and courageous, while tall and robust individuals are sometimes destitute of this propensity.

The desire of fighting is necessary to animals as soon as they are attached to females, to progeny, to dwellings, or to friends; for, according to the arrangement of nature, it is necessary to fight in order to defend. Consequently, this propensity must exist for the purpose of defence; but it seems to me that this faculty is, like all others, general and not limited to self-defence. Therefore I call it the organ of the propensity to fight, or of combativeness. Sometimes this propensity acts with greater energy than it ought; it is charmed with combats: then it produces dispute, quarrelsomeness, attack, *viz.* abuses.

It is to be ascertained whether the want of this organ produces fear. Gall thinks so, but it appears to me, that the absence of any organ cannot produce a positive sentiment like fear. It is conceiveable that the absence of any organ may produce modifications in the manner of thinking and feeling in man; for instance, the absence of this propensity renders a character peaceable, but I imagine that in order to fear, a positive action ought to take place. Hence I think that Gall in general is wrong in speaking of negative qualities. If fear be the result of the absence of courage, I cannot conceive how it is possible to be at the same time courageous and fearful; yet this happens both in animals and mankind. We shall see afterwards that I attribute the sensations of fear and anxiety to the organ of cautiousness.

VI. ORGAN OF THE PROPENSITY TO DESTROY, OR OF DESTRUCTIVENESS.

A difference in the skulls of carnivorous and herbivorous animals gave the first idea of the existence of this organ. If we place a skull of any carnivorous animal horizontally, and trace a vertical line through the external meatus auditorius, a great portion of cerebral mass is situated behind that line. The more an animal is carnivorous, the more considerable is the portion of the cerebral mass situated there.

It is objected that it is useless to admit in the brain a particular organ of destruction, in order to determine the kind of food man and animals live upon; because nature has given to carnivorous animals the feeling of hunger, the taste, teeth, and instruments necessary for seizing and masticating their prey. These external instruments, however, prove only the harmony between the internal faculties and the external instruments. Man has hands in order to take his aliments, but some interior sensation advertises man and animals of the necessity of taking food. The tiger, lion, cat &c. have teeth and claws, but an internal power excites them to use them. A sheep could not employ such instruments any more than an idiot could employ his hands to perform things for which they might be fit, but which his reason could not direct. Thus an internal propensity must make use of the external instruments, and this propensity is attached to a particular organ.

The propensity to kill exists beyond doubt in certain animals. It is more or less energetic in animals of different species, and even in the individuals of the same kind. There are some species which do not kill more than they need for their nourishment. Other species, as the wolf, tiger, pole-cat &c. kill all living beings around them, and that seemingly for the pleasure of killing alone. One dog scarcely has this prosensity, another possesses it in a high degree. Gall had a little dog which had this propensity in so high a degree, that he would sometimes watch several hours for a mouse. As soon as it was killed he left it. Notwithstanding repeated punishment he had an irresistible propensity to kill birds. In short, there is no doubt that different animals have the propensity to kill. Is man also endowed with this faculty?

If carnivorous animals have the propensity to kill, man ought to have it also; for he is omnivorous. There is no carnivorous animal which eats so many kinds of animals as man does. Animals are confined to a certain number of species for the choice of their food, but man lives upon all, and anthropophagi even upon their fellow creatures. Man kills from the insect to the elephant and the whale, in order to apply them to his purposes. It is said that man eats flesh only from depravity of habit; but in examining the teeth of man, it is evident that they partake of the structure both of those of carnivorous and of herbivorous animals.

It is the same with the stomach of man. It differs much from the stomach of herbivorous animals, and resembles that of the carnivorous.

In man this propensity presents different degrees of activity, from a mere indifference to the pain of animals to the pleasure of seeing them killed, or even the most imperious desire to kill. This doctrine shocks sensibility, but it is not less true. Whoever endeavours to study nature and judge its phenomena ought to admit the existence of things as they are. It may be observed that in children as well as in adults, among the uncultivated as well as among the polite and well bred classes of society, certain individuals are sensible, and others indifferent, to the suffering of others. Some persons feel a pleasure in tormenting animals and in seeing them tortured or killed, even when it is impossible to ascribe this disposition to bad habit or bad education. There are some individuals who choose their profession according to this propensity, if it be very energetic. A student often shocked his school-fellows by his extraordinary pleasure in tormenting insects, birds and other animals. In order, as he pretended, to satisfy this inclination he became surgeon. A journeyman apothecary, at Vienna, felt so great a propensity to kill, that he became an executioner. The son of a rich merchant, of the same city, gave up commerce and became a butcher. A rich Dutchman paid the butchers who furnished the navy with beef, for permission to kill the oxen.

We may also determine the existence of this propensity, and its diversities, by the impressions which different spectators receive from public executions. The view of them is insupportable to some individuals and delightful to others. George Selwin sought for such spectacles, and he endeavoured always to stand near the executioner. It is also reported of La Condamine that he was fond of such spectacles, and that on his, at one time, endeavouring to pass through the crowd, as the soldiers pushed him backward, the executioner said to them, Let this gentleman pass, he is an amateur. Mr. Bruggmans, Professor at Leyden, told us of a Dutch priest who had so violent a desire to kill and to see animals killed, that he became chaplain of a regiment solely in order to have an opportunity of seeing men destroyed. The same clergyman kept in his house a great number of different domestic animals, as cats, in order to satisfy his natural propensity by killing their young ones. He also killed all the animals for the use of his kitchen. He was acquainted with the hangmen of the country, and he received notice of each execution which he travelled on foot for several days in order to witness. The executioners placed him always near them. In the field of battle we find a great difference in the energy of this propensity. One soldier is overjoyed at the sight of the blood which he sheds, while another, moved by compassion, gives uncertain blows, or at least spares the vanquished, and stops of his own accord after the victory.

There are highway-men who are not content with robbing, but who manifest the most sanguinary inclination to torment and kill without necessity.

John Rosbeck was not content with maltreating his victims in order to make them betray the places of their concealed treasures, he invented and employed the most outrageous cruelties merely to witness the sufferings of children, of women and of old persons. Neither fear nor torture could correct him. On his first being caught he was shut up for eighteen months, confined in a small subterraneous dungeon, his feet were loaded with chains, he stood in muddy water up to his ancles, and when dragged out of this place he was tortured in the most cruel way. Nevertheless he did not confess any thing. He was enlarged, and the first thing he did, when free, was to steal in full daylight. He soon committed new murders, and he was executed.* At the beginning of the last century several murders were committed in Holland, on the frontiers of the provinces of Cleves. For a long time the murderer remained unknown; but at last an old fiddler, who was accustomed to play on the violin at country weddings, was suspected in consequence of some expressions of his children. Led before the justice, he confessed thirty-four murders, and he asserted that he had committed them without any cause of enmity, and without any intention of robbing, but only because he was extremely delighted by this action. At Strasbourg two keepers of the cathedral were assassinated: for a long time the murderer remained undiscovered, but at last a postillion was killed by the shot of a pistol by a clergyman, called Frick. This monster,

* History of Schinderhaunes, t. ii. p. 8.

in order to satisfy his horrible propensity to murder, had hired a post-chaise for the express purpose of killing the postillion. He was arrested, and he confessed that he was the murderer of both keepers of the cathedral. Without changing countenance he acknowledged that when yet a student he had often engaged children to follow him into the woods, that there he had hanged them on trees, had kindled a fire under them, and destroyed them in that manner. This criminal was rich, and had never stolen. For his crimes he was burnt alive at Strasbourg. "Lewis XV." says M. de Lacretelle,* "felt a rooted aversion against a brother of the Duke of Bourbon-Condé, Count of Charolois, who would have renewed all the crimes of Nero had he occupied any throne. While yet a child he betrayed an instinct of cruelty which excited horror. He was delighted with tormenting animals, and with treating his servants violently. It is related that he liked to shed the blood of those he had debauched, and that he exercised different kinds of barbarities on the courtesans who were brought to him. Popular tradition, which corresponds with several historical relations, accuses him of different homicides. It is said that he committed murders without interest, without anger, and without vengeance. He shot at tilers in order to have the barbarous pleasure of seeing them falling from the top of the houses."

These latter facts, which fortunately are very rare, prove that this terrible propensity is sometimes quite

* Histoire de la France, t. ii. p. 59.

independent of education, of examples, of seduction, or of habit, and that it depends only on the organization. Indeed there are crimes of so high a degree, and accompanied with such repugnant and horrible circumstances, that it would be impossible to explain them in any other way. Prochaska relates * that a woman of Milan flattered little children, led them home, killed them, salted their flesh, and eat of it every day. He quotes also the example of a person who, excited by his heinous propensity, killed a traveller and a young girl, in order to eat them. Gaubius † speaks of a girl whose father was incited by a violent propensity to eat the flesh of man, and who committed several murders for this purpose. This girl, though separated from her father for a long time, and though educated carefully among respectable persons, who had no relation to her family, was overcome by the inconceivable desire of eating the flesh of man.

Some idiots manifest this propensity to kill or to destroy. An idiot, after having killed two children of his brother, came smiling and announced the action to him. Another idiot, excited by anger, murdered his brother, and intended to burn him openly and ceremoniously before the house. A third, according to Herder, after having seen a hog killed, thought he had a right to murder his fellow-creatures, and actually cut the throat of a man. We have seen in prison a young man whom nobody con-

* Opera Minora, t. ii. p. 98.

† Oratio Prima de Regimine Mentis quod Medicorum est.

sidered as silly, and who without any motive killed a child. Different questions were put to him, he was threatened with various punishments in order to obtain a knowledge of his motive. He only answered and repeated incessantly, that he saw nothing but black. "Whoever," said he with a lamentable voice, "was not present cannot believe me. God will pardon me." At Fribourg, in Brisgau, we saw a young man of fifteen years of age confined in prison because he had put fire to nine houses successively; he helped to quench the fire, and, on one occasion, he saved a child who was nearly destroyed by the flames. When the fire was extinguished, he thought no more of it. This proves that his conduct was excited only by some bestial instinct. Indeed he was half an idiot.

Certain madmen are alienated only in respect to the propensity to murder. At Berlin, Mr. Mayer, surgeon of a regiment, showed us a soldier whose body was very irritable and much weakened by the loss of his wife; he suffered every month a fit of violent convulsions; he felt their approach, and at the same time had an immoderate propensity to kill; then he begged instantly to be loaded with chains; at the end of several days the fit and the fatal propensity diminished, and he himself fixed the period when he might be delivered from his chains without any danger. At Haina we met with another person who, at certain periods, felt an irresistible desire to maltreat other persons: he knew his unfortunate propensity, and he also begged to be loaded with chains till his fit was over. A melancholy person saw the execution of a criminal. This spectacle produced in him such a violent emotion that he suddenly was seized with a propensity to kill. At the same time he preserved the strongest aversion against such a crime; he described his deplorable situation weeping bitterly, and with an extreme confusion; he struck his head, wrung his hands, exhorted himself, and cried to his friends to take care and to fly; and he thanked them if they resisted and menaced him.

Pinel has also observed in various mad persons, the fierce impulsion to destroy. He speaks of one who did not show any mark of alienation in respect to memory, imagination, and judgment, and who confessed that, in his narrow seclusion, his propensity to murder was quite involuntary and utterly irresistible; that his wife, notwithstanding his tenderness for her, was near being immolated, and that he had only time to warn her to fly. In his lucid intervals he made the same melancholy reflections, he expressed the same remorse, and he was disgusted with life to such a degree that he several times attempted to put an end to his existence. "What reason," said he, "have I to cut the throat of the overseer of the hospital who treats us with the greatest humanity? Yet in the moments of my fury I feel a desire to attack him in the same way as other persons, and to thrust a dagger into his breast." Another madman for six months in the year suffered periodical fits of fury. The patient felt the decrease of the symptoms, pointed out the periods when the danger was over, and begged those about him not to let him free if he felt an incapacity of governing his blind impulsion to destroy. He confessed, in his calm intervals, that during his fits of fury it would be impossible for him to restrain it; that if he met with anybody it appeared to him that he saw the blood circulate in the vessels of those persons, and that he felt an irresistible desire of sucking it, and of tearing their limbs with his teeth in order to suck the blood more commodiously. Pinel relates also the history of a young alienated person who every morning felt a fit of mania, during which she tore all that fell under her hands, and committed every sort of violence against all who came near her. They were obliged to restrain her by a strait jacket. In the afternoon she repented of her actions, and despaired of being pardoned. Pinel quotes another example of a monk whose understanding was alienated by devotion. He thought that he had one night seen the Virgin Mary surrounded with a choir of angels and happy spirits, and had received expressly an order to kill a certain person whom he considered as unfaithful. He would have executed his project had he not betrayed himself by different observations, on account of which he was shut up. The same author speaks also of a certain credulous vine-dresser, whose imagination was violently shaken by the sermon of a missionary. He thought himself and his family lost and damned to everlasting pains. He considered the baptism of blood, or martyrdom, as the only means of saving them. He first endeavoured to murder his wife, who with difficulty escaped; then he exercised his fury in killing quietly two of his children in order to procure to them eternal life. Confined to prison in order to be judged, he cut the throat of a criminal who was with him in the same room, always with the intention of doing some expiatory action. His alienation being proved, he was condemned to be shut up in the Bicêtre for life. Long solitary detention exalted his imagination; and because he had not been executed, he fancied himself the Almighty or, according to his own expressions, the fourth person of the Trinity, and that he was sent to save the world by the baptism of blood. He was confined for ten years, and as he was continually calm and quiet, he received permission to converse with the other convalescents in the court of the hospital. He passed four years tranquilly in this way, and his healthy state seemed to be restored, when he suddenly manifested his former superstitious and sanguinary ideas. The day before Christmas, he conceived the project of doing some expiatory sacrifice in killing all those who might fall under his hands. He consequently got a shoemaker's knife, and at the moment when the keeper went the rounds, he gave him a thrust from behind which fortunately slipped over the ribs; he cut the throats of two other madmen, and he would have continued his homicide had he not been arrested by force.

All these and many similar examples, observed in the healthy and diseased state of man, in idiots and madmen, prove evidently that the propensity to kill and destroy is innate, not only in animals but in man. Moreover, does not the whole history of mankind confirm this assertion? In all ages the earth has been drenched with blood. It is now to be examined with what view nature has created this propensity. We cannot imagine that this propensity is innate in order to murder man. Carnivorous animals are endowed with this propensity, but they do not kill other individuals of their own kind. They kill other animals in order that they themselves may live. In what then does the food of man consist? He lives on other animals, and therefore he must kill them. Thus it may be questioned whether this propensity determines the sort of food, that is, flesh? Gall thinks so; I do not. It is certain that the propensities are in relation to the whole nature of animals, and that the propensity to kill is in relation to the food of every species of animals; but the power which desires to kill is not the same as that which chooses flesh. One special faculty produces the propensity to kill, and another faculty makes choice of flesh. On this account, there is no proportion between the propensity to kill and the want of food. Some animals kill more than is necessary for their nourishment. Some persons like meat, but they cannot kill any animal; other persons have no reluctance to kill, and yet prefer vegetables for nourishment. Children, in general, have this propensity more energetic than adult persons, but they prefer fruits to meat. Hence it must be allowed that this propensity is necessary to carnivorous animals, but not that they are carnivorous because they have the propensity to kill.

It remains still to be examined what is the essential nature of this faculty? I think that the sphere of activity of this faculty is more extended than the instinct to kill. It seems to me that this faculty produces the propensity to destroy, in general, without denoting any object. Destruction may be applied to inanimate things, to animals, or to man. In this signification, it is conceivable that this faculty is necessary and destined from creation. It must certainly be granted that throughout all nature one being lives upon another, that violent death is an institution of nature, and that there are animals of prey among all orders of animals. Now if nature had created animals which ought to live upon meat without giving to them, at the same time, the instinct of killing animals, it would be contradictory and absurd. Moreover, nature has even taught carnivorous animals to kill others in the most certain and sudden way, that is, in wounding their neck at the place of decussation. Sometimes it is necessary to destroy what is useless in order to replace it by what is useful; and there are many things which are relatively hurtful, which we are provoked to destroy. In this sense it is permitted to destroy others in order to save one's self; in this sense destruction is not only permitted and exercised by justice, but it is even rewarded and considered as a virtue. On the contrary, whenever this faculty destroys what ought not to be destroyed some abuse takes place; for example, in murdering and assassinating man, or in setting fire to houses &c.

This faculty then produces the propensity to destroy, in general, without determining the object to be destroyed, or the manner of destroying it. This faculty gives the propensity to pinch, scratch, bite, cut, break, pierce, devastate, demolish, ravage, burn, massacre, strangle, butcher, suffocate, drown, kill, poison, murder, and assassinate. Gall formerly called the organ of this faculty the organ of murder, because he found it much developed in two murderers; but it is evident that a name cannot be given to any faculty according to its abuse. It is true that the organs can be discovered only when they are extremely developed; and in the highest state of developement, many faculties produce abuses. Such was the origin of this too limited term, erroneously derived from the abuse of a faculty of which the well regulated employment is, like that of all other faculties, essential to life. I think that the name organ of the propensity to destroy, or of destructiveness, is the most general and the most conformable to the sphere of activity of this faculty. We are convinced, by a great number of observations, that the seat of this organ is on the side of the head immediately above the ears. (*Pl.* IX. *fig.* 1 & 2. VI., and *Pl.* XII. *fig.* 2. VI.)

VII. ORGAN OF THE PROPENSITY TO BUILD, OR OF CONSTRUCTIVENESS.

Gall observed that those who had a particular disposition to mechanical arts presented a face of somewhat parallel form, that is, a face as large at the temples as at the cheeks; consequently that a greater disposition to mechanical arts is indicated by the developement of the brain at the temples.—(*Pl.* XIII. *fig*. 2. VII.) He found this sign in great mechanicians, architects, sculptors, and designers. The skulls of animals which build, and those of others which do not build, present a remarkable difference at the place where this organ is situated; for instance, the skulls of rabbits and of hares. It is known that rabbits build burrows, while hares, which in general resemble rabbits, lie in the field. In the beaver, marmot, field-mouse &c. this organ is distinctly expressed.

A certain skull is preserved at Rome which is said to be the skull of Raphael. There exists some doubt of its reality. Professor Schell, of Copenhagen, brought a cast of it in plaster to Gall, and asked him his opinion relative to this skull. Gall answered that three organs were very considerable: that the organ of mechanical arts was more developed than he had ever seen it before, and that the organ of imitation, and that of physical love, were very large. Gall possesses the skull of a milliner of Vienna, who had a good taste, and understood perfectly to change the forms of her merchandises. In this skull the organ in question is prominent.

Adversaries of our doctrine may ridicule a comparison between Raphael, a milliner, and a field-mouse. They may laugh at a doctrine which, as they conclude, attributes to a similar organ the sublime conceptions of Raphael, the pretty productions of a milliner, and the inartificial habitation of a field-mouse. But does not the sloth creep by means of organs similar to those by means of which the horse can gallop or the roe run? Does not the ass cry by the organs by means of which a Catalani sings? It is indeed true that this faculty alone does not produce the sublime conceptions of Raphael, but it was essential to the execution of their objects.

It seems to me that this faculty produces every thing that may be called construction. By means of it birds build nests for their young, rabbits and other animals make burrows, and the beaver its hut. I think that in mankind all propensity to construct, from the huts of savages to the palaces of kings, and the temples of God, is the result of this faculty: It produces, according to my opinion, fortifications, ships, the engines of war, of manufactures and commerce, instruments of all kinds, furniture, clothes, fashionable merchandises and toys. This faculty is essential not only to every mechanical profession, but to all that, in any way, require construction, as the arts of drawing, engraving, writing, carving, and sculpture. Lock-makers, watch-makers, joiners, cabinet-makers, turners &c. are directed by this faculty. Thus it seems to me that the propensity to construct, or constructiveness, is the special faculty of this organ, which does not however determine its object. I know a lady at Paris, who, every time when she was with child, felt the greatest propensity to build. Too large a developement of this organ might produce too great a propensity to build or an abuse. A man, for instance, might ruin his family by building, or employ this faculty for coining false money.

VIII. ORGAN OF THE PROPENSITY TO COVET, OR OF COVETIVENESS.

Certain persons have a particular propensity to steal or rob. It is known that Victor Amadeus I. King of Sardinia, took every where objects of little importance. Saurin, Pastor at Geneva, though acquainted with the best principles of reason and religion, was overcome continually by the propensity to steal. Another individual of good breeding was given up to this inclination from his infancy: he betook himself to the military service in hopes of being restrained by the severity of its discipline; but, as he continued to steal, he was in danger of being hanged. Struggling against this propensity, he studied theology and became a Capucin: his propensity followed him into the convent, but he took only little things, as candlesticks, snuffers, scissars, drinking-cups and glasses. He did not however conceal the stolen objects, but acknowledged that he had taken them home that the proprietors might have the trouble of carrying them to their houses again. A person employed by the government of Austria, and established at Presbourg, had filled two chambers with stolen furniture, but he never dared to make use of it. The wife of Gaubius, the famous physician at Leyden, had in so high a degree the propensity to steal, that, when making purchases at shops, she always endeavoured to take something away. Her husband ordered a servant to follow her, and to prevent or to compensate for her theft. The Countess M***, at Wesel, and J***, at Frankfort, manifested the same propensity. Madame de N*** had been educated with great care, her understanding and talents assured to her a distinguished place in society, but neither her breeding nor education secured her against the powerful propensity to steal. Lavater speaks of a physician who did not leave the rooms of his patients without putting something into his pocket, as keys, scissars, knives, spoons, thimbles, buckles and boxes, but he sent them back again to their owners. Moritz, in his treatise on the human mind, relates, with much detail, the history of a certain thief, whose propensity to steal was so energetic, that even when dying he stretched out his hand in order to steal the snuff-box of his confessor. Dr. Benard, physician to his Majesty the King of Bavaria, told us the history of an Alsacian who was rich, and not at all avaricious, but who had a great propensity to steal. He had been educated with great care, and sometimes severely punished on account of his stealing: his father caused him to become a soldier, and as he continued to rob he was hanged. We know the history of the son of a very learned man: he excelled his comrades at the schools; but from his earliest infancy, he stole from his parents, sisters, brothers, servants, comrades, schoolfellows and professors: all sorts of correction were useless to him; as a punishment he was given up to military service, and several times suffered severe inflictions, but all without changing his character. In all other respects, his behaviour was regular, but in this fault he was entirely indifferent to the most energetic exhortations: he looked as if he did not hear any thing, and they were obliged to confine him in prison. The chaplain of a regiment in Prussia, a man of great intelligence and ability, could not avoid stealing handkerchiefs from the officers at the parade. The commanding officer esteemed him much; but as soon as the chaplain made his appearance all cabinets, presses, and cupboards were shut up; for he had carried off handkerchiefs, towels, shirts, and even women's stockings. He, with pleasure, gave back the stolen things. We saw, at Copenhagen, a prisoner who was an incorrigible thief, but who sometimes distributed the things he had stolen among the poor. Another thief was shut up for the seventh time, who confessed that it seemed to be impossible to change his behaviour. He begged earnestly to be kept in prison, and that he might have the means of earning a livelihood. A young Calmuck, brought to Vienna by Count Stahrenberg, Ambassador of Austria at the Court of Petersburg, became melancholic, and fell into a nostalgia because his confessor, who instructed him in religion and morality, had forbidden him to steal. The confessor, a man of understanding, discovered the cause of his disease, and gave him permission to steal on condition that he would give back what he had stolen. The young Calmuck profited by this permission, and stole the watch of even his confessor during the consecration of the mass, and, leaping with joy, gave it back after the mass was over.

It would be easy to multiply examples of this kind to an almost infinite number; and they prove that the instinct of stealing is not always the effect of bad education, of poverty, idleness, or of the want of religion and moral sentiments. This truth is so evident that every one winks at a little theft committed by rich persons who have a good behaviour in other respects. These thefts are then said to be the consequences of mental abstraction. Moreover, the propensity to steal is proved by a state of disease. We knew several cases in which pregnant women felt this propensity in a high degree only during pregnancy. Certain individuals manifest the propensity to steal only if their mind be alienated. Hence it is obvious that the faculty of this propensity must be innate. We have examined the heads of a very great number of thieves; and there is no doubt that those who manifest a great propensity to steal, present one part of the brain much developed, while in other persons, who are destitute of this inclination, that part is small in proportion to the other cerebral parts.

The idea however of considering stealing as a natural propensity is so contradictory to common opinion, that it is impossible to avoid all objections to it. It may be objected that stealing presupposes the existence of property; but that property is the result of society and social convention; and consequently that stealing is not supported by any natural propensity; and that it is absurd to admit an organ of theft. In this objection there are two things to be considered; first, it must be examined whether property is not grounded upon some natural and particular instinct? In treating of the innateness of the faculties, we have seen that many actions which are considered as the effect of society, or as factitious, result from particular innate faculties. Besides, we have seen that society itself is the result of a particular instinct, and that all other faculties are combined with this propensity. It is easy to demonstrate that the sentiment of property is natural and not at all factitious: even animals possess it. Birds have their own nests; many quadrupeds their burrows and dwelling-places; and all animals defend their habitation against foreign aggression. Tame animals also know their own places in the stables: if they go out and return home, every one takes its place. Nightingales, red-breasts &c. have their districts, and drive away all other individuals of their kind, even their young ones if they have grown up. The constancy of storks and swallows is known in respect to those places of nestling of which they have taken possession. Bees and all insects fight even till death to defend their hives against intruders. Every one knows that a dog defends his bone with more courage in the house of his master, than in the house of a stranger. Sportsmen and hunters know, that in a certain district there is only a certain number of animals of the same kind, which do not permit other individuals of the same species to take possession of the same part of the country. This is the case even with certain social animals. Every herd of chamois, for instance, occupies one district, and drives away all other herds. The same takes place with man. Let us suppose two persons living in a wood: one gathers fruits which the other endeavours to eat; will not the former feel that the fruits are his? Such examples might be multiplied innumerably; they clearly prove that the sentiment of property is natural in animals and man, and that it is anterior to legislation. In animals this sentiment submits only to strength or force. Man, who is susceptible of morality and justice, determines the laws according to which a thing is property or not. Consequently, the sentiment of property has produced legislation of this kind, and not legislation the sentiment of property.

It must also be inquired whether stealing is natural, and consequently whether there is a special propensity of this kind? Our opponents maintain that such a doctrine is both ridiculous and dangerous: ridiculous, because nature could not produce any faculty absolutely hurtful to man; dangerous, because it would permit what is punished as crime by the laws. Gall was accustomed to answer: nobody can deny the facts which prove that theft exists; and as it exists, it was not against the will of the Creator: this propensity is also more or less energetic in different thieves, and there are very few persons who have never stolen any thing. The organ is moreover very considerable in inveterate thieves. I allow that God cannot have created any faculty which is only hurtful to mankind, and this would be the case if there were an organ of theft, that is, destined only to theft and robbery. On the other hand it is also certain, that there is no action without faculty and without the assistance of organization. Consequently, theft is grounded upon a certain faculty, and this faculty manifests itself by means of an organ; but theft being an evil action, is only an abuse of a certain faculty. This point is cleared up by analogy. Gluttony and drunkenness are the effect of a certain power, but there is no faculty solely destined to these actions: they are abuses of the special propensity, hunger, and thirst. It is the same with adultery and incest, which are abuses of the propensity to physical love. Attack and quarrelsomeness are abuses of the propensity to fight. Hence, we must examine what is the special faculty which produces theft? May it not be the faculty of property and possession? Some thieves take without any intention of keeping what they have stolen; and sometimes men and animals take away things which are entirely useless to them: magpies and ravens, for instance, carry away money and spoons, and gather stones and similar things of which they cannot make use. Certain thieves give back, or they are content if the proprietor carries home, what they have taken away. Consequently, the faculty which steals is not essentially the faculty of keeping possession. The faculty in question precedes the possession, it is rather the propensity to take possession. The name possession therefore does not characterise this special faculty, which does not care about keeping and preservation.

Gall says that theft is sometimes an exuberance of cunning, and a very great propensity to exercise one's cunning. Certain dogs prefer bad bits which they steal, to good dishes which are given to them. The proverb says, " Stolen morsels are sweet." I am not of the opinion of Gall; for there are thieves who are not at all cunning. For the same reason, Gall was obliged to admit two organs; one of theft and another of cunning. It is also evident that this organ cannot be that of theft, because various persons who have this organ very much developed never steal. Are they therefore destitute of the manifestations of this faculty? To this Gall replies, that he cannot determine whether any person with whom he meets in society, and who has this organ much developed, has really stolen; and that he distinguishes only the disposition. But in this manner of speaking, the kind or nature of this faculty remains always the same, *viz.* the disposition to steal.

According to all that I have observed, in comparing animals and man with respect to the functions of this faculty, it seems to me, that the special faculty of this organ is the propensity to gather and acquire—to covet—without determining the object to be acquired or the manner of acquiring it. This faculty gives a desire for all that pleases: money, property, animals, servants, land, cattle, or any thing upon the earth. This faculty produces egotism and selfishness. Persons endowed with this faculty in a very high degree will never forget themselves. But the objects they desire, and their manner of acquiring, whether by gaming, commerce, industry, or stealing, depend on the influence of all the other faculties. It is in consequence of this faculty also, that we ask what is this or that object good for?

This faculty is essentially necessary to man and animals, because their subsistence depends on it. By means of this faculty also, according to my opinion, man and animals make provision and collection. The activity of this propensity may be more energetic than necessary. We have seen that some species and some individuals of carnivorous animals kill more than is necessary to nourish themselves, and that they like to kill animals which they do not eat. In the same way, animals and man do not only gather what is useful and permitted, but sometimes they take away what belongs to others, and that of which they cannot make any use. These latter actions then constitute abuses. They have different names, as usury, plagiarism, fraud, or theft. Thus, after having determined the special faculty of this organ, and after having explained the possibility of its abuses, it can no longer be said that it is dangerous to admit an organ of this faculty. In this chapter I examine only the special faculties. Their mutual influence forms another consideration, wherein I shall determine how far every faculty may be active, and where its abuses begin. This organ is situated at the temples on the anterior inferior angle of the parietal bone.—(*Pl.* XII. *fig.* 2. VIII.)

IX. ORGAN OF THE PROPENSITY TO CONCEAL, OR SECRETIVENESS.

Gall calls this organ that of cunning, and he allows that he does not know the sphere of its activity. He ascribes to it cunning, prudence, the *savoir faire*, the capacity of finding means necessary to succeed, hypocrisy, lies, intrigues, dissimulation, duplicity,falsehood ; in poets the talent of finding out interesting plots for romances and dramatic pieces ; and finally slyness of animals. In all individuals remarkable for such actions, a larger developement of this organ is observed. It is situated in the midst of the side of the head above the organ of the propensity to destroy.—(*Pl.* XI. *fig.* 2. and *Pl.* XIII. *fig.* 1. IX.) Gall first observed this organ in a person who had many debts, but who had the address to conceal his real situation, so that the creditors could have no knowledge of each other. Hence it is evident that Gall observed only the different functions of this faculty, but that he did not determine the special faculty itself. Hence also he complains in respect to this, as to every organ, that he does not know its sphere of activity. According to his manner of proceeding, it is scarcely possible to determine the sphere of activity of any organ, because the functions of the faculties are infinite. I have mentioned that it is necessary to determine the special faculties without considering the objects upon which, and the manner in which, they act. What is then the special faculty of this organ ?

If I consider the faculty of the person in whom this organ was first observed; if I examine the manners of sly animals, and consider what in them is sly; more especially if I consider the mimickry of man and animals, when they exercise functions of this kind, it seems to me, that the special faculty is the propensity to be clandestine in general, to secrete thoughts, words, things, or projects. The fox takes care not to be perceived; a cat, waiting for a mouse, does not move a single limb; sly animals in general, if pursued, hide themselves dexterously; and cunning persons conceal their opinions and intentions, and sometimes manifest an opinion opposite to their own. Hence, the special faculty seems to be the propensity to conceal without determining the object or the manner of concealing. The uses and abuses of this faculty have these various names; but the propensity to conceal is common to all its manifestations.

Genus II.—*Sentiments.*

After mere propensities follows another kind of faculties which I call sentiments. Several of them are common to man and animals, others are proper to man. I first shall consider the former.

X. ORGAN OF SELF-LOVE.

This is one of the faculties which are generally attributed to external circumstances; and no one thought of an organ on which its manifestations might depend. Sometimes however pride, or a great opinion of their own persons, is observed in individuals who have no influence upon others, neither by birth, fortune, nor personal talents. Gall first found this organ in a beggar. In examining the head of this person, he observed in the midst of the upper posterior part of the head, an elevation which he had not observed before in so high a degree. He asked him the cause of his mendicity. The beggar accused his pride as the cause of his present state, he having considered himself too important to acquire any business. He therefore only spent money, and did not think of earning a livelihood. We have a great number of proofs of this organ, and can establish its existence. Proud persons and those who are alienated by pride, who imagine themselves to be emperors, kings, ministers, generals &c. possess it in a high degree.—(*Pl.* IX. *fig.* 1. and *Pl.* XI. *fig.* 2. X.)

It appears that certain animals are endowed with this organ, as the turkey-cock, peacock, horse &c. Gall thinks also that this organ is the same as that of the faculty which makes certain animals dwell upon mountains, or in general in high regions. Therefore he calls this organ that of haughtiness, in order to designate at once physical and moral height. In speaking of the organ of inhabitiveness, I have examined the proofs which Gall admits, and have made opposite observations. I separate these two organs one from another, and according to my opinion, one faculty produces the propensity to a determinate inhabitation, and another that sentiment of which I now treat.

This faculty gives us a great opinion of our own person, self-love or self-esteem. Its too great activity is the cause of various abuses as pride, haughtiness, even of disdain, contempt, presumption, arrogance and insolence. The want of it disposes to humility. There are a greater number of mad men than of mad women, who are alienated by pride. Their mimickry is conformable. They speak little, they command, and show their importance with gravity.

XI. ORGAN OF APPROBATION.

Persons who are very fond of being caressed, honoured and applauded, in short, who are ambitious, have the upper posterior and lateral part of the head much developed.—(*Pl.* IX. *fig.* 2. XI.) Gall calls this the organ of ambition or vanity, according to the object. It is called ambition if the object to which we aspire be of importance, and vanity if we endeavour to distinguish ourselves by little things. I consider the activity of this faculty in general. Certain animals are sensible to caresses and flattery; others are destitute of this sentiment. It is the same with man. Some persons are fond of flattery or of applause, they wish to be distinguished and to be honoured. To this end they make use of various means, of dresses, of decorations &c. This faculty makes us attentive to the opinion which others have of us, and it loves their approbation in general without determining the object or the manner of acquiring their approbation. It may act upon things of the highest importance, upon altogether indifferent, or upon useful, or even hurtful, objects. A coachman endowed with this faculty is pleased if his manner of conducting horses be approved, and a general is elated if he be applauded by his nation for leading an army to victory.

We do not doubt of the existence of this organ. I call it, according to its special faculty, the organ of approbation. This faculty contributes much, and is necessary, to society. It excites the other faculties, and produces emulation and the point of honour. Its activity, when too strong or irregular, causes many abuses. The want of this faculty makes us indifferent to the opinions of others. This faculty is more active in women than in men, and even in certain nations more than in others. There is also a greater number of women than of men alienated in this respect. We have met with only one mad man alienated from vanity. Mad women manifest themselves in a manner which indicates evidently that they wish to please. They are affable, civil and courteous.

XII. ORGAN OF CAUTIOUSNESS.

Two persons at Vienna were known to be remarkable for their extreme irresolution. One day in a public place, Gall stood behind them and observed their heads. He found them extremely large on the upper posterior part of both sides of the head.—(*Pl.* IX. *fig.* 2. XII.) This observation gave the first idea of this organ. The heads of circumspect persons, and of those who want this faculty, are very different. Circumspect animals also, as the stag, roe, pole-cat, otter and mole, and those which place sentinels to warn them of approaching danger, as the chamois, cranes, starlings and bustards, have this cerebral part much developed. Indeed, geese, cranes &c., have not understanding enough to induce us to think, that their habit of placing sentinels is the result of any intellectual combination, but it is possible that this faculty is commanded by nature, by means of some organic arrangement. Moreover, animals which see during day-light, but which do not dare to seek their food except at night, have the upper lateral and posterior part of their heads more developed than those which go out during the day. The skulls of eagles are different in this respect from those of the horned owls, which see both in the day-time and at night, because they can contract and dilate the pupil at pleasure. Bats also have the head large posteriorly.

The special faculty of this organ produces precaution, demurs, doubts, places sentinels, and in general exclaims continually, Take care. It considers consequences and produces all the hesitations expressed by *but*. This faculty when too active causes abuses, as uncertainty, irresolution, unquietness, anxiety, fear, melancholy and hypochondriasis. In treating of the organ of the propensity to fight, I have mentioned that anxiety and fear cannot be the result of the want of courage; but that they must be attributed to some positive sentiment. They result from a too great activity of circumspection. Nevertheless, a person destitute of courage is overcome by cautiousness sooner than a person who feels a great propensity to fight. The want of cautiousness modifies the actions of the other faculties as far as these act according to their own nature without being restrained by circumspection. The result is what is called levity or inconsideration.

Thus this faculty is necessary to our preservation, and only its too great activity, like that of every other faculty, causes abuses. A great degree of cautiousness predisposes also to the disease of suicide. I say, it predisposes to suicide, but it is not the only cause of that crime. In speaking afterwards of the diseased state of the moral sentiments and intellectual faculties, I shall treat of the unfortunate disposition to suicide. This and the preceding organ are commonly more developed in females than in males, probably because they are obliged to take greater care of their progeny, or in order to supply in them what is wanting as to force.

XIII. ORGAN OF BENEVOLENCE IN MAN, OR OF MEEKNESS IN ANIMALS.

For a long time Gall did not think of placing goodness of heart in the brain. A family at Vienna often praised the goodness of one of their servants. This family several times told Gall, that he ought to mould this servant in plaster. At last he actually did so, and observed a considerable protuberance on the superior middle part of his forehead. This organ was afterward confirmed by numerous observations; for it is very easy to examine and verify this organ in children and in adult persons.—(*Pl.* VII. *fig.* 1.; *Pl.* XI. *fig.* 1. XIII.) This organ may also be proved by reference to animals, either in comparing different species or different individuals of the same species. Several kinds of animals are naturally meek, as the roe, goat, sheep, while others are wild, savage and mischievous. Some dogs, horses, cows &c. are meek and familiar, while other individuals of the same kind bite, kick &c. The mild and good-natured animals have the place of their forehead corresponding to the organ of goodness in man elevated and prominent (*Pl.* X. *fig.* 1. & 3. VIII), while the ill-natured present a hollow at this place.—(*Pl.* X. *fig.* 2. & 4. XIII.)

It is sometimes maintained that goodness is the result of the want of courage. But it is in my opinion a law, that the want of any faculty cannot produce any positive sentiment. On the other hand, many persons are very quarrelsome, and at the same time very good-hearted. In the same way active cruelty cannot be the result of the want of goodness; for cruelty is a positive sentiment. It is true, goodness or compassion cannot exist in cruel beings which are fond of tormenting others, but cruelty belongs to the organ of the propensity to destroy, without being restrained by any other sentiment.

This faculty, although it exists in animals, is greatly magnified and ennobled in mankind. In the greatest number of animals it is restrained to a passive goodness, but in man its sphere of activity is very considerable. It produces in man goodness of heart, kindness, peacefulness, mildness, benignity, benevolence, complaisance, clemency, mercifulness, compassion, humanity, hospitality, liberality, equity, cordiality, urbanity, in one word, *Christian charity.*

ON THE SENTIMENTS WHICH ARE PROPER TO MANKIND.

Hitherto we have considered man so far as he is animal. All the organs and special faculties I have spoken of are common to man, quadrupeds, birds &c. In this respect man is even the most perfect of them all; he possesses all those faculties which are distributed among different kinds of animals. Besides this prerogative, every faculty is susceptible of many more modifications, and its energy is greater in man than in animals. Moreover, man is endowed with sentiments which constitute the human character, of which animals are entirely destitute. Till the present time, no system of philosophy has clearly indicated the line of demarcation between man and animals. It was believed for a long time that man differs from animals in being endowed with memory, judgment, and imagination; but a great number of facts prove that animals possess all these faculties. Others again consider reasoning and religion, as particular attributes of human nature. I shall here treat only of the sentiments proper to man; and in speaking of the intellectual faculties, I shall also point out which of them are common to animals and man, and which are proper to mankind.

XIV. ORGAN OF VENERATION.

Dr. Gall, in examining the actions of man, visited churches in order to see the configuration of the heads of those who excel in devotion. He first observed, that the heads of those who prayed with the greatest fervour were bald. Now it is inconceivable that the bald state of the head can produce devotion. For every bald man is not pious, and though women do not grow bald, yet a great number of them are pious and devout. Gall observed also, that the heads of these pious men were very elevated.—(*Pl.* XII. *fig.* 1. XIV.) Lavater had made the same observation.

Priests who have chosen this state from natural propensity or vocation, and those who have become priests by external circumstances or from various other views, religious and irreligious persons, present a different degree of developement in the middle of the upper part of their heads. The pictures of the saints show the very configuration of those pious men whom Gall had first observed. It is also in this respect remarkable, that the head of Christ is always represented as very elevated. Have we the real picture of Christ? Have artists given to the head of Christ a configuration which they have observed in religious persons; or have they composed this figure from some internal inspiration? Has the same sentiment among modern artists given to Christ an elevation of head, as among the ancient it conferred a prominence of the forehead upon Jupiter? At all events the shape of the head of Christ contributes to prove this organization. If the head be very high in the middle line, the hair falls down on both sides, just as this arrangement of the hair is presented in the pictures of Christ.

An objection made on account of this organ is, that if there be an organ of religion, there is no occasion for revelation. But it is easy to prove that this objection is false. First, there were systems of religion before any revelation. Cicero says expressly, that there is no nation, no people, who do not adore a Deity. Plutarch observes, that there is neither town nor village in the world without a God. Aristotle, Plato, and all the ancient philosophers make the same remark. Even the fathers of the church have commented on this truth, in order to prove that the belief in a God is innate. We only add that it manifests itself by a certain organization. Thus the sentiment of religion has existed long before any revelation. Besides, all nations are not yet acquainted with revelation, and yet these nations manifest religious sentiments. Moreover, if revelation was to be given to mankind was it not necessary to prepare man, or to make him capable of receiving revelation? Who would endeavour to make any animal inferior to man acquainted with revelation? It is a general law, that neither man nor animals can be instructed or educated, if the respective faculty be not innate. Dogs do not learn religion any more than mathematics. Hence, man must be prepared to receive the former as well as the latter; and on this account he has received a particular organ of veneration. Finally, if revelation ought to regulate religious sentiments and ideas, was it not necessary that they should exist previously?

Thus these considerations prove that the sentiment of religion is inherent in the nature of man, that it is an arrangement of creation, and that mankind never will exist without religion. Gall even maintains that this organ is not only necessary, but that it is also the most evident proof of the existence of God. If nature, says he, has produced any faculty, there is an object of this faculty; for example, the propensities to love, to destroy &c. exist as well as their objects. The faculty of music exists, and the laws of vibration in external objects are conformable. In general every other faculty of man and animals has an object which it may accomplish. Can it then be probable that God does not exist while there is an organ of religion? Hence, God exists. Gall speaks of this organ under the name of religion, of theosophy, or even of morality.

These expressions are very vague, and far from indicating any special faculty. They designate a greater sphere of activity than that of this particular organ. First, I disapprove the name theosophy; for we cannot flatter ourselves that we know the nature of God. We can only say what God is according to us, that is, all the superior faculties of man, elevated to the highest degree, are attributed to God; but God may possess many other faculties of which we have not the slightest notion. We can only speak of a Supreme Being without determining his nature. I dislike also the name religion, because this expression has different significations. It sometimes denotes particular acts and ceremonies by which God is venerated: sometimes it also designates the morality of our actions; but we have established as a principle that the organs cannot be named according to any action. Finally, the name organ of morality is still less applicable; for the religion of God is only one part of morality. It is also known that one man may be religious without being just, and another may be just without being religious. Therefore it remains to be examined, what is the special faculty of this organ. This faculty constitutes a sentiment, and not an idea. Gall observed this organ first in persons who were in the act of adoring God; and according to all my observations it seems that its special faculty is the sentiment of veneration, without determining its objects or its manner. It is by this faculty that man adores God, or venerates saints, persons and things. It respects all sacred objects. Now what can be more natural than to venerate the Being who is considered as the cause of all things? Moreover, experience proves my assertion, that this faculty does not determine the object to be venerated, nor the manner of venerating. The ancient nations admitted a greater or less number of gods; and at the present time, different nations and different persons have different ideas of God, according to their national creeds, and their intellectual faculties, and they venerate him accordingly. We consider this organ as determined. It is situated in the midst of the upper part of the head.

XV. ORGAN OF HOPE AND FAITH.

It seems to me that there is a particular sentiment of hope. Gall considers hope as belonging to every organ. I think there is a difference between desire or want, and hope. Every faculty, being active, produces desire; therefore animals desire; and while the respective organ is active, they wish the satisfaction of their desires; but I do not believe that they have the sentiment of hope. I consider this sentiment as proper to man. No other faculty can produce hope, therefore I admit a particular organ for the manifestations of this kind. This sentiment is necessary in almost every situation; it gives hope in the present and of a future life. In religion it is called faith. Persons endowed with it in a higher degree are credulous. The organ of hope seems to be situated on the side of that of veneration.

XVI. ORGAN OF IDEALITY.

It is a proverb that a poet must be born. It is also certain that the heads of great poets, but not of all versificators, are enlarged above the temples in an arched direction.—(*Pl.* XVIII. *fig.* 2. XVI.)

Now it is impossible that poetry, in general, should be confined to one single organ. I therefore think that the name organ of poetry, given by Gall to this organ, does not indicate the essential faculty of this organ, but that it is necessary to point out what is essential to all kinds of poetry. This common faculty of poets then must be the special faculty of this organ, and the combination of this with the other faculties must determine the kind of poetry of each poet. It can neither be the faculty of versification, nor that of rhyming. For some authors write in prose, and their expressions are really poetical; and others make verses which however contain no poetical thought. Rhyme is still less essential to poetry, for among the ancients it was entirely unknown, and among the moderns poetry is not always rhythmic. It seems to me that in every kind of poetry the sentiments are exalted, the expressions warm, and that there must be rapture, inspiration—what is commonly called imagination or fancy. I observe moreover, that in all persons this faculty gives a peculiar tinge to all other faculties; it makes them in every thing aspire to ideality. It is a sentiment, and, if I may so speak, the opposite of circumspection; it renders us enthusiasts, while circumspection stops our career by saying, Take care. I call this organ that of Ideality.

I have here to mention certain curious observations without being capable of determining their characteristic nature. We have observed that if the part of the head, above the organ of ideality and a little backward from it, be very much developed, the persons are disposed to have visions, to see ghosts, demons, phantoms, to believe in astrology, magic, and sorcery. I cannot say whether this is a particular organ, or a greater developement of the organ of hope, or of that of ideality, or of both together.

XVII. ORGAN OF RIGHTEOUSNESS.

I think also that there is a particular sentiment of just and unjust, right and wrong, and that a particular organ of righteousness must be admitted. No animal has this faculty. Its activity is very different in man. Some individuals are almost destitute of it, others possess it in a high degree. It produces only the sentiment of justice without determining what is just. Particular determinations, as to justice, depend on the other faculties with which this sentiment is combined. A person who combines righteousness with some propensity of the lower order calls just, what another person, who possesses righteousness combined with goodness or veneration, calls unjust.* I shall afterwards give a better elucidation of the mutual influence of the faculties. This faculty produces the sentiment of

* "All the ways of a man are clean in his own eyes, but the Lord weigheth the spirits." Prov. xvi. 2. "Every way of a man is right in his own eyes, but the Lord pondereth the hearts." Prov. xxi. 2.

duty, and constitutes what is called conscience and remorse.

Gall thinks that there is no organ of conscience. He considers conscience as the result of the opposition of the dominant character of a person to his particular actions, and, according to him, there are as many consciences as faculties. He even speaks of a good and of a bad conscience: the good conscience is the opposition of the good qualities to a particular action, and the bad conscience is the opposition of the bad faculties to a particular action. In this respect he admits bad faculties. If a good-natured man commit a fault or offend another, he repents, and his conscience torments him, because he has acted in opposition to his natural character. On the other hand, a usurer and a libertine are sorry for having neglected a good opportunity, the first of deceiving, the second of seducing some innocent person. Gall gives to this opposition of the dominant character to any action the name Natural Conscience, and asserts that we cannot trust to the natural conscience, but that it is necessary to establish some positive conscience, that is, to determine what is to be done and what is to be let alone, without considering what persons may desire. Therefore it is said, Thou shalt adore one God; thou shalt not kill; thou shalt not steal &c.

In opposition to this assertion, Gall, in speaking of criminals, proves that certain inveterate criminals do not feel any repentance, or, what is called by him, good conscience. He does not deny that criminals, who possess good nature, and have committed some fault, repent sincerely. If, for instance, a mother who has been dishonoured, and consigned to the most unfortunate situation, in a moment of despair and confusion, deprives her new-born child of life; if the fatal concourse of circumstances be past, and the innate sentiments of mildness and compassion begin again to act, she feels the contradiction between her natural character and her action, and this contradiction constitutes, according to Gall, her repentance or natural conscience. At Spandau, we saw a man who had assassinated his wife in a paroxysm of anger. This man was unhappy during his whole life. Indeed he was good-natured, and generally considered as an honest man. On the other hand, it is beyond doubt that he who is dragged to criminal actions by very strong internal propensities, rarely feels any natural repentance. In such a man, the inclinations which lead to evil are energetic. They constitute, if I may so say, his principal character. Hence all actions which result from them are in harmony with his inclinations. This fatal truth may displease those who dream of nothing but of the dignity of human nature, but it is proved by observation, and it is even conformable to Christianity. "The soul of the wicked desires evil, his neighbour finds no favour in his eyes." *—"A good tree cannot bring forth evil fruit, neither can a corrupt tree bring forth good fruit." †—"O generation of vipers, how can ye, being evil, speak good things?" ‡—"They that are

* Prov. xxi. 10. † Matt. vii. 18. ‡ Matt. xii. 34.

after the flesh do mind the things of the flesh, but they that are after the spirit, the things of the spirit." *—" The natural man receives not the things of the Spirit of God, for they are foolishness unto him, neither can he know them, because they are spiritually discerned." †—" Some children are called hellish, not because they are born in hell, but because they are destined to hell." ‡

Cardinal Polignac also speaks of mèn who are born wicked, and to whom crime is delightful. Why should a criminal, says he, who does not consider himself as wicked, repent? § Indeed great criminals do not think that they are guilty, and they cannot feel any repentance. Examine them by their juridical processes; follow them to the scaffold and execution! Some of them deny, with an incredible stubbornness, the most evident actions, and sometimes they insult the witnesses with surprising audacity; others, with an impudent sincerity, relate a series of horrible trespasses and crimes; some even make the gayest joke of the most outrageous actions, and often when we shudder with horror at their guilt they break out into laughter. A soldier had stolen successively from twenty churches. Being conducted to the gallows he hoped to receive pardon. But instead of showing any repentance, he said to the auditor Wiedemann of Vienna, "I see well there is nothing more to be done here; I shall endeavour to go elsewhere."—Mr. Bruggmanns, at

* Rom. viii. 5. † 1 Cor. ii. 14.

‡ St. Augustin on Faith, Hope, and Charity, chap. xii.

§ Antilucrece, t. i. p. 164.

Leyden, showed us the skull of the chief of a band of robbers. This man had precipitated different persons into the canals only in order to have the pleasure of seeing them struggling with death. He said, when on his trial, What will you do with me, am I not an honest man?—We have seen a girl who had assisted her mother in killing her father. She did not manifest the least repentance. If her crime was spoken of she only shrugged up her shoulders. In short, all juridical proceedings, which have condemned inveterate criminals, justify our observation, that certain guilty persons never are guided by conscience. Such perverted men are even proud of the faculties by means of which they deceive, and they recount with pleasure the most remarkable tricks of their criminal life. Hence, as it is certain that the greatest criminals are not prevented from doing evil by conscience or by repentance, it is necessary to produce some positive conscience, and to regulate actions by rewards and punishments.

I shall now examine whether there is an organ of conscience, or whether conscience is only the opposition of the principal character to any action. First, I think that if the assertion of Gall be true, every organ ought to produce repentance whenever any action is opposite to the natural dominant character of the acting person; but it does not seem to me that a criminal feels repentance for having done any action which is good in itself, and not hurtful in respect to the criminal. If a criminal give to the poor a part of his booty, will he repent it? I think not, unless he is betrayed by it. Gall asserting that inveterate criminals do not feel any repentance is in contradiction with himself. Besides, if Gall say that libertines or usurers repent of having neglected a good opportunity of seducing or deceiving, I think that he confounds repentance or remorse with being sorry for or being displeased. It seems to me that he commits a fault similar to that of those who confound inclination or propensity with will. Every cerebral organ manifests a desire, a propensity, but every organ does not produce will. In the same way every organ, not being satisfied, or being disagreeably affected, produces pain, the being sorry; but every organ does not produce repentance or remorse. I shall afterward detail the difference between inclination and will. Here I mention it only on account of the analogy. Thus I maintain that no sentiment common to animals and man produces repentance.

It may be asked, whether repentance be the same as will? The answer must be negative; for will is the effect of the understanding, while repentance or remorse is the effect of the mind in the adopted signification. The latter is a sentiment independent of understanding, and there is no proportion between conscience and understanding. I think that repentance, remorse, or conscience, must be attributed only to the faculty of justice and duty. According to the preceding considerations, I also disapprove of the divisions of the conscience made by Gall into natural—good or bad; and into artificial or positive. I divide it, 1st, Into *natural* or *absolute* conscience, which is the effect of justice combined with all the other faculties proper to mankind, while all the faculties common to man and animals are held in subordination. 2d, Into individual, particular, or relative conscience, which results from the justice of every one combined with his other faculties. 3d, Into positive conscience, which is fixed by legislation, whether divine or civil, as by the commands, Thou shalt not eat meat on Fridays or Saturdays; thou shalt go to church every Sunday &c. Thus I admit a particular organ of justice, and seek for its organ on the side of the following organ.

XVIII. ORGAN OF DETERMINATENESS.

Dr. Gall observed that persons of a firm and constant character have the top of the brain much developed.—(*Pl.* IX. *fig.* 2. XVIII.) Lavater had distinguished the same configuration in persons of an immoveable character. The special faculty is difficult to be determined. Its effects are often called will; but this will is not the moral will which is necessary to liberty. It is true, persons endowed with a greater developement of this organ say commonly, " I will," that is, I want, I desire, I insist, I command, but without sufficient reason or reflection. This faculty contributes to maintain the activity of the other faculties. It gives constancy and perseverance. Its too great activity produces infatuation, stubbornness, obstinacy, and disobedience. Its want renders men unsure, inconstant, and changeable, according to the other impressions. We are convinced of the existence of this organ by a multitude of observations; and it seems to be situated in the midst of the feelings, in order to strengthen their activity.

ORDER II.—Understanding or Intellect.

Genus I.—*Knowing Faculties.*

I have finished the first order of faculties—the propensities and sentiments: I shall now consider the second order. The first genus contains those faculties by means of which we know the existence of external bodies and their qualities. Strictly speaking, the five external senses belong, in some measure, to this kind of faculties. I have already treated of the knowledge which man and animals acquire by their assistance. I shall now examine the organs necessary to acquire certain kinds of knowledge which the five external senses cannot produce. The first conception which our understanding must have of external beings is that of their existence. In order to acquire this conception, the external senses are not sufficient, although this conception cannot be determinate without an impression on these senses. Thus the organ which procures knowledge of external beings must be considered as the first in respect to the order in which the faculties are necessary.

XIX. ORGAN OF INDIVIDUALITY.

Dr. Gall observed, in society, different persons who were learned, who had a superficial knowledge of all arts and sciences, and who were not always profound, but who knew enough to be capable of speaking with facility—such as are called brilliant in society. He found that in them, the midst of the lower part of the forehead was very prominent, consequently that the anterior inferior part of the brain was much developed.—(*Pl.* XIII. *fig.* 1. XIX.) At first, Gall called this organ, organ of the memory of things, because the persons endowed with a great developement of this organ had much information, or knew many things. Afterwards, as he observed that memory is only a degree of the activity of every faculty, he named it the organ of the sense of things. In comparing animals with man, and one kind of animal with another, it is obvious that tame animals have the forehead more developed than wild ones, and that they are more or less tameable in proportion as the forehead is developed. Gall now therefore calls this organ that of educability.

The cause of the tameableness of animals has long been sought. It has been asked, whether animals are tamed by nature, or whether they are subdued and subjected to our services by means of our understanding? It was believed for a long time, and a great number of physiologists and philosophers still think, that tameableness in animals is solely the work of mankind. But this opinion is erroneous: otherwise why is it at present impossible for man to tame the other wild species? Yet we are now better acquainted with the manners of animals than two thousand years ago, and consequently we can better suit to them external circumstances. It is possible to tame single wild animals, for instance, one chamois, one tiger &c. but never the whole race. The young ones are always wild and fly into solitude. On the other hand, certain animals are tame without our wishing it. Mice every where follow the abodes of man. Dogs, in Egypt, are considered as impure animals, and have no particular master, yet they remain in the villages and towns, never go far from the dwellings of man, and consequently are originally tame.

Dr. Gall, in his lectures, in order to demonstrate this organ, shows a scale of animals, and proves that they are more tameable in proportion to the height of their forehead. It does not seem to me that this organ fills up the whole forehead. Meekness certainly contributes much to the tameableness of animals. Gall himself, in speaking of the organ of meekness, says, that animals endowed with that organ, are more docile and more serviceable than others. Besides, the reflecting faculties of animals are connected with the organ of facts. I think therefore that the faculties of the whole forehead contribute to the tameableness or educability of animals; that Gall's observations, relative to this special organ, are not sufficiently precise; and that his manner of comparing this organ in man and animals is very inexact. I am confirmed in my opinion not only because Gall, in comparing this organ, compares the whole foreheads of man and animals, but also because he compares the same foreheads in yet other respects.

In looking for the special faculties, and their respective organs, I cannot make use of these comparisons, which are indeed striking as a whole, and show that the developement of the forehead coincides with the degree of the understanding. In animals of lower kinds, the brain, instead of ascending and forming a forehead, is inclined downward. By degrees it becomes horizontal, is elevated, and forms a forehead less or more developed; finally, in man it presents the most developed forehead; still however, in different degrees, being sometimes vertical, sometimes even prominent. Notwithstanding these remarks, I admit that animals are endowed with this organ. They recollect what has happened to them. An old fox which has escaped several snares, and which knows that it is watched, takes more precaution, and proceeds with greater slyness, when it comes near houses, in order to catch poultry. Any bird whose nest has been destroyed, at a place frequented by people, conceives the necessity of in future placing it in solitude; the construction of the second nest is also more perfect. A dog resists its instinct to run after a hare, because it recollects the beating which it formerly received on the same account. Similar facts might be multiplied infinitely; and it is consequently evident that the actions of animals are not subjected to an absolute necessity, but that animals are, in a certain degree, susceptible of education, partly by the organ in question, and principally by the faculties situated in the whole of the forehead.

It already results from what I have said, that the name educability is bad. Besides, every faculty may be educated, that is, exercised or directed. What is then the special faculty of this organ, and its sphere of activity? Persons endowed with this faculty in a high degree are attentive to all that happens around them, to every object, to every phenomenon, to every fact; hence also to motions. This faculty neither learns the qualities of objects, nor the details of facts; it knows only their existence. The qualities of the objects, and the particularities of the phenomena, are known by the assistance of other organs. Besides, this faculty has knowledge of all internal faculties, and acts upon them. It wishes to know all by experience, consequently it puts every other organ in action; it wishes to hear, see, smell, taste and touch, to know all arts and sciences; it is fond of instruction, collects facts, and leads to practical knowledge.

I call this faculty that of *Individuality*, because it knows not only the external world in general, but also each object in its individual capacity. This organ is early developed in children, because they are obliged to acquire knowledge of the external world. By this faculty, children are attentive to every object and fact, and in a short time they make an immense number of observations. We consider this organ as proved by facts. Its place is already indicated.

XX. ORGAN OF FORM.

Dr. Gall sometimes speaks of an organ of the sense of persons. He was desired to examine the head of a young girl who had an extreme facility of distinguishing and recollecting persons. He only found in her the eyes pushed laterally outward, and a squinting look. My manner of considering this faculty is the following. The preceding faculty has knowledge of the existence of external bodies. The first quality, which our intellect considers in them, is their form. Persons are particularly known by their form. I therefore speak of this faculty in general. Persons, endowed with it in a high degree, are fond of seeing pictures, and if they make collections, they collect portraits. Crystallography is the result of this faculty. It seems to me that the conception also of the smoothness and roughness of bodies belongs to it. It is certain that vision and touch are not sufficient to make us acquainted with these qualities of bodies; they furnish only the impressions, and an internal faculty forms these conceptions. There is no proportion between this faculty and the perfection of both external senses.

Animals of the lower orders, as insects, know well individuals of their kind and of their family; they possess therefore the faculty in question. Honey-bees distinguish the individuals of their own hive from those of any other. In a flock of sheep, the young ones know their mother. Elephants and dogs give very striking examples of this kind; they know persons after having seen them a long time before. The organ of form seems to be placed in the internal angle of the orbit. If this part of the brain be much developed, it pushes the eyeball toward the external angle, that is, a little outward and downward.—(*Pl.* XIII. *fig*. 2. XX.) According to the external configuration of the heads of Chinese whom I have seen in London, it seems to me, that this part of the brain is much developed in them. This organ, in order to be verified, requires still a great number of observations.

XXI. ORGAN OF SIZE.

After the existence and figure of any body, the mind considers its dimensions or size. There is no proportion either of the senses of feeling or seeing, or of the other internal faculties, to this kind of conceptions. The faculty of distinguishing form, for instance, is not the same as the faculty of size, because there is an essential difference between the idea of size and that of form. The form may be the same and the size quite different, or the size the same and the form very different. Moreover, one kind of knowledge may exist without the other, and there is no proportion between them. Nevertheless these two organs seem to be near to each other without being the same.

XXII. ORGAN OF WEIGHT.

In treating of the sense of feeling and of its sphere of activity, I have ascertained that the ideas of weight and existence, and of consistency, density, softness, and hardness, cannot be attributed to this external sense. I admit a particular faculty for conceptions of this kind. Its organ must be situated in the neighbourhood of the organ of form and size.

XXIII. ORGAN OF COLOUR.

It is certain that the qualities of external bodies, of which I have spoken, are the most essential to them. The knowledge of these qualities is also more important to man and animals than the faculty which makes us acquainted with colour. In speaking of vision, I have shown that vision is insufficient to bestow excellency in colouring among painters. It is true the eyes perceive the beams of light, and they are affected agreeably or disagreeably by different modifications of light or by colours, but they do not conceive the relations of different colours, their harmony or discord, and they have no memory of them. In order to prove this assertion we need only compare, in animals and man, the faculty of perceiving light or vision with the faculty of conceiving colours. I am not certain that animals are destitute of the faculty of distinguishing colour, because they have no art of painting. For there is a great difference between producing a thing, and being capable of perceiving it. Animals have the senses of smell and taste, but they cannot produce the enjoyments of these senses. In the same way it is possible that they perceive different colours, and their harmony or discord, without being capable of painting.

Certain persons are almost destitute of the power of perceiving colours. We know a family in which all the individuals distinguish only black and white. Dr. Unzer, of Altona, could not perceive green and blue. A boy, of Vienna, wished to become a tailor, but he was obliged to leave this trade because he could not distinguish different colours. There are many similar examples. These persons, who do not perceive colours, have sometimes the vision very acute, and they perceive the other qualities of external bodies, as their size and form. Thus, as in man the faculty of colouring is not in proportion to the sense of sight, nor to the understanding in general, it seems evident that there is some particular faculty which perceives the different colours, recollects them, and judges of their relations. This faculty is necessary to painters, dyers, enamellers, and to all those who are occupied with colours and their shades. It is by means of this faculty that certain persons are so much charmed with flower gardens, and with enamelled meadows. Its organ is placed in the midst of the arch of the eyebrows. The external sign of a greater developement of the organ of this faculty is a vaulted and round arch of the eyebrows.—(*Pl.* XIV. *fig.* 1. XXIII.) This configuration gives to the face a look of joviality and voluptuousness. In the Chinese, the orbitary arch is elevated in the midst, the eyes are depressed, and it is known that they are very fond of colours. This faculty is generally more active in women than in men. Women are more fond of colours than men, and they show this taste even in their dresses. Some women acquire a certain perfection in colouring, while in all other parts of the arts they are surpassed by men. Their eyebrows, accordingly, are more rounded than those of men.

XXIV. ORGAN OF SPACE.

Dr. Gall had always good eyes, but he could not again find places where he had been before, and which he wished to discover. One of his fellow-students had a surprising facility of recollecting localities and particular places. This young man, called Scheidler, never lost any place where he had discovered a bird's nest, but always found it again without having made any artificial marks. Gall, on the contrary, could not find the places again, although he was very attentive and had recourse to artificial indications. As Gall formed various busts in plaster, he moulded also his fellow-student Scheidler, known to him by his excellent local memory; and he distinguished at the eyebrows, toward the middle line of the forehead, a protuberance on each side which reached to the middle of the forehead. He afterwards observed every person endowed with a greater degree of this faculty. One day Gall met, at Vienna, a woman who had this organ extremely developed, so that her face was deformed by it. He spoke to her, and learned that she had the greatest propensity to travel, that she had left her parents, at Munich, solely in order to see foreign countries, that she never lived long in the same house, because she liked change of place, and that her greatest pleasure consisted in travelling.

The pictures and busts of great astronomers, navigators, and geographers, as of Newton, Cooke, Columbus &c., present a great developement of this organ.—(*Pl.* XIV. *fig*. 2. XXIV.) In the biography of Cooke it is expressly said, that his frontal sinuses were extremely prominent. This faculty caused Columbus to seek for a new continent, and it excites every zealous traveller. Bloede, of Dresden, speaks of one who had formerly been a miner, known under the name of Augustus of Schneeberg, because he was born in that town. This man, with a kind of ridiculous eagerness which prevents him from staying longer than one or two days at the same place, runs every year over the greatest part of Saxony, Lusatia, and Silesia. He has every day, like migrating birds, a fixed station, and brings to every landlord, who gives him relief, compliments and salutations from all his friends; he begins to tell all the details of his last journey, and speaks with the greatest volubility, keeping his body immoveable and his eyes shut. Bloede states, that this odd person has really two large and prominent protuberances corresponding to those of this organ. At Torgau, in Saxony, we saw a blind man in whom this organ was much developed. This man told us that he was fond of hearing geography and travels spoken of, and that he often dreamed of foreign countries. In one word, this organ has been proved in man by many thousand facts, and we have no doubt of its existence.

Animals must be endowed with this faculty. Without it they would find neither their progeny nor their dwellings, when obliged to leave them in order to seek for food. This faculty is very active in certain animals, while other are almost destitute of it. This difference is not only perceptible in different kinds of animals, but also in different individuals of the same kind. One dog, having scarcely gone down stairs, loses the door of its dwelling, while another finds its usual abode and master at an enormous distance. A dog was transported in a carriage from Vienna to Petersburg, and after six months it returned to Vienna. Another dog was transported from Vienna to London, and still he found means to come back. He attached himself to a traveller in the packet-boat, and went with him to Mentz, where he left him and returned to Vienna. Another was carried from Lyons to Marseilles, embarked and conducted to Naples, but he came back to Lyons by land. Another found again his former master in Suabia, after having left his new master in Hungary &c. Similar facts prove that those persons are wrong who derive this faculty from the sense of smell. None of the dogs, just mentioned could discover any trace by smell. Besides dogs do not always return the nearest way, but sometimes make extraordinary turnings. Certainly the sense of smell does not lead back pigeons which are transported to the distance of twenty leagues and more, confined in a sack and prevented from seeing the country. It is the same with the falcon of Iceland: though it has been carefully confined, often the first time it is sent against a heron, it ascends vertically into the air, distinguishes its regions, and takes the direction of the north. It is equally impossible to maintain that this faculty is an attribute of the eyes, because there is no proportion between the energy of this faculty and that of vision. Hence it must be attributed to some internal organization.

This faculty being innate, and being active by internal excitement, explains a phenomenon observed in many animals. Certain animals, chiefly birds, as swallows, storks, starlings, quails, nightingales &c., emigrate at certain periods of the year. These animals also come back, not only into the same climate and into the same country, but to the same place, to the same window, bush, chimney, or tree. These emigrations do not result from want of food alone. It is true faculties are excited by external wants, and certain birds leave one country in order to seek food elsewhere; but the faculties must exist before they can be excited. Besides, every faculty may be active without being excited by an external want. This is evident, because certain birds emigrate before food is wanting, and they come back before food is to be found. Moreover, if such birds be confined to a cage, and fed abundantly, they become unquiet at the periods of migration. It may lastly be asked, why do not all birds leave their ordinary dwelling when food is wanting? Hence it is necessary to admit an internal and innate faculty which produces all these phenomena.

It remains to be determined what is the special faculty of this organ, and the sphere of its activity? This faculty makes the traveller, geographer, landscape-painter; it recollects localities, judges of symmetry; it measures space and distance, and gives notions of perspective. Hence it seems to me that it is the faculty of space in general. As soon as we have the conception of the existence of any body and its qualities, it is necessary that it should occupy a place. This faculty conceives the places occupied by the external bodies. It makes space not only known, it is also fond of this kind of knowledge, and explains all the phenomena of which I have spoken. The place of its organ has already been designated.

It does not seem to me that space is a mere form of our understanding, as Kant has maintained. It is true the conception of space cannot be attributed to the five external senses, but space certainly exists in the external world. The conception of causality also cannot be attributed to the five external senses, but the relations and succession of phenomena, called cause and effect, exist in nature. The same idea prevails in respect to all categories established by Kant, and relative to external subjects: internal faculties constitute them, and they are adapted to external bodies, or, in other terms, all conceptions of external objects are the result of internal faculties which are adapted, by creation, to the external world.

XXV. ORGAN OF ORDER.

It seems to me that there is a particular faculty which makes us conceive order. We may have some idea of different objects without order. The mind being acquainted with external objects, their qualities, and the places they occupy, considers also the order in which they are ranged one by the side of another. Order then may be applied to different faculties, to form, size, weight, colour. Its organ is probably situated outward, but not far from the organs of size and space. Is cleanliness dependent on the same faculty as order?

XXVI. ORGAN OF TIME.

The faculty of time also seems to me a quite distinct faculty: it may exist without order and number. Yesterday, to-day, to-morrow, the day after to-morrow &c., constitute a succession without any regard to the number of days. There is more connexion between order and number than between time and number, and there is more connexion between time and order than between time and number. Order is more in relation to objects, and time to events or facts. The conception of time seems to be higher in the scale, and its organ occupies a higher place in the brain; the organ of order, the middle, and that of number, the lowest and the most outward. The mimickry of time and number proves indeed that the organs of these faculties occupy different places, and that the seat of the organ of time is higher than that of the organ of number. We raise up the eyes in thinking of time, and we look downward and outward in ciphering. I shall afterwards speak of a faculty which examines the relations between cause and effect. This faculty supposes a succession of phenomena, and cannot, in place, be far from the organ of succession or of time. It seems indeed that the organ of time is situated between the organs of individuality, space, order, tune, and cause.

XXVII. ORGAN OF NUMBER.

Some individuals remarkable for their great talent of calculating excited the attention of Dr. Gall. There are children who excel in this faculty. A child of seven years of age, called Devaux, was extremely delighted with running about the fairs, and making calculations for the merchants. A boy of thirteen years of age, born at St. Poelten, not far from Vienna, excelled his school-fellows in a surprising manner. He learnt easily an immense quantity of numbers, made the most complicated arithmetical operations from memory, and very soon found their result. Mr. Mantelli, a counsellor of the Court of Appeals at Vienna, took a particular pleasure in the solution of arithmetical problems; and his son of five years of age did nothing but calculate during the whole of the day. In such individuals the arch of the eye-brows is much depressed or elevated at the external angle of the orbit.—(*Pl.* XV. *fig.* 2. XXV.) This sign is the result of a greater developement of the part of the brain situated behind this place. The portraits and busts of great calculators present the external sign of this faculty, as Newton, Euler, Kaestner, Jedidiah Buxton, Pitt, &c.—(*Pl.* XV.) We have an infinity of observations upon this organ, and we consider it as demonstrated.

Certain races of negroes make five the basis of their enumeration, that is, they count only as far as five by simple terms, whereas we Europeans proceed as far as ten. All their numbers after five are compound, whereas ours are not compoud till we have passed the number ten; in short, while our terms, six, seven &c. are simple, they terminate their simple numbers at five, and say five-one, five-two, five-three &c.—Negroes in general do not excel in this faculty. Accordingly the heads of negroes are very narrow at the place of this organization. However in certain individuals among them, the faculty of reckoning is considerable and more energetic than in a great number of Europeans.

I am not certain whether this faculty exists in animals. It is said that a bitch perceives if one of its puppies be taken away; but it is not evident that she counts her young ones. She may perceive by the faculties of individuality and form, that this individual is wanting. George le Roi has observed, that magpies count three; for if we construct a hut in the neighbourhood of a tree, upon which a magpie has placed its nest, and if three persons enter into this hut the magpie is not deceived; it does not come to its nest before the three persons have left the hut; but if more than three persons enter, it can no more reckon their number, and cannot compare the number of those who are gone in, with that of those who are gone out. Dupont de Nemours, however, thinks that magpies can count nine.

What is the special faculty of this organ, and its sphere of activity? All that which concerns unity and plurality—number—seems to belong to this faculty. Hence, its object is calculation in general. Gall often calls this organ that of mathematics, but I think that this faculty only calculates: therefore, arithmetic, algebra, and logarithms belong to it, but the other branches of mathematics, as geometry, are the result not merely of this faculty which however may be applied to different faculties as to form, size, colour &c.

XXVIII. ORGAN OF TUNE.

It is with the organ of tune in respect to the ears, as with the organ of colour in respect to the eyes. The ear hears sounds, and it is affected by them agreeably or disagreeably; but the ear has no recollection of tones, nor does it judge of their relations. In treating of the sense of hearing, I have demonstrated, that on the ears the origin of music does not depend. Besides the above-mentioned proofs that the ear is not the organ of musical perception, there exists a direct proof that an internal organ is necessary to the manifestations of this faculty. Sometimes in epileptic fits, in delirium, and syncope, certain individuals sing continually and with great precision. This faculty then is alone active, while in such cases the functions of all the other faculties are deranged. A greater developement of this organ enlarges the lateral parts of the forehead.—(*Pl.* XV. *fig.* 2. XXVIII.) Its form varies according to the direction and form of its convolutions. In Gluck, Hadyn, and others, this organ had a pyramidal form; in Mozart, Viotti, Zumstêy, Dussek, Crescentini, and others, the external corners of the forehead are enlarged but rounded.

The heads and skulls of birds which sing, and of those which do not sing, and the heads of the different individuals of the same kind which have a greater or less disposition to sing, present a great difference at the place where this organ is situated. The heads of males, for instance, and those of females of the same kind of singing-birds, are easily distinguished by the different developement of this organ. In short, we consider this organ as established by the immense number of observations which demonstrate its existence.

There is a striking analogy between colours and tones, and their respective organs. Colours are perceived by the eyes; sounds by the ears. There are primitive colours and shadows; and such also is the case with tones. There is an agreeable succession of colours as of tones, that is, there are colours and tones which agree with one another, and others which do not. Colours must harmonize, and tones must be concordant. Lastly, the concordance of colours and tones may be considered by the faculties of order and number. In this manner, colours and tones are calculated, and thus are the principles of painting and music established.

XXIX. ORGAN OF LANGUAGE.

Dr. Gall, at thirteen years of age, was vexed that while several of his school-fellows learned by heart even things which they did not understand with great facility, he had the utmost difficulty in engraving in his memory a less number of words. On the other hand, however, he excelled them in the powers of reflexion and reasoning. He afterwards observed, that in those individuals who had so great a facility of learning by heart, the eyes were very prominent. This observation was the commencement of all his future inquiries into psychology. Studying medicine he learned that the functions of the brain are not known, and at the same time observing that great eyes indicate a good verbal memory, he thought, that perhaps different other faculties might be distinguished by the external form of the head. He established an organ of words, the greater degree of developement of which is denoted by the prominence of the eyes. Sometimes the eyes are not only prominent (*Pl.* XVI. *fig.* 1. XXIX.), but also depressed downward, so that the under eye-lid presents a sort of roll, or appears swollen.—(*Pl.* XVI. *fig.* 2. XXIX.) Such persons are fond of philology, that is, they like to study the spirit of different languages. Gall speaks of these two configurations as of two different organs under the name, organ of words, and organ of languages.

It is true that some persons learn easily the spirit of different languages without having a great memory of words, and that other persons easily acquire words without knowing the spirit of any language. It seems however to me, that the memory of words and philology in general, are grounded upon the same special faculty. I shall afterwards show that the judgment and memory of any faculty are not different degrees of activity, but that judgment is only a mode of activity, and that it may exist without great memory of the respective faculty. It seems also to me, that the organ of words must have its laws as well as the organ of colour, tune, and other faculties; and these laws of words constitute the spirit of language. I am satisfied of the truth of this opinion, because the spirit of all languages is essentially the same, just as the spirit of all kinds of music; that is, the laws or principles of music, painting, and language, are constant and every where the same. Music, painting, languages &c., are only modified in different nations according to the modifications in the structure of the organs, and the combinations of these faculties with others. I therefore admit only one organ of language.

Before it is possible to understand the special faculty of this organ, it is necessary to examine the question so often treated by different authors, *viz.* what is the influence of signs upon ideas? According to many philosophers and to the most common opinion, signs may produce ideas. I think with St. Martin, that it is more reasonable to put the opposite question: what is the influence of ideas upon signs? The Institute of France has given the prize to him who developed the influence of signs upon ideas. In speaking of the influence of signs upon ideas or *vice versá*, the question ought to be more distinctly stated. It should be determined whether artificial signs *produce* ideas? I do not think so; on the contrary, I am convinced that no arbitrary sign *produces* any idea, but that ideas precede, and that arbitrary signs follow; that without ideas there would not be any arbitrary sign; and that without having had the idea before, the arbitrary sign has no signification. We have an evident proof of this in persons blind from birth. The word red, green, and the names of other colours, do not produce any conception of colour.

First, I must explain what may be called an idea. Some philosophers call idea, according to the etymology of the word, every sensation which presents an image. But in this sense there are very few ideas; even the sensations of the five external senses would not all deserve this name; for savours, odours, tones, and colours, do not present any image. Other philosophers call idea every sensation produced by means of the five external senses. Others again understand by this expression every sensation produced both by external and internal impressions. Moreover, they speak of ideas as consisting of two kinds, simple and compound. The first kind of ideas are acquired by the external senses; the second are the result of reflexion, as abstract and general ideas. I propose to call ideas the conceptions only of the knowing faculties, and to call *reflection* every function of those faculties which compare, and of which I shall afterwards speak. Now the internal faculties may be active by means of the organic apparatus; and a being may have an inclination, a sentiment, an idea, or reflection, without manifesting them by any sign whatever. But man and animals are destined for society; consequently it is necessary they should communicate and understand their sensations, ideas and reflections; and this communication can take place only by signs.

These signs are natural, and arbitrary or artificial. The natural signs are conformable to every faculty. All beings endowed with the same faculty manifest its activity essentially in the same manner, and all beings endowed with the same faculty understand its natural manifestations. But several beings, all endowed with different faculties, could not communicate their sensations. This law is common to man and animals. Animals, which have a certain faculty in common with man, understand his natural manifestations. The dog, for instance, perfectly understands the signs of anger in his master, because the dog possesses the faculty which produces anger; but the dog will never understand the natural signs of the adoration of God. Hence, it is also obvious that individuals of the same kind understand these natural signs better, if the respective faculties are of equal strength.

This natural language is also known under the name of mimickry. I shall afterwards treat of it with more detail. Here I mention only in general, that every faculty, being active, involuntarily produces particular signs, that is, the natural language common to man and animals as far as their faculties are common. It is true these natural signs produce the respective feelings. On this account their influence is of great importance in teaching the deaf and dumb; for by means of this natural language they are acquainted with the expressions of the various internal affections. It is, notwithstanding, to be observed, that the natural signs communicate principally the propensities and sentiments, and in a less degree the different conceptions and reflections of the understanding. Natural signs indicate the activity of the different intellectual faculties, but not their determinate actions. These are indicated by the second sort of signs, which are not understood before man and animals have had the relative determinate ideas.

The second sort of signs are arbitrary or artificial. I have mentioned that natural language is common to animals and man; artificial language is a prerogative of mankind. This language is the result of the superior intellectual faculties, which contrive and procure the enjoyments of all the other faculties, and of which I shall afterwards treat. In order to communicate his sensations and ideas to others, man makes more use of the artificial language than of the natural, though natural language always and involuntarily accompanies the artificial. As the natural language is expressed principally by voice and muscular motion, so these parts present the most natural and most convenient means of employing artificial signs. The voice is the most commodious; but if these means cannot be conveniently used, as in addressing the deaf, or persons absent, or at a distance, we must have recourse to other means, as to gestures for the deaf, and to those in sight, but not within hearing, and to written signs for absent persons. How little the artificial vocal signs are understood, is evident from different languages. If we wish to communicate certain sensations or ideas to any other person, and to him alone, we are obliged to choose arbitrary and secret signs—signs which he alone understands. Hence artificial signs do not at all produce by themselves any idea, but only in consequence of an arbitrary agreement.

The superior intellectual faculties form the conception of producing artificial signs: therefore the sensations, ideas, and reflections must exist, before arbitrary signs can be invented in order to indicate them. It follows, moreover, that signs are multiplied and modified according to the sensations and conceptions of the mind. Hence there are as many sorts of signs as there are different faculties. There are words or signs to indicate individual objects, that is, nouns and verbs. Other words denote the qualities of the substantives; and in certain languages the adjectives expressed are concordant to the substantives. The signs of the qualities are susceptible of different degrees. As there is a difference between the sexes in living beings, the signs indicate this difference, and admit genders. The number of objects is also considered, sometimes the number alone, sometimes number combined with order, and sometimes with order and time, as one, two, three &c.; or first, second, third &c.; or first time, second time, third time &c. There are yet other words which may be substituted for substantives, whether persons or other objects, namely, pronouns, which are either personal, possessive, demonstrative or relative. Other signs denote any state of the subject spoken of. The subject may be a person or a thing, and its state may be active, passive, or neuter. This state may be affirmed or denied by certain terms in a positive (indicative); conditional (conjunctive or subjunctive); or imperative manner. This state may be, moreover, considered in respect to time—whether it exist at present, or whether it be past, or whether it will take place at a future period. The words denoting the state of the subject are called verbs. There are yet other signs which explain the verbs:—a great number of them are analogous to those which indicate the qualities of the substantives. They denote places, times, numbers, quantities &c. There are also particles which indicate the different operations of the mind. Some particles denote any cause; some, any connexion or conjunction; others, any condition; and others again, any time, any order, any sudden emotion of the mind, (interjections). Thus there are artificial signs for all the operations of the mind. And if all signs may be reduced, in respect to their etymology, to nouns and verbs, their significations must be different, and on this account the terminations have been changed.

Now there is some particular faculty which learns all these particular signs produced by the superior intellectual faculties, according to the activity of all faculties. This faculty which learns the arbitrary signs is quite different from those which produce them, and from those which produce the sensations. There is no proportion between these different faculties. Animals do not at all produce, yet they learn, the significations of arbitrary signs, as far as they are endowed with the respective sensations; tame animals learn in every country the arbitrary language of their masters; they learn even the significations of different sounds of different languages.

Some persons excel in one kind and not in another of these faculties. It is possible to have many ideas without possessing the faculty of learning the arbitrary signs which express them, and to know many words without having many ideas.

Finally, in order to speak, besides the inclinations, sentiments, ideas, or reflections, and the words or vocal signs which express them, we must possess the organs of voice, and the sense of hearing. I have already stated that arbitrary language is more necessary to the manifestations of the intellectual faculties than to those of the propensities and sentiments. The organ of language accordingly seems to be placed in the midst of the knowing faculties, and it occupies a transverse situation.—(*Pl.* I. *fig* 1. XXIX.)

It appears that this organ is composed of different parts, as is the case with other organs. Some persons forget easily proper names, while they recollect the words which denote the qualities of external bodies. Other persons lose, by disease, the memory of proper names while they preserve the memory of words which indicate the qualities of the objects. One Lereard, of Marseilles, after having received a blow from a foil on the orbit, lost entirely the memory of names; sometimes he did not recollect the names of his intimate friends, and of his father, as he asserted in a letter written to Gall, to ask his advice. Cuvier, in the historical eulogium on Broussonet, pronounced at the Institute of France, the 4th of January, 1808, mentions, that this famous botanist, after having recovered from an apoplectic fit, never could recollect proper names nor substantives, though he had recovered his prodigious memory with respect to other objects. He knew plants, their figure, leaves and colours, he recollected the adjectives, but he could not recover their names.

Gall thinks that animals, as monkies, orang-outangs &c. want the power of speech, in consequence of their being destitute of this faculty. It seems to me, that animals have this faculty in some degree; they learn to repeat arbitrary signs, and understand them as far as they have the respective sensations; but I think that animals want speech for the same reason that they do not make fire, have no clothes, or cannot produce food. It is certain that the organs of voice are not the cause why animals have no artificial language. For some animals pronounce words and even whole phrases, nay they understand them, and yet they do not produce any artificial sign.

Certain children who are half idiots do not speak, though they do many things like reasonable persons, and manifest sometimes a great deal of cunning. Their parents, relations, and even physicians, cannot believe in their partial imbecility. Though such children be not deaf, though they can pronounce various words, yet they do not speak. Physicians often look for the cause of this in the organs of voice, as in the tongue, amygdaloid glands, palate &c.; but these parts are never the cause of the want of language. It is true that the organs of voice produce sounds, but they are not the origin or the cause of vocal language. Certain persons deprived of the tongue have yet continued to speak.* It is evident that their pronunciation could not be so distinct as that of other persons, they could not pronounce certain letters; but they felt the necessity of speaking, or of communicating their sensations and ideas, and they actually spoke. On the contrary, these half idiots pronounce single words very well, but they cannot maintain any discourse; they cannot keep up their attention, nor combine their expressions. These children are destitute of the faculty of learning arbitrary signs, as well as of the intellectual faculty of inventing them.

The occasional cause of this partial imbecility is two-fold. It may be a slight hydrocephalus which distends the brain and pushes the globes of the eyes forward, in the same way as a very considerable developement of the cerebral parts situated behind the orbits. Hence, these children present the same external mark, which in the healthy state of the brain denotes a great strength of this faculty. It must however be observed, that this circumstance does not prove the impossibility of discovering and knowing this organ, as certain adversaries of our doctrine have maintained: it presents only a difficulty which must be removed. The

* Bartholin speaks of this in a boy who lost his tongue by suppuration, produced from the small pox:—Huxham saw the same in a girl:—Scheak, Tulpius, Richter &c., speak of similar facts. There is also a dissertation by Aurran, De Feminæ Elinguis Loquela. Argentor. 1766.

state of the whole organization must direct our judgment. The cause of the second sort of this partial imbecility is some real defect of organization: the cerebral part affected with this faculty is either wanting or very little developed. Such individuals never speak. The eyes, instead of being pushed forward, lie deeply in the orbits; the roof of the orbits, instead of being flat, is very convex toward the interior of the skull. Gall has in his collection two skulls of children who had this imbecility. The roofs of the orbits present also this convexity. He possesses also the skull of a woman of forty years of age who never was capable of learning any language.* Thus I admit only one organ of language. Its respective faculty produces similar phenomena in respect to languages or arbitrary signs, as every other intellectual faculty does in respect to external impressions. It makes us acquainted with arbitrary signs, has memory of them, judges of their relations, and produces a propensity to these functions.

* What is to be done with such children? Those of the first kind ought in every respect to be strengthened by physical education, by not employing too incessantly their feelings and intellectual faculties. Sometimes with age the fibres of the brain become stronger; they resist the pressure of the water accumulated in the cavities of the brain. Too early instruction is in all cases hurtful, but it is most so to this kind of children. The disease of the second kind of these children is incurable.

Genus II.—*Reflecting Faculties.*

XXX. ORGAN OF COMPARISON.

Dr. Gall observed various persons, who, in every conversation, had recourse to examples, similitudes, and analogies, in order to convince others; and seldom to reasoning and philosophical arguments. In them he found, in the midst of the superior part of the forehead, an elevation which presented the form of a reversed pyramid, and he named this organ according to its functions, organ of analogy.—(*Pl.* XVII. *fig.* 1. XXX.) This organ is developed in all popular preachers beloved by the crowd, who speak of examples and parables, and who choose their similitudes from facts which are generally known. Gall possesses the skulls of two Jesuits who had this faculty in a high degree. Indeed, in order to persuade and to affect, the speaker or orator must speak by analogy: he must bring spiritual things near to terrestrial objects, and compare them with each other; he must imitate the manner of the preaching of Christ.

The activity of this faculty is very important. It compares the sensations and ideas of all the other faculties; points out their difference, analogy, similitude or identity. It compares, for instance, the functions of the five external senses with the functions of the internal faculties, and therefore it often happens, that the same vocal signs or expressions are applied to both kinds of functions, so that the same expressions are sometimes positive, and sometimes figurative. For this reason the language of every nation proves whether this organ is much or little developed in the greatest number of its individuals. If they have this faculty in a high degree, they are fond of figurative language.

This faculty attaches us to comparison without determining its kinds: every one chooses his analogies from his knowledge, or from the sphere of activity of his other faculties. He who has the faculty of space in a high degree, derives thence his examples; another from figure, or from any other faculty in which he excels. The name and place of this organ are already indicated.

XXXI. ORGAN OF CAUSALITY.

Dr. Gall remarked, that persons who like metaphysical study have the superior part of the forehead much developed and prominent in a hemispherical form, as Mendelsohn, Kant, (*Pl.* XVII. *fig.* 2,) Fichte, and others. It is also remarkable that the ancient artists have given to Jupiter Capitolinus a forehead more prominent than to any other antique head. It seems therefore that they had observed that the developement of the forehead has a relation to great understanding. Gall ascribes to this hemispherical configuration the love of metaphysics. He allows that he does not know its sphere of activity.

I must object, first, that in this configuration are involved both the middle and lateral parts, and the special faculty of the lateral cannot be the same as that of the middle parts. It happens indeed that sometimes the middle, sometimes the lateral parts are much developed. Moreover, the name metaphysics does not designate a special faculty. Hence I ask, what is the special faculty of the lateral parts? To this end we must examine what is the most active faculty in metaphysicians? Their object is to dive into the nature of every thing, even into the nature of God, and into the immortality of the soul. Though I think with Kant and others, that it is impossible to penetrate by reasoning to the bottom of these inquiries, it may however be examined what special faculty endeavours to do this? Metaphysicians endeavour to explain phenomena, but in order to do so, it is necessary to examine the relations between cause and effect. Even philosophers who explain natural phenomena by reasoning admit some cause, and explain the rest by mental induction according to the supposed cause. Hence it seems to me that this special faculty examines the causes, considers the relations between cause and effect, and always prompts men to ask, Why.

Thus the faculty of individuality makes us acquainted with objects and facts; the faculty of comparison points out their identity, analogy, or difference; and this faculty desires to know the causes of all events. Consequently, these three faculties together form systems, draw conclusions, inductions, or corollaries, point out principles and laws, and constitute the true philosophical understanding. The faculty of individuality must furnish a sufficient number of facts in order to permit the two other faculties to draw consequences and establish general principles. The too great activity of this faculty, or the mania of explaining, produces abuses, and has done great harm to natural knowledge, principally to physics and to medicine. It is evident that it is impossible to know final causes which must exist: the only thing we can know is the succession of phenomena, and if one uniformly succeed another, the preceding is considered as the cause, and the following as the effect. This latter kind of mental operation is manifested by the developement of those convolutions which occupy the upper, middle and lateral parts of the forehead.

XXXII. ORGAN OF WIT.

Persons who are called witty, who write like Sterne, Voltaire, Piron, John Paul &c., have the superior external parts of the forehead elevated. —(*Pl.* XVIII. *fig.* 1. XXXII.) Jest, raillery, mockery, ridicule, irony &c., belong to this faculty. It is asserted that wit consists in comparing the resemblance and dissemblance of objects; but the two preceding faculties compare also; and comparing in a philosophical way is quite different from comparing in the witty manner. Thus the essence of this faculty consists in its peculiar manner of comparing, which always excites gaiety and laughter.

XXXIII. ORGAN OF IMITATION.

There is in the brain an organ of a faculty for which Gall never would have thought of seeking. It seems to be a faculty *sui generis*. One of Gall's acquaintance, Mr. Hannibal, governor to the young counts Festerditsh at Vienna, possessed the faculty of imitating in a surprising degree; he was a perfect actor. He desired Gall to examine his head, because he had a transverse furrow in the midst of it. Gall found the hollow place; but he at the same time observed before it, at the superior part of the forehead, a considerable elevation of a semi-globular form. Sometime after, Gall observed in the institute for deaf and dumb persons, an individual, who, the first time he put on a mask at the carnival, imitated perfectly well all the persons who frequented the institution. Gall found the configuration of the upper fore-part of his head the same as that of Mr. Hannibal. In comparing many persons endowed with this faculty at Vienna, and during our travels, we have always found that the developement of this organ coincides with the energy of the faculty of imitating. We therefore admit this organ as demonstrated. Thus persons endowed with a higher degree of developement of this cerebral part, imitate with great precision the gestures, voice, manners, and in general all the natural manifestations of man and animals. They like also to be actors.—(*Pl.* XVIII. *fig.* 2. XXXIII.)

It seems to me that this faculty has a great sphere of activity. This organ is in general more developed in children than in adult persons. It is also known that children learn a great number of things by imitation. They do what they see done by others; they repeat what they hear told. Is it not the same in a great number of adults? Those who possess this organ much developed do not only mention a fact or an action, but they also imitate as far as possible the gestures and voice of the persons and animals they describe.

It is difficult to determine whether, and in what degree, animals possess this faculty. Some birds imitate the song of others. Monkies and apes do various things like man; but do they act by imitation, or because they have certain faculties in common with man? I think that the latter is often the case. In the same way the imitation of singing birds may be explained by the faculty of tone, which perceives, recollects, and repeats the song of other birds.

RECAPITULATION.

In this chapter I have mentioned the particular organs which are discovered, and those which are still to be verified or pointed out. I have shown the importance of determining every special faculty and its sphere of activity, a point which Gall hitherto has too much neglected. I think that I have specified various faculties, and proved the necessity of admitting others. I have divided these special faculties into two orders—and each order into two genera. The first genus of feelings contains the propensities—amativeness, philoprogenitiveness, inhabitiveness, adhesiveness, combativeness, destructiveness, constructiveness, covetiveness, and secretiveness. To the second genus belong self-love, approbation, cautiousness, benevolence, veneration, hope, ideality, righteousness, and determinateness. The first genus of the intellectual consists in the faculties of individuality, form, size, weight, colour, space, order, time, number, tune, and language. In the second genus of intellectual faculties I spoke of comparison, causality, and wit. The last faculty I treated of,—imitation,—belongs to none of the four genera, and acts upon them all. I have considered in every special faculty the necessity of its existence, its use and abuse, and the result of its inactivity. Finally, I have indicated the situation of every organ. A double objection against this kind of considerations is made. Some adversaries object that there are too many organs; others say, that there are not enough. Those who find the organs too multiplied must know that every organ is admitted by the same proofs, namely, by those which establish the plurality of the organs, and that it is verified by experience. The independence of one organ is neither more nor less certain than that of any other organ, and if any proofs be admitted in respect to one organ, they must be agreed to in respect to all other organs. Those who think that we do not admit organs enough, must consider that every faculty may be applied to an infinite number of things; for instance, seeing is always seeing, but what an infinite number of objects may be seen? Hearing is always hearing, and so on as to every external sense. It is the same with the internal faculties. Constructing is always constructing, but what an infinite number of objects may be constructed &c.? Moreover, it is to be observed that a great number of actions (not a great number of faculties) result from the combination of different faculties; and therefore it is not surprising to observe so many effects produced by so small a number of them. Are not twenty-four letters of the alphabet sufficient to compose all imaginable words? The muscles of the face are not very numerous, yet the face of almost every individual presents different physiognomical traces. There are a few primitive sounds or colours; there are only ten signs of numbers; and what an infinite number of combinations do not each of these present? There are probably thirty-three special faculties. Now if we consider all possible combinations of thirty-three faculties and their modifications, it would be indeed surprising if we did not observe such a number of modified functions. Consequently, we do not multiply the organs any more than is necessary, but we follow determinate principles in establishing each of them.

CHAPTER IX.

ON THE DIFFERENT MODES OF ACTION OF THE SPECIAL FACULTIES OF THE MIND.

After having determined the special faculties of the mind and their respective organs, I shall examine the different modes of action of every faculty, a kind of consideration which Dr. Gall has quite overlooked. The modes of action of the faculties of the mind are either general, that is, they may take place in every faculty; or they are common to several faculties; or they are proper to some one special faculty.

The general modes of action which may be applied to all faculties of the mind; to propensities, sentiments, knowing and reflecting faculties, are the following. Every faculty of the mind may be in a state of less or greater inactivity. There are then different expressions in order to designate these degrees; as heaviness, indifference, laziness, negligence, apathy. The complete want of activity is called imbecility, if the faculty never existed; fatuity, if the faculty have been suppressed by any disease. Faculties, being active, may manifest more or less energy; and there are various expressions for denoting this state. To like, for instance, is a general expression; for every faculty, being active, likes, or produces some inclination, some propensity, or desire. Tranquillity and patience designate a less active state of the faculties: impatience, on the contrary, denotes a very active state. One may be quiet and tranquil in respect to one object, and impatient in respect to another. Temperance indicates the best degree of activity of every faculty; intemperance is a too high degree of activity. Other expressions which designate the different degrees of activity of every faculty are inclination, desire, longing, want, ardour, passion, and, in the diseased state, irresistibility. Here it is to be observed that, according to our opinion, passion denotes only the highest degree of activity of every faculty; this expression then must not be confounded with that of affection, which I shall speak of immediately. Thus the first kind of general modes of action of every faculty consists in the different degrees of activity, from imbecility to passion and irresistibility.

The second kind of general modes of action is, that every faculty may be put in action in an harmonious or unharmonious manner, that is, every faculty may be agreeably or disagreeably affected. *Affections* then are only modes of action of the special faculties, and not at all special faculties themselves. They are divided into two classes, agreeable and disagreeable, and every class admits of different degrees. The different degrees of the agreeable affections are called pleasure, joy, and ecstasy. Those of the disagreeable affections are termed pain, grief, and misery. According to these considerations it is easy to rectify the confusion of ideas and expressions observed in different writings in respect to the affections and passions. I have already mentioned that *passion* ought to indicate only the highest degree of activity of every faculty. The word affection, which sometimes is employed as synonymous with passion, which sometimes designates certain special faculties, as pride, ambition, friendship, hope &c., and very often the different modes of action of the different sentiments, as shame, anger, fear, fright, terror &c., indicates, according to us and according to its etymology, only the modes of being affected. Hence affections are only modes of feeling, and belong particularly to certain propensities and sentiments.

The affections of certain propensities and sentiments may also be divided into simple and compound. Simple affections, for instance, are—anger, of the propensity to fight;—fury and rage, of the propensities to fight and destroy;—sorrow, anxiety, anguish, fear, terror, and melancholy, of cautiousness;—pretension, pride, contempt, and disdain, of self-love;—compassion, of benevolence;—contrition, repentance, and remorse, of justice. The compound affections are jealousy, of which egotism forms the basis, and which is modified according to the other organs which desire; envy, which is jealousy without benevolence; shame, the result of love of approbation combined with justice; and consternation and perplexity the result of much cautiousness, much love of approbation, and little propensity to fight &c.

In respect to the intellectual faculties there are also some expressions, as to learn, know, think, and to be attentive, which belong to every one of them. Some other common expressions designate the different degrees of their activity, as perception, memory, and imagination. Gall speaks of four degrees of activity in every organ of the brain: of perception; memory, recollection or remembrance; judgment; and imagination. Gall admits perception in every organ. I make use of the name perception only in respect to the intellectual faculties, and of the name sensation in respect to every faculty of animal life. Every faculty which has consciousness has sensation, and every faculty which perceives impressions made upon it has perception; for instance, any being which feels hunger or physical love has the sensation of hunger or physical love; and any being endowed with the faculty of tone, or which is capable of perceiving tones, has perception of them as soon as its faculty acts upon them. Thus perception is a common expression of the intellectual faculties.

It is the same with *memory* or *recollection*. Memory is the reproduction of perceptions. Propensities and sentiments cannot be reproduced voluntarily, consequently it is impossible that we have any memory of them. It is only possible to remember that they have existed, for instance, that we have been hungry, that we have felt the propensity to physical love &c. But it is possible to renew the perceptions of the intellectual faculties, for instance, the impressions of form, size, colour, tone &c. This internal reproduction of the perceptions of external impressions ought alone to be termed *memory*. It follows that there are as many memories as perceptions, and that memory is not a special faculty. This is also evident from the following reason. If memory were a special faculty, he who has one kind of memory ought to have all kinds of memory. But this opinion is refuted by daily experience. Thus as the perception of every faculty has its seat in the respective organ, so also the memory of every faculty resides in the organ of the faculty, the memory of tones in the organ of tone, the memory of colour in the organ of colour &c.

Gall thinks that memory and remembrance are only two modifications of every faculty. Remembrance is the faculty of recollecting that we have perceived the impressions, and memory is the faculty of renewing the impressions which we have perceived. Gall then considers memory as a higher degree of activity. I must first observe that I do not think that memory is an attribute of every faculty of the mind; for what memory can be attributed to propensities and sentiments? Every faculty of animal life produces some sensation, and the sensations of the intellectual faculties are called perceptions; but as we cannot reproduce propensities and sentiments voluntarily, so they are destitute of memory, and memory belongs only to the intellectual faculties. Moreover, I distinguish *memory* from remembrance. It is possible to have some remembrance of all propensities and sentiments without memory, that is, without reproducing them. In respect to the intellectual faculties, we have sometimes the remembrance of an impression without being able to reproduce the perception; for instance, we may know that we were acquainted with a certain name, we may know that we have heard some music, that we have seen some person &c., but we cannot recollect the name, the music, nor the person. A certain person lost, during a nervous fever, all remembrance; but he spoke French, and was astonished to find that he had learned it; and he played upon a musical instrument without recollecting that he had had a music-master. Sometimes we repeat a song without recollecting where we have heard it. Thus memory and remembrance may exist separately; therefore it seems to me that they do not belong to every intellectual faculty. I consider memory as an attribute of every knowing faculty, and as the second degree of its activity; while remembrance is the same degree of activity of the organ of individuality. This faculty knows what happens in the other organs; and if it reproduce its perceptions, it produces remembrance in the same way as the other knowing faculties produce memory, if they reproduce their perceptions.

Gall considers judgment as the third degree of activity of every organ; and he admits as many kinds of judgments as there are special faculties. Now, in the first place, it does not seem to me that judgment is an attribute of every faculty of the mind; for what judgment have pride, circumspection, and, in general, all the propensities and sentiments? In my opinion, judgment belongs only to the intellectual faculties. Moreover, I cannot imagine that judgment is the third degree of activity. For some individuals judge very well as soon as they perceive impressions, without possessing the respective memory; other persons have a great memory of one kind of impressions, and a bad judgment of the same faculty. It even happens that in certain individuals certain faculties are active in the highest degree, while the same persons judge badly in respect to these very energetic faculties. Hence it follows that judgment is not the third degree of activity. Before I explain what I consider judgment to be, I shall treat of imagination as of the highest degree of activity of every faculty. *Imagination* is the internal activity of the faculties when they are not excited by external circumstances. There are as many kinds of imagination as there are special faculties. It is the same with propensities, sentiments, knowing and reflecting faculties. We are hungry without the presence of food, and we feel physical love when in solitude. Certain persons are cautious, pious, or like to play on musical instruments, to sing, to draw, to travel, to calculate, to build &c., without being excited by external impressions, and they do not repeat the impressions which they have perceived. This degree of activity then is designated by the word imagination in respect to the intellectual faculties. It is essentially the same thing in respect to all faculties in man and animals. In the latter it is called *instinct*. Imagination and instinct then are common expressions, and applied to different kinds of faculties, but they indicate essentially the same thing, that is, some activity excited from within; for if animals sing, build, choose a dwelling &c., without rational determination and only by instinct, they act by their internal faculties. In the same way men endowed with genius in music, mathematics, mechanics &c. act by the energy of their respective internal faculties.

Thus I think that, in respect to the intellectual faculties, there are only three degrees of activity: perception, memory, and imagination. I shall now examine what, according to my opinion, judgment is. I consider judgment as a mode of action of the intellectual faculties. Propensities and sentiments have only the judgment called agreeable and disagreeable. Intellectual faculties are equally affected in an agreeable or disagreeable manner; but there is also some relation between the faculties and their respective external impressions; and every one who considers the relation which exists between his faculties and the external impressions, judges. In this sense, judgment belongs to all degrees of activity of every intellectual faculty. A good or a bad judgment must alone be spoken of. Therefore any intellectual faculty may be very active without having a good judgment. The functions of the reflecting faculties bear particularly the name judgment, but their judgment essentially is only some mode of action of them, as that of the intellectual faculties in general. The faculty of tone, of colour &c., perceive and know the relations of tones, of colours &c., and approve such or such a relation in the same way as the reflecting faculties distinguish analogies or dissimilitudes, and point out the causes of phenomena.

It is obvious that the laws between the external impressions and internal faculties are determinate, and essentially the same in individuals of the same kind; for instance, in man; but that the actions of every faculty must be modified, consequently also the judgments. This idea however will be farther elucidated in the following chapter. Thus it results that judgment is only a mode of affection of the intellectual faculties, and not a degree of their activity; or, in other terms, that it is a mode of quality and not of quantity.

It may be of some interest to the philosophical reader to see the difference between my manner of philosophising and that of others. I shall therefore consider, in a general way, various philosophical systems. The mind, considered as the power of knowing, was the object of all the ancient, and is still the object of the modern philosophical systems. The Greek philosophers paid great attention to this subject. The Romans made no improvement in it; they only learned from the Greeks. The first philosophers made no difference between the considerations or thoughts, and the objects which were considered or thought of; they particularly studied cosmogony, God and the soul. Later philosophers began to distinguish the considerations of the mind from the objects which were considered. There were then two classes of philosophers. Some of them admitted the senses as particular means of acquiring knowledge; others considered their testimony as illusive, and had confidence only in the understanding. Democritus admitted both kinds of knowledge, considering however that obtained by the senses as changeable and not to be depended on, and gave therefore the preference to knowledge obtained by the understanding. In respect to the objects of their philosophical examination, it is to be observed that they considered external objects much more than their own nature.

Socrates gave a particular direction to philosophical investigation. He thought it much more reasonable to examine the things in relation to man, and the principles of his moral behaviour, than to speak of things which lie out of the sphere and reach of the human mind, and have consequently no relation to it. Socrates was in general practical. Plato also distinguished the knowledge obtained by the senses from that obtained by the mind; and observed that the former is individual and simple, while the latter is general. He admitted, moreover, certain considerations of the mind, though destitute of all experience, as necessary and positive.

After the restoration of the sciences, Bacon, Descartes and Leibnitz, excelled, though in a different way, in philosophy. Bacon established, as the basis of his philosophy, observation and induction. The essential point of Descartes's philosophy is thinking and the knowledge obtained by thinking. Like Plato, Leibnitz never gave to his philosophy a methodical arrangement, of which Aristotle was so fond. The philosophy of Leibnitz admits two kinds of perceptions, one without and the other with consciousness: it considers the knowledge by the senses as individual, accidental, and changeable; but that by thinking and reasoning, as general, necessary, and positive. According to it our reasoning power is endowed with principles, and all phenomena are intellectual.

Locke maintained that all knowledge begins with experience, that all conceptions are founded on sensations, but that our mind never can acquire any knowledge of the objects themselves. Condillac, and the French philosophers, agree with Locke about the origin of our knowledge; they never try to examine the things in themselves, but only judge of their relations to each other. Hume not only confines all knowledge to mere experience, but even denies the necessity of causality. Finally, Berkeley was so far from examining the things in themselves, that he even denied the possibility of proving the existence of external objects.

The principal schools of modern philosophy, in Germany, are the critical philosophy, the transcendental idealism, and the philosophy of nature. Kant, the founder of the critical philosophy, distinguished two kinds of knowledge, an experimental (*Kritik der reinen Vernunft*), and another founded on belief (*Kritik der practishen Vernunft*). In respect to the first kind he maintained that it is only relative, subjective, or phenomenal, or that we know only the relation of the subject to the object: we do not know either the subject or the object in themselves, but both only in their mutual relation, and this relation then constitutes their reality to us. The subject is endowed with particular categories which are applied to the object. Whatever is general and necessary in knowledge belongs to the subject; the particular and variable is the attribute of the object. Hence all experimental knowledge is founded upon dualism, upon the union of subject and object. Even the categories, though inherent in the subject, and conceived by the mind from within, acquire objective reality only by their application to the object. Kant, though he considered both subject and object, had however more in mind the subject than the object. He reduced all categories, or forms according to which the mind acquires experimental knowledge, to four kinds—to quantity, quality, relation and modality. The two former concern objects in general, the two latter the relations of the objects to each other and to our understanding. Thus Kant admits notions, independent of experience, as the conceptions of space, time, cause, and others; and considers these conceptions not as the result of external impressions, but of the faculties of the subject: they exist *à priori*, and, according to them, we are acquainted with the objects. Our notions of morality, God, and immortality, are not experimental but belong to the practical understanding and originate *à priori*. Liberty is a postulatum.

Fichte went farther, and established the transcendental idealism. All certainty and reality is confined to the subject, which has knowledge only of his own modifications. By means of abstraction and reflection, he arrived at the intellectual intuition of the subject.

The philosophy of nature rejects subject and object, makes no abstraction or reflection, begins with intellectual intuition, and knows immediately the objects in themselves. It does not consider the objects as existing, but as originating, and it constructs them *à priori* by mere speculation. Absolute existence without qualities and liberty are the basis of this philosophical system.

My mind can never rise to similar conceptions: it is confined to analysis. According to the principle of Bacon, it collects as many facts as possible, compares them, and draws conclusions, or forms inductions. As the system of Locke is the basis of the greatest number of philosophical opinions in England and France, I shall compare its principles with our philosophy. I shall mention how far we agree with him, and wherein our opinions are different. Like him we think that truth is to be placed above all other considerations, that we cannot examine the nature of the mind but only observe its faculties.—We then examine the organs by means of which the different faculties of the mind are manifested.—Like him, we admit innate capacities, but no innate idea or innate principle. He denies the innateness of ideas and principles, because children or certain adults, and even nations, are destitute of them, or possess them variously modified. These assertions however are no proofs, because the inactivity of the faculties is explained by the want of developement of the respective organs; and the different modifications of ideas and principles are the result of the combinations of the different faculties of which I shall afterwards treat in a particular chapter.

Locke admits only one primitive source of the activity of the mind, that is, external impressions on the senses. If we speak of the mind in general, we admit still a second primitive source of its activity which is internal.—According to Locke, the mind begins with external sensations, and by means of its perception, contemplation, retention, comparison, and its faculties of composing and abstracting, it performs all the particular operations or manifestations of thinking and volition: the feelings also primitively result from external impressions, and mediately from the understanding. I, on the contrary, entirely separate the mere propensities and sentiments of the mind from its understanding; they exist independently of it, and are in no proportion to it; they are internal faculties which may be excited by external impressions, but they often are active by their internal power alone. They are innate as particular faculties inseparable from the nature of man, though their determinate actions are not innate.—According to Locke, the moral principles must be proved; I think they must be felt; and reasoning does not produce them any more than it produces the perception of colours without any impression of light upon the optic nerves.

In respect to the understanding, Locke thinks that, by means of the five senses alone and their impressions, it conceives the existence of external bodies, their inseparable or original qualities, as extent, figure, and mobility, and their separable or sensible qualities. I am of opinion that the mind conceives very few ideas by the five senses alone, but that the internal parts of the brain are still necessary. On this account, in treating of the five senses, I spoke of their immediate and mediate functions. To the latter class belong our conceptions of the existence of bodies, their form, size, weight, colour, space, order, and number. The understanding as a reflecting power acts, in my opinion, not only upon the sensations and conceptions of external objects, but also upon the propensities and sentiments; it knows them as well as the external sensations and perceptions, compares them, considers them in different ways, and determines their various relations. Moreover, I do not only admit an internal activity of the mind independent of external experience in respect to the propensities and sentiments, but also with Kant in respect to the understanding, and in respect to experimental knowledge as well as to the reflecting powers. The conception of size, for instance, that the whole is greater than the half, is not the result of experience, but of an internal faculty. In the same way the conception, that there is nothing without cause, is internal. These general conceptions are the attributes of the internal faculties of the understanding, in the same way as the particular feelings result from the propensities and sentiments. The internal general conceptions of experimental knowledge and the particular feelings are calculated for the external world; and the general conceptions of the reflecting powers of the mind are calculated for experimental and sentimental knowledge. This second knowledge then is as positive as the former; for we know our feelings as well as our sensations and perceptions by the five senses. Every determinate action of any faculty whatever depends on two conditions, on the faculty and its object. The activity of every faculty, or the general conceptions of the knowing faculties, and particularly the feelings, are only applied to the external world; and the general conceptions of the reflecting faculties are applied to experimental knowledge and to the feelings. In a perfect state all conditions must agree with each other. If, for instance, external impressions do not agree with the general state of man, and the respective internal faculties, they are illusive; and if internal faculties suppose in the external objects something which experience does not confirm, they are also erroneous: each condition corresponds with another. All conditions must be conformable to the conceptions of reflection, and these must be applicable to the actions of the particular faculties.

Thus, in a perfect system of our knowledge of man, all particular faculties must be pointed out and considered in their concordance. I admit internal powers and intermediate faculties by means of which the internal powers and the external world are brought into communication and mutual influence. The internal faculties are essentially different, and they may act by their internal power, or be excited by respective impressions. Some of them make man act; others modify, assist and direct our actions: some procure for us a relative knowledge of external beings; and others are destined to bring all the faculties into harmony, in order to constitute unity. If such a system be practical, it requires first a knowledge of particularities, and if these be capable of a useful application they must be reduced to generalities and even to unity.

RECAPITULATION.

All that I have said, in respect to the modes of action of the special faculties, may be reduced to two general considerations. Every faculty may be more or less active, and the activity of every faculty may result from its internal energy, or it may be excited by respective impressions. In this respect I have spoken of different names given to different degrees of activity. Moreover, every faculty may be affected differently, and these different affections or different modes of action bear equally different names. Finally, I have given a general view of different philosophical systems, and compared them with my own.

CHAPTER X.

ON THE MUTUAL INFLUENCE OF THE FACULTIES OF THE MIND AS THEY CONCERN THE MORALITY OF OUR ACTIONS.

Having considered the special faculties, their sphere of activity, and their modes of action, I shall now point out their mutual influence. The first thing which is to be examined in this respect is an arrangement relative to the morality of our actions. Whatever philosophers may say against the plurality of the faculties and their respective organs, it is indispensable for a philosopher of nature to admit them in animal life as well as in automatic life. Indeed both lives are more or less complicated in different orders of animals. Organic life, for instance, is very simple in the lower animals. In them nutrition is limited to intussusception, absorption, and assimilation, while it becomes compound by degrees. It is known that in perfect quadrupeds nutrition is the consequence of mastication, deglutition, digestion, chylification, sanguification, respiration, circulation, assimilation, and of a great number of secondary and auxiliary functions, as of the secretion of bile, that of the pancreatic juice, the secretion and excretion of urine &c. It is also known that even the particular kinds of function which contribute to the reproduction of the organization, as intussusception, digestion, respiration, circulation &c., are composed of a greater or less number of apparatus, though the common purpose is always the same, that is, the preservation of the individual.

It is the same with animal life: it is very simple in lower animals, and begins with the sense of feeling. It is multiplied by taste, smell, hearing, seeing, by various instinctive labours, by propensities, sentiments, and intellectual faculties; and finally, in man it is most complicated. For man unites all the faculties which are dispersed in different animals, and he is endowed with various faculties peculiar to himself. Thus it is an incontestable fact, and proved by daily experience, that the faculties of man are multiplied. Let us now consider in what order the faculties of the mind and their respective organs are arranged.

Except the organs of voluntary motion and of feeling, all other organs of animal life are placed in the head. The organs of the faculties which are very common, and bestowed upon all animals, are placed downward in the inferior part of the head, while the faculties proper to man are situated in its highest region of the head. The more noble the faculties are, the higher are the organs situated; and the more important the faculties, the nearer the organs toward the middle line of the head. The organs of the propensities, those of the sentiments, those of the knowing and reflecting faculties, are always placed together. The organs of the propensities and sentiments are larger than those of the intellectual faculties; and the organs of the reflecting faculties are larger than those of the knowing faculties. The whole mass of the organs common to animals is ordinarily larger than the mass of the organs proper to man. The organs of the faculties which assist one another are near each other; consequently the organs may be divided into rubrics: for instance, the organs of physical love, philoprogenitiveness, adhesiveness, and the propensity to fight; the organs of the propensities to fight and to destroy; the organs of the propensities to destroy, to possess, and to conceal; attachment, and love of approbation; self-love, and determinateness; justice, and determinateness; benevolence, hope, and veneration; the organs of space, and form; of number, and constructiveness; of number, colour, and tone; the organs of individuality, comparison, and causality; the organs of wit, ideality, and imitation.

As the faculties are different, it is to be considered whether they are equally important. This is neither the case in organic nor in animal life. All the functions which contribute to the preservation of the body are not equally important: mastication, for instance, and the mixture of the food with saliva, are less important than digestion, circulation, and assimilation. The secretion of certain glands is less necessary than respiration &c. It is the same with animal life. In respect to the external senses, every one would lose the sense of smell rather than that of sight. Who would not lose some talent, as the faculty of drawing, of music, of painting, rather than that of reflection and reasoning; and one sentiment rather than another. Every one is offended if we call him stupid; but not so if we say that he has not such or such a talent. Moreover, if we examine the influence of different faculties of animal life upon the happiness and preservation of mankind, it is easily observed that several faculties are much more important than others. The love of approbation is less important than benevolence. The Christian religion places charity above faith and all other moral faculties. Thus I think it must be granted that the faculties of animal life have different degrees of importance. In this respect they may be divided into two classes, into those which are common to animals and man, and into those which are proper to man. This double nature of man is evident, and has been designated by different expressions; the flesh and spirit, or the animal and man, or the carnal and spiritual part of man.

It is now to be known whether the faculties common to animals and man, or those which are proper to man, are the most important. The answer is obvious, and not subject to any doubt. There is even a general law throughout all nature, that inferior faculties are subordinate to superior ones. Physical laws are submitted to chemical laws; gravity, for instance, is a physical law, and modified by chemical affinity. The particles of any salt are attracted one to another in opposition to their physical gravity, and form a crystal. Physical and chemical laws, though preserved in organic beings, are modified by organic laws. Plants do not increase by juxtaposition; they assimilate heterogeneous substances. The physical laws of motion and hydraulics are preserved in the muscles and in the circulation, but they are subjected to the laws of life. Chemical laws are preserved in digestion, but they are modified by organic laws. Physical, chemical, and organic laws exist in animals, but they are modified by animal laws. Animals take food, plants do the same; but animals choose it, guided by the sense of taste. Plants propagate their species automatically, but animals feel a propensity to do so. Thus in animals the propensities, sentiments, and intellectual faculties, modify extremely the properties of the organization.

The same principle ought to be applied to the laws of human nature; that is, all inferior laws, as physical, chemical, organic, and animal, are preserved in man, but they must be subordinate to the laws of the human faculties. Thus all faculties are not equally important, and certain faculties ought to be subordinate to others. Therefore, in respect to actions, I divide the faculties into three orders. Certain faculties excite man and animals to determinate actions; for example, hunger, physical love, the propensity to fight, to build, to gather provision &c. I call them *faculties of action*. Other faculties are *auxiliary;* they assist and modify the faculties of the first kind. Still other faculties ought to direct: these are *directing faculties.*

The natural law of the subordination of the faculties one to another leads us immediately to the consideration of moral evil and moral good, or to the consideration of the morality of our actions; and, under this head, the first thing to be considered is, whether any evil exists? I shall then examine its origin.

There exist indeed two kinds of evil; one physical, and the other moral. The first kind belongs beyond doubt to the plan of Eternal Providence. For there is a continual opposition throughout all nature. Earth, water and air, present a perpetual scene of destruction and reproduction, of pain and pleasure. It is even obvious that in the same way as temporal good is distributed unequally and without personal merit, physical evil happens often without any corresponding fault. This is the case in animals and man. What have animals done, which are ill-fed and ill-treated in every respect for the services rendered to man? Who is the cause of contagious diseases? If children are begotten in the excess of debauchery, for what reason must they expiate the faults of their parents? When the hail ravages the harvest of the indolent and idle rich man, does it spare the garden of the laborious poor? This melancholy observation has been made at all times. The preacher says, "There is a just man that perisheth in his righteousness, and there is a wicked man that prolongeth his life in his wickedness."* "All things," says he, "come alike to all: there is one event to the righteous, and to the wicked; to the good and to the clean, and to the unclean; to him that sacrificeth, and to him that sacrificeth not: as is the

* Eccles. vii. 15.

good, so is the sinner; and he that sweareth, as he that feareth an oath. This is an evil among all things that are done under the sun, that there is one event unto all: yea, also the heart of the sons of men is full of evil, and madness is in their heart while they live, and after that they go to the dead."* In another passage he continues: "I returned, and saw under the sun, that the race is not to the swift, nor the battle to the strong, neither yet bread to the wise, nor yet riches to men of understanding, nor yet favour to men of skill: but time and chance happeneth to them all."† Physical evil indeed does not only exist, it comes also to all according to established laws of creation. It is also unquestionable that moral evil exists. Although man thinks himself abased by his wickedness and imperfection, he must acknowledge the existence of moral evil. Moses said, "God saw that the wickedness of man was great in the earth, and that every imagination of the thoughts of his heart was only evil continually."‡ David thought, that "there is none that doeth good, no not one."§ Christ taught, that "out of the heart proceed evil thoughts, murders, adulteries, fornications, thefts, false witness, blasphemies."‖ St. Paul speaks of men, "being filled with all unrighteousness, fornication, wickedness, covetousness, maliciousness; full of envy, murder, debate, deceit, malignity, whisperers, backbiters, haters of God, despiteful, proud,

* Eccles. ix. 2, 3. † Eccles. ix. 11, 12. ‡ Gen. vi. 5.
§ Ps. xiv. 3. ‖ Matt. xv. 19.

boasters, inventers of evil things, disobedient to parents, without understanding, covenant breakers, without natural affection, implacable, unmerciful: who knowing the judgment of God, that they which commit such things are worthy of death, not only do the same, but have pleasure in them that do them."* Thus moral evil has existed at all times, as well as physical evil; and it seems that the time when it will be rooted out is yet far off.

Let us now consider the origin and cause of moral evil. I pass over in silence the opinion according to which two creative principles—a good and a bad, were admitted. Neither do I speak of original sin in the first man. Moreover, I do not find any explanation of the origin of evil in admitting free will. It is true, without liberty man never can be guilty, but free-will does not give any idea of the origin of the evil. For as soon as free-will is spoken of, good and evil are supposed: to what purpose should there be free-will, if there were not two different things, good and evil, between which the free man may choose? It is said, that man abuses his liberty; but by what motive does he abuse it, if there be nothing from within which provokes him to act badly? Therefore liberty is not sufficient to explain the origin of moral evil.

Are there any bad faculties? Gall is disposed to admit wicked propensities. He says, that man must submit to the laws of creation, in respect to moral evil as well as in respect to physical evil; that

* Rom. i. 29—32.

no man can say, he is without any temptation; and that all our thoughts and inclinations are not innocent and virtuous. He even thinks that moral evil belongs to the plan of the Creator. I am intimately convinced that no faculty in itself can be bad, and that all innate faculties of man have some aim; that every faculty is necessary; that none leads necessarily to evil; but that every faculty may produce abuses. The faculties are no more bad than every substance. I think with Philo the Jew, Eusebius,* and St. Augustin, that any substance, as fire, water, iron &c., is not bad in itself, and is not the cause of evil; and I think with Augustin,† that evil is not a substance, and that only the abuse is evil. Hence, I consider every faculty neither as good nor bad. The evil consists only in such or such action. Every faculty is necessary, and none of them can be destroyed. The germ contains the faculty of producing all dispositions. Therefore, parents who have lost any limb of their body, as a leg, an arm &c., get children provided with all the parts of the body. But what then is the origin of moral evil?

I have spoken of the law of subordination of one faculty to another. All the faculties, common to man and animals, act in animals in the same way as in man; but it is never said that animals sin or commit a crime. This is a new proof that liberty does not produce moral evil, for animals modify their actions, and suppress different instincts by other

* Præpar. Evang. Lib. vii. n. 22.

† Lib. de Verâ Religione, c. 20.

motives; but no action of any animal can be considered in respect to morality. However, without liberty no man can be guilty. Therefore in order perfectly to understand moral good, and moral evil, we must consider two things, *liberty* and *morality*.

LIBERTY.

Being free is the opposite to being forced; liberty is opposite to irresistibility. Because we maintain that all faculties are innate, our adversaries object that all actions are unavoidable, necessary and irresistible. On the contrary, we think with St. Augustin,* that God, in giving the power (faculty), does not impose necessity. Thus, it is to be known in what liberty consists, and what faculties produce it? Some philosophers attribute to man an unlimited or unbounded liberty. According to them man creates, so to say, his own nature. He is independent of every natural law, and his will is the only cause of his actions. But such liberty in a created being is contradictory. Hence all that can be said in favour of this liberty is mere declamation, destitute of signification and truth.

Others maintain that the liberty of man is absolute, and that he acts without any motive. This is the same as saying, there is an effect without a cause, but such an assertion is against the law of understanding. Moreover, liberty without motives would be contradictory in itself; for a person would

* Lib. de Litt. et Spir. c. 31.

act reasonably or unreasonably, justly or unjustly, well or ill, but always without any motive. Finally, in this supposition all institutions which respect the happiness of mankind would be useless. Education, morality, religion, punishment and reward, would be without effect, because man is not determined by any motive. According to this notion of liberty, we might expect from every one hatred and perfidy as well as friendship and fidelity, virtue as well as vice. Thus, such a liberty is merely speculative. We can only admit a liberty which corresponds with the general laws of nature, and with the nature of man. Hence, if we admit that man acts by motives, then he is placed like all the rest of nature, under the law of cause and effect. This kind of liberty alone has been professed by ancient philosophers and legislators, and only this kind of liberty is supposed by morality and religion, because these furnish the most powerful and most noble motives to direct the actions of man. *Liberty consists in the possibility of doing or of not doing any thing, and in the faculty of knowing the motives and of determining one's-self according to them.* Two things then must be considered in liberty: *will* and *motives.*

A great number of authors deny the existence of free-will, but they confound the propensities, inclinations, lusts and concupiscences, with *will.* The internal satisfaction alone, and will, are two quite different things. Neither man nor animals act freely if they feel only an internal satisfaction. This accompanies the fulfilling of every desire.

The sheep and tiger do not act freely because they are pleased, the former with grazing, and the latter with tearing its prey in pieces. Every faculty of animal life, being active, gives a desire or an inclination. Even man and animal feel these inclinations involuntarily. They cannot change the nature of their faculties and organization. They are forced to feel hunger, if the respective nerves act in a certain manner; they must see, if the light strikes the retina of their eyes &c. Thus man neither has any power upon accidental external impressions, nor upon the existence of internal organs. He is obliged to feel an inclination if the respective organ be excited. Man is not master of this, and he cannot be answerable for it. But these inclinations, propensities, or desires of different organs, are not yet *will*, because man and animals have often inclinations, yet *will* not. A dog, for example, which is hungry, but which has been beaten for having eaten such or such a thing, will not eat the meat you lay down before it. It may be hungry, it wants, but it will not eat.—It is the same with man. How often are we obliged to act against our inclinations. Hence, we see by this experience, not only that the faculties do not act irresistibly either in man or in animals, or that there exists *liberty* or *freedom*, but also that inclinations are not yet *will*. However, freedom presupposes *will*. Therefore it is to be examined how *will* is performed.

In order to have *will*, to decide *for* or *against*, I must know what happens or has happened; I must compare: hence *will* begins with the knowing and reflecting faculties, or with the understanding; therefore the will of every animal is proportionate to its understanding. Man has the greatest freedom, because his will has the greatest extent; and this is the case because he has the most understanding. He knows more than any animal; he compares better the present with the past; he foresees the future; he discovers the relation between cause and effect; and he has traditions. It is even to be observed that not only *will*, but also the participation of the individual, and our accountableness, begin with the knowing faculties. Idiots have sometimes inclinations, but they are neither free, nor answerable. And a man of great understanding and good education is more blameable for a fault, than an uncultivated and stupid person.

The willing faculties however are not given up to chance, but submitted to certain laws; for the laws of the understanding are as determinate by creation as the laws of nutrition. Man cannot will any thing which does not seem good to him. Therefore St. Paul said,—"Being made free from sin, ye became the servants of righteousness."* Thus the first condition of freedom is *will*, which is the effect of knowledge and reflection. The second part of freedom concerns what is to be known and compared, that is, the motives. Will is the decision of the understanding, but this decision takes place according to motives.

* Rom. vi. 18.

I shall now consider the source of the motives. They result principally from the propensities and sentiments, and sometimes from the knowing faculties. Thus the motives are as numerous as the faculties; even their energy depends on the energy of the faculties. Hence, an animal which has many and energetic faculties, has many and vigorous motives, and its freedom is proportionate to the strength of will, and to the number and energy of its faculties or motives. Therefore will, or the faculty of choosing or deciding, is not sufficient, but the plurality of motives is also necessary to freedom. An animal endowed only with one faculty would not be susceptible of any other feeling or motive, and its knowing and reflecting faculties could not act upon this single faculty, so as to make a comparison or choice between motives, because there is only one motive; the animal would act according to its propensity which is active, and the action or inaction of this animal would be only the effect of the action or inaction of this single faculty. On the contrary, if animals are endowed with several faculties, they are susceptible of different feelings. It is true, that in this case the action of one faculty and its respective organ does not destroy either the existence or the action of any other faculty and its organ. But here it must be considered at the same time whether the animal acts without or with freedom. The plurality of the faculties and organs alone is not sufficient. This idea is of essential importance; but was not sufficiently considered in our book on the innate dispositions. If man or animals act by motives without will, they do not act freely. It is only necessary that one faculty be stronger than another in order to act. Give food to a hungry dog, and at the moment when he eats, make a hare run before him; the dog will eat or follow the hare according to its strongest propensity. Here is no freedom, the strongest propensity prevails. On the contrary, if another animal be endowed with the faculty of knowing and comparing; if, for instance, another dog which is fond of hunting, but which has been punished for having followed hares, feel a great propensity to follow a hare which passes before him; if it tremble and have palpitations without pursuing the hare, there is liberty; the dog chooses between different motives. It *may*, but it *will* not. Thus liberty requires will and motives. It begins with the understanding, which knows and compares the different motives, and decides the action according to its choice. The plurality of the faculties produces only the plurality of motives; but will decides. This is the true idea of liberty, but this liberty is not yet moral liberty; consequently, it remains to be examined where the morality of our actions begins.

MORAL LIBERTY.

I have shown that all faculties are not equally important, and that, according to a general law of nature, inferior faculties are subordinate to superior faculties. Hence it is also evident, that all motives are not equally important. In this respect I establish the following principle: all motives which result from faculties common to man and animals do not present any morality, do not suppose any idea of conscience or duty, nor any idea of sin; for no animal is susceptible of these feelings. Moreover, as liberty begins with the understanding, so morality begins with the faculty of duty and justice. Thus moral liberty is will, applied to absolute conscience. Absolute good or moral actions therefore result, if will act according to absolute conscience, or to the motives proper to mankind; and whatever is not conformable to will applied to the motive of absolute conscience, is absolute evil. Man then has not only the greatest liberty, for he has the greatest will and the greatest number of motives, but he alone possesses a moral liberty. As long as he determines himself to any action by motives common to animals, his actions are not primitively moral, though they may be conformable to moral actions. The inferior motives, however, must be employed; they must support, and sometimes supply the place of, the superior motives.

It results from all that I have said in respect to moral liberty, that no accountableness takes place without liberty; that liberty begins with the understanding or with the faculties of knowing and choosing the motives, and of deciding according to them; that man has the greatest liberty; and that the faculties proper to man, produce motives which contribute to the morality of our actions.

According to these considerations, we may easily conceive how moral evil has come into the world, or what is its origin. It consists in actions which are not conformable to the whole of the faculties proper to man. As soon then as any faculty acts without being directed by all the faculties proper to man, these declare that the actions are abuses, or are morally evil. Thus moral good is any action conformable to the faculties proper to man or to the directing faculties; and moral evil is any action which is not conformable to them. Now it is also clear why moral evil has always existed, and probably will always exist. For the inferior faculties exist, and are inherent in human nature: their use is necessary to the preservation of man; but their energy goes easily farther than the faculties proper to man permit; and then it produces abuses. Hunger and thirst will always exist; therefore at all times man may eat and drink more than the preservation of his body requires, and gluttony and drunkenness may easily take place. In the same way, all other faculties may act with greater energy than the faculties proper to man approve of: consequently they may commit errors, faults, sins. Now also it is conceivable, why sins or actions against the moral laws of nature unavoidably produce physical evil. For the laws of nature are determinate in the physical and moral world; they are put in relation; the natural order cannot be changed; and every one who endeavours to change this order, or does not act conformably to it, produces moral and physical evil at the same time. It would be easy for me to examine all faculties and their actions according to this principle. Its consideration is of the highest importance to all those who form moral institutions. No faculty of human nature ought to be neglected, and the sphere of activity of every one ought to be determined. Every intelligent reader who knows history will be convinced of the solidity of this principle.

Moreover, it is evident why man is inclined to moral evil.* We have seen that the organs common to man and animals are very considerable: therefore the manifestations of the respective faculties are very energetic; and for the same reason they submit themselves, sometimes with difficulty, to the superior faculties proper to man, and very seldom to the will alone. The two natures of man which combat one another † are easily understood: that is, man as animal; and man as man, or man endowed with faculties common to man and animals, and with others proper to himself. We easily conceive how certain faculties give laws to other faculties; that is, how laws began; how the law makes sin; how we know sin by the law; how until the law, sin was in the world, but how sin is

* "If we say that we have no sin, we deceive ourselves." 1 John, i. 8.

† "For the flesh lusteth against the spirit, and the spirit against the flesh: and these are contrary the one to the other; so that ye cannot do the things that ye would." Galat. v. 17.—"But I see another law in my members warring against the law of my mind, and bringing me into captivity to the law of sin which is in my members." Rom. vii. 23.

not imputed when there is no law. * For the superior faculties command obedience to the inferior: without the existence of the superior faculties, no sentiment of law, and none of sin, could take place: the inferior faculties may produce the same actions, as is the case in animals; but the superior faculties alone disapprove of them.

It is also explicable how men who have not the law, do by nature the things contained in the law; who, having not the law, are a law unto themselves; and who show the work of the law written in their hearts, the conscience witnessing with them, and their thoughts the mean while accusing or else excusing one another; † and also how there are elect persons. A person endowed with the faculties proper to man in the highest degree, and with very small animal faculties, will act by nature conformably to the faculties which give the law when the animal faculties act with energy. He has no occasion for any law either for putting in action the superior faculties, or for preventing the abuses of his animal faculties, and is really elect. We also understand how a person may dislike and hate evil, and yet do it; ‡ how virtue is possible, and how merit and demerit take place. The inferior faculties ought to be subordinate, and the victory that the superior faculties gain over the inferior is virtue. If the combat be difficult, the merit of vanquishing is great, while he who does good

* Rom. vii. 7.; v. 13. † Rom. ii. 14, 15.
‡ Rom. vii. 15—25.

because he likes it, and has no opponent, has less claim to merit. Finally, it is now easily explained what is the difference between the kingdom of law and the kingdom of love, and why the law cannot be abolished, but must be fulfilled. If in all men the superior faculties were eminently active, and the inferior less and only proportionate, every one should be a law unto himself, or rather every one should do good by love; but the law or its kingdom is necessary, as long as it is necessary to excite the superior faculties, and restrain the activity of the inferior, that is, as their activity is not proportionate, and the inferior not subordinate by love, to the superior.

Here it may be asked, what individual must determine moral good and moral evil, or who can serve as a model to others? I think that it is the same with moral principles as with all other faculties. A great genius for music establishes musical principles which other persons learn; the great painter gives the rules of his art &c. In the same way, he who possesses the faculties proper to man in the highest degree, and who is capable of submitting all his animal faculties to the superior—he who can say, Who can accuse me of any injustice? must establish moral principles.

Those who are acquainted with the preceding considerations, or the spirit of our doctrine, cannot ask, whether it can be reconciled with moral liberty. I am convinced that no philosophy has so distinctly demonstrated the moral liberty, as the physiology of the brain does. Nay it is evident, that our inquiries into the nature of man, instead of being dangerous to the Christian religion, support it greatly, and explain many expressions which have grown out of use, and have almost entirely lost their meaning. It is indeed quite natural, that physical and moral truths support one another, since there is only one Creator. Those who think that inquiries of this kind do not belong to our doctrine ought to consider that all the functions of man, which take place with consciousness, are the objects of our investigations.

Before I finish this chapter, there are to be examined several opinions relative to the questions: What is the aim of all our faculties? and which is, or ought to be, the moral motive of all our actions? The modern physiologists in France maintain that all faculties are destined to the preservation of the individual, and to the preservation of the species. But there are many faculties which do not contribute any thing to this purpose, as the song of birds, the pride of man &c. In respect to the motives of our actions, certain philosophers maintain that man acts only by interest or egotism. This may be said in a very general and indeterminate sense; that is, the greatest number of persons act according to their propensities and sentiments; but many individuals do things which are opposite to their particular interest. Moreover, this maxim of egotism, excluding every idea of right and wrong, can never be established as a moral principle. Other philosophers and moralists wish to reduce all actions to the moral principle of charity as the only motive; but a great number of necessary actions cannot be the result of charity: thus killing animals in order to live upon them, singing, adoration of God &c., do not take place by charity. Others again maintain that faith alone is the true moral motive of our actions. This however is saying that there is no absolute good, and that no action was morally good before the introduction of faith. I do not deny that faith is a very important motive, and indeed one of the most efficacious ones; but I do not think that good actions become good, because they are conformable to faith. I think that they are good in themselves, and that they have been taught because they are good.

I think that all the actions of man cannot be reduced to one single motive. It seems to me that every moralist or philosopher judges more according to his own sentiments, than to the absolute nature of the human race. Man is endowed with several superior faculties, and these all produce moral motives, and are really all considered in the Christian religion. The aim of the actions of man seems to be of three kinds: every individual considers either himself, or other individuals—men or animals, or his Creator. If we examine what faculties produce every kind of these actions, it may be observed that actions relative to the individual himself result from certain propensities, sentiments and intellectual faculties, but that all actions concerning other individuals, and even God, are the effect of propensities and sentiments. This explains the assertion of certain observers, that man acts only by sentiments, and not by understanding. These philosophers considered then the actions of man only in respect to other persons or to society.

RECAPITULATION.

In this chapter, I have considered the mutual influence of the faculties of the mind, with respect to the morality of our actions. With this view I have ascertained, that the faculties are not equally important; that, according to a general law throughout all nature, inferior laws are subordinate to superior ones; that, therefore, the faculties proper to man ought to govern the other faculties common to man and animals; that for this reason man must be free; that liberty begins with understanding, and requires will and motives; that motives are of two kinds; that the faculties proper to man procure moral motives; that, therefore, man alone has moral liberty. By these considerations, I have explained the origin of moral evil; I have shown why moral evil has always existed; why man is inclined to it; why it is unavoidably punished; why it is said that man consists of two natures, which combat one another; why one can do what he would not do. I have elucidated how the law has begun; how persons without the law can do the things contained in the law; how virtue is possible and meritorious; moreover, what is the difference between the kingdom of law and that of love. Finally, I have stated the aim of our actions, and observed that there is not one simple moral motive of our actions, but that all faculties proper to man furnish moral motives, and that they altogether constitute a perfect morality.

CHAPTER XI.

ON THE MODIFICATIONS OF THE MANIFESTATIONS OF EVERY FACULTY.

After having considered the mutual influence of the faculties of the mind, with respect to liberty and morality, I shall examine the mutual influence of the faculties as the cause of their modified manifestations. Hitherto this subject has been too much neglected. I consider it however as one of the most important in anthropology, and very necessary to the elucidation of our doctrine. In philosophy it is commonly admitted, that the world is different to every species of animals, and even to every individual of the same species. This is easily understood, when we consider that all the beings of nature are in relation one to another, and that the beings endowed with consciousness are acquainted with this relation, or, in other terms, perceive various impressions of the other beings. Now it is evident that every sentient being perceives impressions in proportion to the number and energy of its sentient faculties. Hence it results that the world is different to different species of animals; that it is essentially the same, but modified to the individuals of the same species; and that man, who unites all the faculties distributed among different animals, and possesses certain faculties peculiar to himself, has the most extended world; that nevertheless the world of every person is modified, as well as that of every animal of the same species.

I shall now investigate with more detail the modifications of the faculties. First then the manifestations of every faculty itself are greatly modified in different kinds of beings. This is evident from the functions of the faculties common to man and animals, both in respect to automatic and animal life. The liver secretes bile, the kidneys secrete urine, the salivary glands, saliva &c.; these secretions however, and those of other organs, vary in different kinds of animals, and they are modified even in different individuals of the same species. The power of motion is modified in the muscles of different kinds of animals; and in the same way the consistence, texture, and taste of these different muscles vary. The five external senses present various modifications in different species of animals, and in different individuals of the same species. It is yet to be known whether the faculties attached to the brain are also modified in different animals.

If we examine the functions of these faculties, there remains no doubt that it is the same in respect to the brain. The cerebellum, for instance, must be modified in different species, because the individuals of every species prefer others of their own species. Sometimes the manifestations of this propensity, if very active, are quite inordinate, as happens with the sense of taste and with hunger and thirst. It is the same with philoprogenitiveness.

Animals love the young of their own kind more than those of other kinds. The organ of inhabitiveness must be modified in animals which live in the water or upon dry land, in the air, in higher or in lower regions. Adhesiveness presents many modifications in solitary or social animals. Destructiveness and constructiveness are much modified, for animals do not kill in the same way, and the nests of different birds are not built in the same manner. The same observations may be made in respect to all propensities, sentiments, and intellectual faculties. The song of different birds, and their instinct to migrate, are much modified. Thus it is certain that all the faculties of the mind are modified in different species, and in different individuals of the same species. Nay, it seems to me that there are idiosyncrasies in respect to propensities, sentiments and intellectual faculties, as well as in respect to digestion and the five senses. It is known that certain stomachs do not digest some things; that certain individuals cannot bear some odours, savours, colours, and sounds. In the same way, some persons cannot bear certain modes of feeling or thinking, and certain series of tones or of ideas. The same thing is approved or disapproved of according to the manner in which it is proposed.

Another reason of the modified manifestations of the faculties is their mutual influence. I here consider only mankind. It is indubitable that if two or more persons do the same thing, it will be done with certain modifications by every one. As far as the faculties are essentially the same, we find the same actions in all mankind: nay, as far as the individuals of different nations have similar faculties, we observe a certain analogy in their actions and manners, because the actions are the effects of the special faculties and their combinations, and it is only their modifications and different combinations that produce modifications in the actions. Every faculty then may be considered as combined with one, two, or more faculties. Hence it is evident that the number of binary, ternary, and more multiplied combinations is immense, especially if we reflect that every faculty may be modified in itself, and may be more or less energetic. As this object however is of the highest importance in anthropology, and indispensable to the elucidation of our doctrine, I shall treat of it with some detail, and shall choose examples which are easily understood, and may interest every person.

Physical love alone, or combined with adhesiveness, philoprogenitiveness, benevolence, and veneration, or with the propensities to fight and destroy &c., acts quite differently. Two mothers who both love their progeny, but of whom one has philoprogenitiveness combined with much self-love, much firmness, a great propensity to fight, and with little benevolence, while the other has philoprogenitiveness combined with adhesiveness, benevolence, veneration, and with very little self-love and propensity to fight, will love their children in a quite different way. Determinate or individual justice is greatly modified in every person. Every where justice gives laws, but these are modified according to the simple and combined faculties of the legislators. What a difference in the characters of Lycurgus and Solon; but what a difference also in their precepts? Socrates and his disciples looked for happiness as the aim of all our actions. Socrates placed it in moral and virtuous actions; his disciple Aristippus in agreeable impressions on the senses; Anniceris in agreeable sensations and moral feelings; Antisthenes in self-satisfaction; Hegesias, a disciple of Aristippus, in voluptuousness; Theodorus, another disciple of Aristippus, considered every action which procured pleasure as good in itself and as virtuous, because, according to him, man was born in order to be happy. Diogenes, disciple of Antisthenes, raised his mind to an absolute independence: he became almost a savage, and had no respect for any thing.

Every where man believes in one or several Gods; but what a difference betwèen the Gods of different nations! It seems to me that every where the Gods are endowed with faculties conformable to those of the nations or of their religious legislators. The God of the Jews, particularly that of Joshua, and that of true Christians, are represented as extremely modified. If we ask different individuals of the same religion their opinions about God, we hear also of great modifications. St. Peter and St. John, speak of the same God of Christians, the former with fear, the latter with meekness and love. Examine the different opinions of reformers, as of Luther, of Calvin, Zwingli, and of many others. Do we not in them always observe the faculties of the individuals? Who, for instance, does not find in the principles of Melancthon the mildness and moderation of his character? A person endowed with veneration, combined with charity, attachment, and understanding, and without pride, destructiveness and physical love, will establish a system of religious veneration quite different from that of a person endowed with veneration combined with covetiveness, pride, physical love and destructiveness, and without charity and understanding.

Music is different in every nation. We easily distinguish the music of the Italians, Germans, French, Scots &c. Even the music of every composer offers some thing particular, so that connoisseurs distinguish the music of Gluck, of Mozart, Haydn &c. It is the same with painting. All painters are colourists, but there is a difference in their choice of colours and their shades? Does not every painter prefer certain colours as well as certain objects? Hence the difference of the pictures of Titian, Rembrandt, Paul Veronese &c. Those of Paul Veronese show that he was fond of architecture. Albano betrays in his paintings the propensity to physical love, and the faculty of space &c.

The languages of different nations present a beautiful example of the mutual influence of the faculties. I even admit as a principle, that according to the spirit of any language we may judge of the faculties of the nation. I spoke of a faculty which learns and knows the signs denoting the feelings and ideas, and is invented by the superior intellectual faculties. Hence it is evident that a nation must have many signs if it have many feelings or ideas, and that the number of one kind of signs indicates the energy of the respective faculty. The Greek and French languages, for instance, have a greater number of tenses than the German and English languages. The French language, on the contrary, is poor in respect to philosophical expressions, and to those of the sentiments: moreover, it does not like figurative expressions; while the German language is rich in these respects. The German language has also many more signs of disjunction. Frenchmen have the organ of individuality very much developed, and therefore they are fond of facts; but their faculties of comparison and causality are commonly smaller. In consequence of this, the French Institute does not admit analogies as proofs; these consist according to it only in facts; while the Germans are fond of analogies, and perhaps too much so, for they compare and wish to explain every thing. The French expressions are individual without any comparison; therefore many sounds, though the same, denote different objects, and are distinguished only in writing. We see by this that the distinguishing faculties were not very active in Frenchmen. The same defect is apparent from the quite different names which they give to very similar objects, while the German and English languages are more systematic. Even the common German language is conformable to the system of Linnæus. The French say, *bouvreuil*, *chardonneret*, *pinçon* &c., while the German and English preserve the generic name *fink*, or *finch*, and join a distinctive character. In the same way the French say, *rasoir*, *couteau*, *canif*, *serpette*, &c., while in German and English the generic name *messer* or *knife* is retained, and the particular destination is affixed, as *pen-knife*, *cutting-knife*, *pruning-knife* &c. For this reason also the number of the roots of the French language is so considerable, though there is a smaller number of words than in the German which has fewer roots. Another proof that the French language is very unsystematic is, that there is very often an additional adjective, and an additional substantive, in order to designate the same idea. These examples evidently show the influence of other faculties in establishing languages. Thus the number of signs is relative to the special faculties, and the choice of words depends on the faculties which invent the arbitrary signs. The faculty of individuality being the first active in children, we may understand why nouns and verbs are first invented, and constitute almost the whole artificial language of children; and why all words may be reduced to their etymology. By degrees, as other faculties are active, other significations of signs must be pointed out, even if the signs remain the same.

The construction of every language proves also the influence of other faculties. It denotes the manner of thinking of different nations. The French like facts, and direct their attention to them without first considering the cause. It is natural to begin, in general, with the subject; and after that the French immediately join the action of the subject; after this the other circumstances are expressed. If cause and effect are indicated, the French style begins with the effect, and the cause is related afterwards. The German language is quite different; it requires much more attention than the French language. It begins also ordinarily with the subject; then follow the expressions of the relations between the subject and object, which are both mentioned; and lastly, the action of the subject upon the object is expressed. Moreover, if a fact and its cause are spoken of, the cause is ordinarily denoted first and the fact after it. It is known that certain languages admit a great number of inversions, others very few. It appears to me that the former are more logical; for it seems natural that attention should be directed first to the most important object. The French language begins almost always with the fact: hence French understandings consider the fact as the most important. From these observations relative to languages, we may easily conceive that the spirit of any *one* language cannot become general. I am of opinion that the spirit of the French language never will please Germans; and that Frenchmen, on the other hand, will always dislike the spirit of the German, because the manner of thinking, and the concatenation of ideas, are quite different in the two nations.

I am convinced that even different philosophical systems are the result of the different combinations of faculties. He who has more of the faculty of individuality will never neglect facts. He who possesses this faculty in a low degree, and those of comparison and causality in the highest, will begin to philosophize with cause, and construct the world instead of observing its existence. He in whom, on the contrary, the faculty of causality is less active, will reject this kind of consideration, and think that it is unphilosophical to admit a primitive cause. If, in a philosopher, the superior sentiments be very energetic, his mind is directed principally toward moral principles. Hence philosophers think in a different way as well as every other person does, and every philosopher also considers his manner of thinking and feeling as the best. It seems to him to be right, because his consciousness tells him so, but I think he is wrong in considering himself as the measure of the absolute nature of man. I am of opinion that, in examining the nature of man, we ought to make abstraction of our manner of feeling and thinking. We never ought to admit in man a feeling as the strongest, or a manner of thinking as the best, because they are conformable to ours; and we also ought never to deny in others what we do not possess; but we ought only to observe the operations of the human mind in the conviction that all essential kinds of manifestations of the mind, that is, all particular faculties, are inherent in its nature by creation, and to observe how every faculty acts and can act, and under what circumstances it does act. In this manner I think it possible to determine the absolute nature of man, and the infinite modifications of individuals.

It would be easy to quote examples of every faculty, and to multiply them infinitely in order to prove the mutual influence of the faculties upon their actions. But I shall not dwell farther on this principle, except with regard to the abuses of the faculties. I mention this in order to show how it is possible to explain peculiarities which seem inconceivable to those who have no idea of our doctrine, and who therefore deny the possibility of determining the modifications of the functions. Suppose, for instance, that we find two thieves confined to a prison, and we are told that one has robbed a church, the other not: in this case we may distinguish him who robbed the church from the other. If one have the organ of charity much developed, and that of veneration very little, while the other has less charity, and much veneration, we may be assured that the former is the robber of the church. Suppose we see two women in a prison, and are told that one has stolen, and that the other has concealed the stolen things; the former will have the organ of covetiveness larger, and that of the propensity to conceal less, while the second will have the organ of secretiveness much developed. If a certain number of highwaymen be shown to us, and if we wish to point out their chief, we look at the organs of self-love and determinateness. We distinguish a vagabond thief from a coiner of false money: the former has, besides the organ of covetiveness, the organ of space large, and the organ of cautiousness small; the latter has that of constructiveness developed. We may also distinguish dangerous criminals from those who are more easily corrected. Any one who has the organs of the sentiments proper to man very small, and very little of will, but the organ of covetiveness, those of the propensities to fight, to destroy, to conceal, very much developed, will be corrected with much more difficulty than another criminal who has the organ of covetiveness very much developed, but at the same time the organs of the human faculties very large, and who is susceptible of moral *will*.

The mutual influence of the faculties explains also that which is called the association of ideas. This name, according to my opinion, designates only a phenomenon which is quite general, and not confined only to the intellectual faculties. It is true that one intellectual faculty, being active, excites one or several others; but this is also the case with propensities and sentiments. Certain philosophers consider the association of ideas as the effect of habit, and not as a law of our nature; but it must be admitted as an innate principle. Many admit a primitive associating power which I deny. The faculties exist and are associated. Moreover, as the energy of the different faculties varies in different individuals, it may easily be conceived why the facility, with which ideas are associated, is very different in different individuals. Faculties, the organs of which are neighbouring, or which are active at the same time, will easily excite one another. Moreover, the faculties which contribute to the same function will easily excite one another, in the same way in animal life as is the case in organic life. The principles of association are essentially the same as those of sympathy or consensus.

These considerations explain also the principle of mnemonics, and show their importance. It follows however that the same mnemonical rules cannot be equally perfect for every person. One person, for instance, will more easily recollect ideas by the assistance of space, another by that of form, or of colour, or number &c. This consideration, in its whole extent, ought to be employed in education. Never ought one intellectual faculty alone, but all those which are necessary to a perfect knowledge of an object, to be exercised together. I shall farther elucidate this matter by mentioning the opinion pretty generally believed, that every one thinks in his mother tongue. The meaning of this phrase is not distinct, and it should be determined. We do not think in any language in the sense, that the language primitively produces our thinking; for the feelings and ideas exist before the signs, and we may have feelings and thoughts without any sign or language. The signs are only associated to the feelings and thoughts. This association then is extremely quick, and takes place instantaneously; it corresponds to our manner of thinking, and therefore it is said that we think in our native language. This fact however proves the importance of association or mnemonics, or of the mutual influence of the faculties in general. The vocal signs excite again the feelings and thoughts, and in the same way the ideas of form, size, colour, space &c., may reproduce the vocal signs; or size may excite the idea of colour, or colour the idea of order, and so on.

It results from what I have said in this chapter, that in different species of animals, and in different individuals of the same species, the actions of every faculty are modified partly by the modified faculties themselves, and partly by the mutual influence of the faculties. This mutual influence and excitement of the faculties is quite general, and explains, in particular, the association of ideas, and the principle of mnemonics.

CHAPTER XII.

ON THE MUTUAL INFLUENCE OF THE FACULTIES AS CAUSE OF DIFFERENT CHARACTERS AND TALENTS.

A FEW only of the manifestations of man are the result of any single faculty: his actions are mostly the effect of the various combinations of his faculties. It is therefore very important to consider those different combinations of the faculties which produce his various actions. Propensities may be combined with propensities, or with propensities and sentiments, or with propensities, sentiments and intellectual faculties. In the same way every faculty may be combined with faculties of the same or of other kinds. The combinations of the propensities and sentiments with propensities and sentiments produce the different characters of men, and the combinations of the intellectual faculties, one with another, determine the different talents. It is obvious that very few characters and talents are simple, but that the greatest number of them is compound. The agreeable, polite, and amiable characters result from the combinations of amiable, benevolent, and superior sentiments. Determinateness, righteousness, and cautiousness, if predominant, render one serious in general. Characters become good and noble in proportion as the propensities and sentiments, which are common to man and animals, are subordinate to the sentiments proper to man. On the contrary, characters become impolite, disagreeable, immodest, partial, vindictive, corrupt, or untractable, if the superior sentiments be less active, while self-love, covetiveness, and the propensities to conceal, to fight, and to destroy, act with great energy.

The various talents in art and science result from the combinations of feelings with intellectual faculties. The faculty of constructiveness, for instance, combined with number and size, makes mathematical and geometrical instruments; space and number are essential to astronomy; construction, space, and colour, principally constitute the landscape-painter. Religious sentiments and space produce a zealous missionary. Moreover, all artists, as painters, sculptors, musicians and poets, choose their objects, and execute them according to their manner of feeling and thinking. Hence it is evident that all the functions of man are the result of the action and reaction of all his faculties together. These considerations, elucidated by different forms of the heads corresponding to the particular characters and talents, may form the object of an interesting separate book. At all events they lie out of the limits to which this work is confined.

CHAPTER XIII.

ON THE DIFFICULTY OF JUDGING THE ACTIONS OF OTHER PERSONS.

Having considered the modified manifestations of the faculties of the mind, natural order leads me to the consideration of the difficulty of judging the actions of others, and determining the motives of their actions. From the preceding considerations it first results, that the judgment itself of every one must be modified, as well as his other functions in general. Indeed if we attend to the judgments of different individuals in respect to the same object, observe their reflections, and consider what every one praises or blames, we are convinced by experience of the truth of this assertion. It may be admitted as a principle that every one judges according to the natural modifications of his faculties, and according to their mutual influence; and that every one judges others according to his own nature, or that he takes himself as the measure of good and evil. Therefore God is always, and at all times, anthropomorphosed, every one thinking him modified and conformable to his own manner of judging. Therefore also if great philosophers, moralists, and others, who are good-natured, consider, in criminals and malefactors in general, the absolute conscience as their most severe judge, they suppose in them the sentiment which they themselves feel; they judge themselves in the actions of the others. In the same way whatever is conformable to our manner of feeling and thinking is approved, while the contrary is disapproved. Hence, in order to judge well, we must first distinguish the nature of man in general, from the modifications of every individual; and then we must know our own nature and our modifications, in order not to censure others according to our favourite sentiments or ideas. Thus we must judge others and ourselves according to the same measure—according to absolute good and evil.

It is also difficult to judge the actions of other persons, and to determine their real motives, because the motives of the same action or omission may be quite different. It is proverbially said that appearances are deceitful. I shall quote only a few examples; but if we consider all kinds of actions in man, we may observe different motives to the same action in different individuals. One gives to the poor from ostentation, another from duty, a third from the hope of gaining heaven, and others again from real charity. One wishes to be acquainted with the situation of unfortunate persons before he does good; another gives as soon as he sees misery, and every one is his neighbour; his left hand will not know what his right hand does. One goes to church in order to see or to be seen, another in order to get the friendship of the pious, and a third from sincere veneration. One is only clean when he goes into society, another is clean at all times, even in solitude. One cultivates an art or science from vanity, another because he is charmed with it, and a third because he finds in it the greatest advantage &c.

It is the same with the omissions of abuses. One, for instance, does not steal from charity; another steals every where except in the house of those with whom he lives; a third robs churches, but not the poor. One does not steal for fear of being punished, or for fear of doing harm to his reputation, or from a sense of duty and justice &c. In short, every one knows that the same action he has done, or not done, was not always the effect of the same motive. Thus, if an action or omission must be judged, it is necessary to consider whether it is the result of the natural energy, and of the want of the respective faculty, or whether other faculties have influenced this action or its omission. In judging others, we must consider that every faculty may be active by its own energy or by the excitement of other faculties; and that in the same way every faculty may be inactive by the want of its energy, or by the influence of other faculties. Hence it follows, that every function does not suppose a large developement of the respective organ; and, on the other hand, that the organs may be greatly developed without producing abuses. The organ of covetiveness may be very large without stealing; the organ of physical love much developed without committing any abuse &c. The functions of very large organs may be suppressed, though with difficulty. The activity of every organ produces only a corresponding inclination, but the mutual influence of the faculties must regulate their subordination. Thus we cannot judge other persons according to our sentiments and faculties, nor according to one or several of their faculties; but we must consider, besides individual faculties, all their faculties together, and censure then the moral value of their actions, according to the absolute nature of man.

The consideration that every faculty may be active by its internal energy, answers the question so often mentioned in different books: what is the origin of all the arts and sciences? Commonly, in examining this cause, they begin with the highest antiquity, and endeavour to show how external circumstances have produced and improved them. Without denying the importance of external circumstances as exciting powers, we think however that the most important and primitive cause is overlooked, and exists in the innate organization. It is the same as that of the instinctive labours of animals. Man invents and cultivates arts and sciences in the same way as the beaver builds its hut, and as the nightingale sings. Every sentiment and every intellectual faculty may act without external excitement, by its internal activity, and this is the primitive source of the arts and the sciences. Scarcely could Handel speak, before he articulated musical sounds. His father, grieved at the child's propensity to music, banished from his house all musical instruments. But this musical genius was not to be extinguished by the caprice of a mistaken parent. The child contrived to get a little clavichord into a garret, to which applying himself after the family retired to rest, he soon found means to produce both melody and harmony. Nature invented arts and sciences, and revealed them to man by means of the organization. Even the gradual perfecting of arts and sciences takes place, only in proportion as the individuals who cultivate them are possessed of more or less energetic organs.

The consideration of the two kinds of activity of the faculties leads me to the following question, What actions deserve the greatest confidence in respect to morality, those which result from good nature, or those which are the effect of virtue? Though I think that good is always good in itself, and must be approved of, I allow however that the merit of virtue is greater than that of good-nature. I agree with the definition of virtue which all great ancient and modern philosophers have given, as Aristotle, Plato, Cicero, Seneca, Kant, and others. I admit, that those who have vanquished temptations deserve particularly to be rewarded, and that by the possibility of being virtuous or vicious our actions have the greatest merit or demerit.*

* Non virtus est, non posse peccare; cum renunciatur improbitati, statim adsciscetur virtus. *St. Ambrosius.*—Nulla sine labore virtus est. Non est gloriosa victoria nisi ubi fuerint gloriosa certamina. *Idem in Ps.* 118, *et De Off.*—Posse peccare datum est primo homini, non ut proinde peccaret, sed ut gloriosior appareat, si non peccaret, dum peccare posset. *St. Bernardus de Lib. Arb.*—Vita nostra in hac peregrinatione non potest esse sine peccato, sine tentatione, quia profectus noster per tentationem nostram fit; nec sibi quisquam innotescit, nisi tentatus; nec potest coronari, nisi vicerit; nec potest vincere, nisi certaverit; nec potest

Nevertheless I confess that with respect to my own behaviour in society, I trust more to good-nature than to virtue. I love good-nature and esteem virtue. Guided by daily experience, which shows that the greatest number of persons act much more according to their propensities and sentiments, than according to their understanding and will, I never choose for my intimate friends persons in whom the inferior organs are very large, and the superior very small. In the same way I think, that the effect of the intellectual faculties, if they act by internal energy, is much greater than if they are excited by other sentiments.

From the modifications of our faculties results still a very important practical rule—indulgence. It is impossible that other persons should feel and think in every point in the same manner as we do. In the same way as it is generally admitted, that the functions of the five external senses cannot be altogether the same, and without any modification—

certare, nisi inimicum et tentationes habuerit. *St. Augustinus super Ps.* 60.—Quidam in juventute luxuriosè viventes, in senectute continentes fieri delectantur, et tunc eligunt servire castitati, quando libido eos servos habere contempsit. Nequaquam in senectute continentes vocandi sunt qui in juventute luxuriosè vixerunt; tales non haberint prœmium, quia laboris certamen non habuerunt; eos enim spectat gloria, in quibus fuerunt gloriosà certamina. *Isidor. de Summo Bono, Lib. i. c.* 31.—For there are some eunuchs which were so born from their mother's womb; and there are some eunuchs which were made eunuchs of men: and there be eunuchs which have made themselves eunuchs for the kingdom of heaven's sake. *Matt.* xix. 12.—Joy shall be in heaven over one sinner that repenteth, more than over ninety and nine just persons which need no repentance. *Luke*, xv. 7.

as it is proverbially said, *De gustibus non est disputandum*, the internal faculties are also modified, and no one has a right to desire other persons to feel and think in the same manner as he does. A certain indulgence is necessary in society. I do not maintain that every manner of feeling and thinking, and every action, can be tolerated. There is a common touchstone for every individual. The feelings, thoughts, and actions, must be conformable to the absolute conscience of man; all other modifications ought to be tolerated. This principle may be applied to both sexes, to all conditions and ages; and no friendship can be permanent without indulgence as to many modifications in the manner of feeling and thinking. It is the same in religious and other opinions. St. Paul said to the Romans, "One believeth that he may eat all things, another, who is weak, eateth herbs; let not him that eateth despise him that eateth not, and let not him that eateth not judge him that eateth. One man esteemeth one day above another, another esteemeth every day alike. Let every man be fully persuaded in his own mind. We then that are strong ought to bear the infirmities of the weak, and not to please ourselves. The kingdom of God is not meat and drink, but righteousness and peace."

CHAPTER XIV.

ON SYMPATHY AND ANTIPATHY.

THE idea that all the manifestations of the faculties are modified in different individuals leads me also to the consideration of sympathy and antipathy. Hitherto I have considered merely human nature, and every individual only in himself; but throughout all nature beings have some relation one to another. And as we have seen that there are different relations between the different faculties of the same individual, so there exist different relations between the different faculties of different individuals. Indeed it is generally observed, that certain beings cannot exist in the society of others, while others are attached one to another. The attractive and repulsive power of physics, the affinities of chemistry, are well known; but even among vegetables, certain species perish in the neighbourhood of certain others, while other species increase and prosper very well together. Among animals, this law does not only exist in respect to different species, but also in respect to different individuals of the same kind. Certain individuals of the same species manifest a particular attachment one to another, while others cannot bear each other. In a herd of cows, the bull is commonly more attached to one individual than to the rest. Birds are paired by choice &c.

It is the same with mankind. It is however to be remembered, that I do not speak in the same sense of sympathy and antipathy, as many authors do, in speaking of the sympathy and antipathy of the stomach and the five senses. They then describe what is called idiosyncrasy. It is, for instance, known that certain persons cannot digest a particular kind of food. One cannot bear the smell of certain odours, or he is disgusted in tasting a particular savour; he cannot look at certain figures, or touch certain bodies. I mentioned above that I admit idiosyncrasies in the internal faculties, but here I speak of the natural relations between the faculties of different individuals. Certain individuals are as it were born one for each other, while others mutually feel an invincible aversion. This may be explained in the following manner. First, certain faculties of man are eminently social, as attachment and charity; and others are quite the contrary, for instance, selfishness and pride. Moreover, according to a general rule, every faculty desires to be satisfied. Hence every person is pleased with that which is conformable to his manner of feeling and thinking: every one wishes to enjoy; therefore every one likes those who procure or permit to him enjoyments. Hence it is easily conceived, that there is no permanent and invariable combination: on the contrary, the relations vary in the same degree as the modifications of the faculties of different individuals. Before we can decide whether two individuals sympathize or not, we must consider all their faculties. In this respect then, it is obvious that understanding likes understanding, and every kind of intellectual faculty likes a similar faculty. The musician is pleased with music; a mathematician with mathematics; a philosopher with philosophical ideas; a philologist with languages &c. In the same way, the sentiments proper to man look for similar sentiments. A charitable person likes mild and good-natured people; religious persons prefer similar individuals. Thus, all the faculties of the understanding and all the sentiments proper to man, are favourable to society.

It is not quite the same with the faculties common to man and animals. Certain of these faculties are also social, as attachment, adhesiveness, and, in a certain degree, amativeness and philoprogenitiveness; but the greatest number of these faculties are antisocial. Interested persons, for instance, do not like other interested individuals, except as far as their own covetiveness is satisfied. Proud persons do not like other persons endowed with the same faculty. Proud and interested persons not only dislike one another, but they are also disliked by persons endowed with the superior sentiments. This is also the case with the propensities to fight and to destroy. Thus every one will sympathise with those in whose society his faculties are satisfied; and antipathy will be proportionate to the hinderance of enjoyments.

There is a question relative to the consideration of the happiness of man, which may here be spoken of. It is asked whether it is better to have many or few wants in order to be happy? Wants in this sense are synonymous with instincts, inclinations, desires; and they are the result of the activity of the faculties. Hence this question might also be proposed in the following manner: is it better to have more or fewer faculties, and to have them more or less active, in order to be happy? I think that the number and energy of the faculties may be the cause either of a fortunate or unfortunate condition. Every faculty, being active, wishes to enjoy, and he who is possessed by many and energetic faculties, if his faculties be satisfied, will enjoy more than another person who has very inactive faculties; but the former will also be much more unfortunate, if his faculties be not satisfied. Happy is he, who has many faculties which he himself can satisfy; but unhappy are ordinarily those who have many and energetic faculties which can be satisfied only by the assistance of others. Unhappy also is he, whose inferior faculties are the most energetic; principally if they do harm to the health, and if their satisfaction be expensive. Yet it is to be observed that these kinds of wants are rather inordinate actions of the faculties than their natural destination, and it is necessary to distinguish wants, as simple activities of the faculties, from their abuses; here in examining this question, I speak only of wants in the sense of activity of the faculties.

CHAPTER XV.

ON PATHOGNOMY.

After having considered the faculties in particular, their modifications, their mutual influence, and the consequences of this mutual influence, I shall treat of another very important consideration.—It is to be investigated whether it be possible to point out certain and determinate rules, according to which the faculties, and their different modes of action, manifest themselves by certain and positive signs. It seems to me, that a doctrine which teaches the special external expressions of every faculty is possible. I shall speak of it under the name of natural language or pathognomy.

What can be more interesting than the knowledge of man, and the doctrine of the possibility of distinguishing the feelings and thoughts of others? Hence, from the highest antiquity this study has been cultivated, and several opinions in it have been established. Solomon said, " A naughty person, a wicked man walketh with a froward mouth. He winketh with his eyes, he speaketh with his feet, he teacheth with his fingers."* Ecclesiasticus observed, " that the heart of a man changes his countenance, whether it be for good or for evil; and a

* Prov. vi. 12, 13.

merry heart makes a cheerful countenance."* "The envious man has a wicked eye, he turns away his face and despises men."† "A man may be known by his look, and one that has understanding by his countenance, when thou meetest him &c."‡ Aristotle, Cicero, Leibnitz, and a great number of ancient and modern writers have treated of this matter. Lavater obtained great reputation by observations of this kind. This study however is still far from being reduced to fixed principles. I cannot enter into all the details which an exact elucidation of this subject requires; but shall confine myself to general observations, in order to show with what view this study ought to be cultivated. I am obliged to do the same in respect to the subjects of the following chapters. If however circumstances permit, I shall publish farther on these subjects, which are so intimately connected with anthropology, and seem to me of the highest importance.

The first thing to be considered is the difference between physiognomy and pathognomy. The former is the doctrine which judges of the faculties of the mind, according to the form of the solid parts of our body; the latter considers the motions of the mobile parts. Lavater thinks, that it is easy to know the dispositions and the fundamental faculties, by means of the shape of the solid parts and of the permanent features; he considers pathognomy as necessary, but deceitful on account of the dissimulation of man; he prefers physiog-

* Ecclus. x iii. † Ecclus. xiv. 8. ‡ Ecclus. xiv. 29.

nomy, because it is impossible to change and conceal the form of the bodily parts. He insists particularly on the harmony of the different parts. According to him the form of every part, separated from the rest, indicates the form of all other parts and of the whole body. "All that belongs to man arises from the same source. All is homogeneous: size, shape, stature, colour, hair, skin, veins, bones, nerves, voice, manners, passions, love and hatred. He is always one."*

Our observations do not agree with this proposition. In treating of the brain as the organ of the faculties of the mind, I have shown that there is no harmony or proportion of the different bodily parts to each other, but that it is necessary to compare the relation of every faculty to its respective organ. For this reason, all the physiognomical signs mentioned by Lavater, which do not belong to the skull are quite incorrect, and even those relative to the head are only useful hints, because he always considers the shape of the whole head. It follows, that the physiognomical system of Lavater cannot be confounded with our doctrine. We deny all means of measuring the faculties of the mind, which do not consider the developement of the cerebral parts in particular. These are the only physiognomical signs which are drawn from their configuration.

The second kind of signs are pathognomical or mimical. They consist in the motions of the soft

* Tom. ii. fr. 14.

and mobile parts, and indicate the activity of the internal faculties. Their existence is not only evident, but their study is also very important and indispensable to artists, painters, sculptors, actors, and anthropologists. Till the present time, all mimical knowledge has consisted only in detached observations: it has not been reduced to principles. This however ought to be, and seems to me to be possible. I think that the manifestations of every faculty are as determinate as the special faculty itself. I shall endeavour to point out this relation of the faculties to their external expressions. Gall, in speaking of mimickry, considers the motions, gestures and attitude, only in order to prove the seats of the organs. He is right in saying that the motions are modified according to the seats of the organs, but this consideration alone is too limited to explain all the variety of expression. This may be the cause why the greatest number of his auditors are not satisfied with his explanations of mimickry.

Mimickry is divided by different authors according to their knowledge of our faculties. Engel divides mimickry into that of pleasure and pain. I divide mimickry or pathognomy, according to my division of the faculties of man, into that of automatic and into that of animal life. I subdivide the mimickry of animal life into that of the five senses and of the internal faculties. I then consider the expressions of every particular faculty; and after this, the pathognomy of the different modes of action of the faculties. Finally, pathognomy is simple—that of every single faculty; or it is compound—the effect of the activity of several faculties together. In treating of the faculties of the mind, I have shown that there are several general ideas which concern all the faculties, and it is the same with mimickry. Therefore I shall speak first of these general considerations, and then of the particular signs of every faculty.

GENERAL PRINCIPLES OF PATHOGNOMY.

1. As soon as any faculty of the mind is active, all the bodily parts which contribute to the performance of the respective function enter into action.

2. All motions and all activity of the auxiliary parts are adapted to the performance of the function.

3. Though the activity of only one part be necessary to any function, yet all other similar parts enter into action.

4. If any internal faculty be active, and somewhat energetic, though no function is produced, yet the external expressions take place conformably.

5. All external expressions are concordant over the whole body.

6. The external expressions are stronger or weaker according to the activity of the faculties; they are modified in different nations, individuals, temperaments and ages; but the essential is every where the same.

7. The motions and attitude of the body are modified according to the seats of the organs.

8. External expressions are either transitory or permanent.

9. Pathognomy may be studied in respect to truth, or in respect to gracefulness.

10. Finally, pathognomy is to be distinguished from pantomime.

It answers my present purpose only to mention these general principles, but they might be ascertained by a great number of particular observations. The reader however may be desirous to know some particularities as to the special faculties, and I shall therefore shortly examine the simple pathognomy of different faculties. It is unnecessary to particularise certain motions which indicate the propensity to love; such as the head and body drawn backward and downward &c.—In adhesiveness, all the motions express this propensity: there are shaking hands, kissing and embracing; and the motions in general are soft, engaging and insinuating, the voice mild and gentle.—In combativeness, we defend or attack; and all motions then are conformable. No blow, for instance, can be given without contraction of the muscles; and to this end the muscles which must act are always extended in contracting the opposite ones when we endeavour to give any blow. The contraction of the muscular fibres is also observed in the vocal organs. Thus contraction is the characteristic sign of this faculty.—In destructiveness, the instruments which catch and seize enter first into action; man opens the fingers, and carnivorous animals the claws. In a high degree of activity, we gnash the teeth, pinch, scratch, stamp with the feet, and make motions relative to destruction.

In secretiveness all the expressions correspond. The head is drawn downward between the shoulders; the look is from below upward, and turned in all directions; the whole body is contracted. The cunning man feigns not to observe the object he looks at; he goes on tip-toe, and his voice is soft and low. Every sign indicates concealment.—Self-love draws the head and the whole body upward and backward, and keeps them stiff. The eyes are open and staring; all motions are measured; the voice is slow and brief. The inactivity of this faculty, or humility, is indicated by quite opposite signs. The head and body are then bowed forward; and its highest degree is marked by prostration of the body.—In approbation, all the expressions of the face, voice, and motions, are pleasant: the face is smiling; the lips are softly closed; sometimes the mouth is a little pointed; the voice is engaging; the motions light, agile and caressing. This faculty wishes to be looked at by others, and hence all its decorative signs.—Cautiousness lifts the head up and a little backward, puts every sense into activity, and commands attention. We listen and look around us.

In benevolence, all the expressions are lively, quiet, soft, free, peaceful, and without any constraint.—Adoration directs the head upward and forward; the eyes and arms take the same direction; and the fingers are opened as if to receive a certain influence from above. If we need the assistance of God, we call on him, stretch out our hands, close them together as if we would keep him, and say, Do not leave us, we hang on thee. It is objected, that in adoration and saying of prayers, our motions are upward, because we think that God is above. But why do we think that God is above, while we are taught from infancy that God is every where. Moreover, it is a known fact that we turn with the earth; yet at every moment we think that God is above, though after twelve hours the former above is become the below.—In righteousness, and determinateness the whole body is upright and immoveable. The manner of speaking is short, slow, and expressive, and all the motions are slow.

The faculty of individuality desires to know, it therefore excites the activity of the external senses. On this account, even in touching, we listen at the same time.—If we hear music, or play on any musical instrument, we listen and make different motions forward and sideward according to the cadence; the eyes are turned outward upward; and certain persons open the mouth in order to hear better:—if we reckon internally we look downward and sideward:—if we think of time we raise our eyes upward:—if we cannot recollect any name or word, we make different motions with the eye-balls and eye-lids, and we shut the eyes or rub them with the hands.—In deep reflection, we put all the external senses in inactivity, and we keep the hands before the forehead. In general all motions show that reflection takes place in the forehead. Therefore if we reproach any one on account of his want of reflection, we bring the hand to his forehead or to ours, indicating its want. It seems that Sterne placed his finger upon his organ of wit, as his portrait represents him.

The second section of pathognomy concerns the modes of action of the faculties. We have seen that there are general modes of action, and particular ones. It is the same with the mimical expressions. If the faculties be inactive, there is no external expression. In perfect idiots, for instance, the muscles act according to the preponderance of their natural strength; and therefore the flexor muscles, being stronger than the extensors, produce a conformable attitude of the body. In a lazy and stupid fellow, the head hangs forward, the legs are turned inward, and the body never keeps an active position. Moreover, all faculties are either agreeably or disagreeably affected; and there are also expressions common to each of these states. In every disagreeable affection, we endeavour to remove the impressions; but in every agreeable affection, we try to receive and to retain them. In the same way as we stop the nose and propel the air, if the smell be affected by any disagreeable odour, and as we shut the eyes and ears in order to avoid disagreeable impressions on these organs, so we shut all the organs of the senses, contract our limbs, and shorten our body in order to present a smaller surface, when our mind is disagreeably affected. It is quite the contrary in agreeable affections. This consideration may explain the natural signs of yes and no. The former inclines the head forward; the latter shakes it. It seems to me, that in assenting we show our inclination by approaching the object we think of, and by the sign of denying we indicate that we would not be touched or retain the idea.

The different expressions of the particular affections are explained by the particularities of every faculty, combined with the common expressions of agreeableness or disagreeableness.—Anger is disagreeable and is an affection of combativeness.—Anxiety and fear are disagreeable affections of cautiousness. The expressions of disdain are composed of disagreeableness, self-love, and the desire to see any one down and below us.

The third section of pathognomy contains the expressions of different characters. I have mentioned that the greatest number of characters are compound. Therefore the compound pathognomy is as numerous as the characters themselves—almost infinite in modification and combination. The general rule is, that in the compound pathognomy the signs of every faculty are distinct, in the same proportion, as the faculties which constitute the characters are active. I conclude this chapter with the remark, that pathognomy constitutes natural language; that its perfect study is difficult, but very important; and that its acquirement amply rewards for the pains which its prosecution requires.

CHAPTER XVI.

ON MAN AS AN OBJECT OF EDUCATION AND CORRECTION OR REFORM.

After having considered the special faculties of the mind, their modes of action, their mutual influence with all its consequences, and the expressions which indicate the activity of the faculties; after having pointed out the nature of man, we may speak of his education and correction or reform. I commence with the principle that all faculties are innate, and that their manifestations depend on particular organs. Hence education can only take place where the faculties, and the conditions of their manifestations, exist; for education is nothing but exercise, cultivation, and direction.

Those who have the care of education will agree, that the acting powers are not equal in all individuals; and therefore the first object to be examined is the cause of this difference, and the second whether we have any influence, and what, upon this cause. It follows from our doctrine that the material organs produce the difference of the manifestations of the mind. Moreover, as it is impossible to exercise any power upon the faculties themselves, we are obliged to confine our examination to the conditions of the material organs. In this respect, man is submitted to the general law of living nature, and like other organised beings he participates in the properties of his parents as far as their organization is propagated. Hence the first principle of all education, or of all endeavours to perfect mankind, is to observe the same method which is kept in view in perfecting all other living beings, that is, to take care that the germ be good.

Since it is known by constant observation that the disposition to certain diseases, as to the gout, dropsy, consumption, scrofula, deafness, epilepsy, apoplexy, idiotism &c., are hereditary, several authors insist in their writings upon a better choice of marriages for the sake of the progeny. Now as it is indubitable that the manifestations of the mind depend on the organization, and as the organization is propagated, it results evidently that the first means of perfecting mankind depends on innateness; and that, as Moses said, " the sons of God ought not to come to the daughters of man." All ancient legislators considered marriage as a very important point of their institutions. It certainly is a pity that, in this respect, we take more care of the races of our sheep, pigs, dogs, and horses, than of our own offspring.

After birth we have no more immediate power than before birth, upon the faculties themselves; we have some influence only upon the organization. At this period however, strictly speaking, education begins. It is commonly divided into physical and moral; the former concerns the body, the latter the faculties of the mind. But as the manifestations of the mind depend on the body, this division seems to me incorrect. I therefore divide education differently, though also into two parts. I consider, in the first part, whatever contributes to the activity of the faculties, and, in the second, whatever concerns the mutual influence of the faculties, and contributes to the morality of our actions. The first condition of a greater energy of the manifestations of the mind is the developement of the respective organs; the second is the internal constitution of the organs: these two conditions then constitute particularly the object of physical education. The third condition is the exercise, and the fourth the mutual influence of the faculties.

Though we have great power over physical education, yet innateness is, in this respect, of the highest importance; for there are individuals who resist all hurtful influence and prosper, while others are overcome by little impediments. After innateness, the influence of climate, air, light, and food; in one word, of all the hygiena, is the most important. Hygiena then must be studied according to temperaments, ages, professions, and climate; and all its rules must be established according to a long series of observations. The law of nutrition is general throughout all organised beings, why should it not be applicable to man? and as the whole body is modified by nutrition, we are obliged to admit that it is also the case with the nervous system, which is nourished in the same way as all the other systems.

In respect to exercise, as the third condition which contributes to a greater energy of the manifestations, I mention that its influence is observed throughout all living beings, and in the automatic and animal life of man. No exercise however can take place if the organ be not given; and exercise will produce a different effect according to the developement, and the internal constitution of the organs. Here it may be asked whether the organs increase by exercise? This may happen in the brain as well as in the muscles; nay, it seems more than probable, because the blood is carried in greater abundance to the parts which are excited, and nutrition is performed by the blood. But in order to be able to answer this question positively, we ought to observe the same persons exercised and not exercised; or at least observe many persons who are, and many others who are not exercised during all periods of life. Strictly speaking I consider in exercise only the facility of action produced by it. The fingers of an individual, who exercises himself in playing upon the piano-forte, do not always increase, but their motions become more facile and less easily fatigued, than in a person who seldom makes use of his hands. The part of education which concerns exercise is still extremely defective. I shall mention only its chief principles. First, to exercise is synonymous with putting in action: hence in exercising one faculty, we do not exercise another, and every faculty must be exercised in itself. Now what shall we say of that education which endeavours to cultivate feelings by exercising intellectual faculties or mere verbal memory? Is it conceivable that the feelings are not learned? I think that feelings must be educated and exercised in the same way as the intellectual faculties, that is, by putting them in action. Speak to a child of music, but prevent him from hearing music, and never permit him to play on any musical instrument, can you imagine that his faculties of tune will be exercised? Speak to a child of compassion, but let him never see any unfortunate being, will his benevolence be exercised? This consideration explains the ancient adage, *Verba movent, exempla trahunt.*

Moreover, no faculty can be exercised before the respective organ is developed. But certain organs are early developed, others increase later; some act early and last during life, and others begin to act early or late, and do not last till the end of life. This is necessary to be observed in an exact plan of education. The fourth means of activity consists in the mutual influence of the faculties. As I have treated this consideration in another chapter, it is not here necessary to enter into any detail. I shall therefore state several notions, in respect of the second part of education, which concerns the direction of the manifestations.

In order to understand this consideration, it is necessary to recollect what I have said of the sphere of activity of every faculty, of their mutual influence, of their natural arrangement with respect to morality, and of the modifications of every individual. All these notions are necessary to education if it intend to direct action. The basis then of all education is, that the faculties common to man and animals ought to be directed by those which are proper to man. Moreover, it is to be considered that every one is fond of what gives him pleasure. This principle, combined with that of morality, will greatly support the direction of the faculties. If, for instance, love of approbation exist in a child, it cannot be annihilated but must be directed, and ought to be approved of as far as it is combined with superior sentiments; praise is to be given to him for his benevolence, justice, perseverance, and other noble manifestations.

A third principle is, that no action takes place without motive. The motives are of two kinds; superior or inferior. The former are the best; but if the manifestations of the superior faculties be very weak, we must supply their place by the inferior. Man is susceptible of shame, fear, interest, of the enjoyments of the five senses, of hunger and thirst, of bodily pain and pleasure; he likes his personal freedom &c.; hence all these sensations become motives for him to act in different ways. It is also to be considered that, besides the two kinds of motives, the will contributes much to the direction of the actions, because the faculties of will render man attentive to the motives. Hence he who has more will, or whose reflecting faculties are more active, who compares better the present with the past, and foresees the future, who distinguishes easily the relation between cause and effect &c., will consider more exactly the different motives, and will form a different decision from him who pays very little attention to motives.

Another essential point to be considered in education is, that not every one is fit for every condition.

It is a general complaint that very few persons occupy the places to which they are destined by nature. This great error in society will exist as long as the unity of faculties is believed, or as long as the general faculties of the mind are considered as special. This fault will be corrected when the true special faculties are known, and when it is admitted that the manifestations of every special faculty depend on a particular organ. Before I finish this chapter, I may mention another great error of education. Many things are learned in order to be unlearned, and auxiliary faculties often are not at all exercised. To obviate this it is necessary to know not only that every faculty itself must be exercised, but also that certain faculties are required for different professions, arts or sciences. All faculties proper to man ought to be exercised in every one; but among the others a choice ought to be made, and those only which are indispensable or auxiliary ought to be exercised. I conclude this subject with the remark, that those who endeavour to educate mankind ought to begin by studying the nature of the human race.

ON MAN CONSIDERED AS AN OBJECT OF CORRECTION OR REFORM.

I shall here mention only a few general ideas. First, I repeat the remark, that the nature of the human race is by no means known. It is therefore not astonishing that the means which have been and are still employed for correcting malefactors have not succeeded, and neither do nor can succeed. I consider the principles according to which institutions for correction and punishment ought to be established, as the continuation of education, that is, of the education of bad children. Neither all adult persons nor all children can be left to themselves, and to the motives which they find in their minds; for these very often would not be sufficient to produce moral actions, and hence governments are obliged to direct the actions of society. Now it seems to me that the aim of all institutions ought to be essentially the same, that is, to render subordinate the actions of the faculties common to man and animals to those which are proper to man; or, in other terms, to combine the common happiness, as far as possible, with that of every individual.

I have shown that the superior faculties produce laws, and that without them no law could exist. It is now to be observed that every perfect institution ought to be founded upon all the superior faculties together. It is defective as soon as one faculty is neglected. Hence it must be, only according to the absolute conscience, charitable, wise, and immutable. Though the branches of legislation are very numerous, they ought all to have the same aim; and moral and religious precepts, and civil laws, ought to agree with each other. I also think that all institutions, called houses of correction and prisons, ought to have the same aim, and be established upon the same principles. Punishment ought to be only a means of correction, and not the aim of any legislation. The faults and crimes of adults must be prevented in the same way as those of children; I mean, by education in all its extent. Adult persons, who commit faults, ought to be corrected; and, if any one be incorrigible, society must be secured against him. It is not my intention to enter into details; I wish only to call the attention of moralists and legislators to the knowledge of human nature, and to show that our doctrine is intimately connected with all professions in society, and with all the actions of man.

CHAPTER XVII.

ON THE DISEASED STATE OF THE BRAIN, AND ON THE DERANGEMENTS OF THE MANIFESTATIONS OF THE MIND.

Considerations of this kind, in particular, belong to medical men. I shall therefore develope only certain ideas which may have some interest with every intelligent reader. The first distinction to be made concerns the difference between the diseases of the brain with respect to its automatic life, and the derangements of the manifestations of the mind. Indeed the diseases of the brain and the derangements of the mind may be considered separately by philosophers; and they are too often so considered by physicians, though these latter never ought to do so. It would evidently be very odd if we should examine the diseases of the lungs, liver, stomach &c., without considering the derangements of their functions, or to speak of the derangements of respiration, secretion, digestion &c., without thinking of the diseased state of the relative organs. Physicians however, who speak of the derangements of the manifestations of the mind without considering the cerebral organization, proceed in a similar manner. Such an error is immaterial as long as it is not applied to practice; but it is hurtful and unpardonable when it is necessary to act and to cure; or when institutions for such unfortunate creatures are established according to such conceptions.

The importance of these considerations will excuse my digressing from the object of the work. Indeed I should be very happy could I call to them the attention of those who contribute to the foundation and direction of similar institutions, which, according to their common arrangement, I should be inclined to consider as indeed mad-houses, not houses for madmen. They are at least an evident proof of our ignorance as to these diseases. I also think that this ignorance does greater harm to humanity than any kind of insanity. I cannot help confessing my indignation at such institutions, and my pity for these unfortunate creatures who are given up to chance only from our ignorance. What would a physician think of hospitals wherein all patients were received indiscriminately, curable and incurable, cripples, blind, deaf and dumb, with acute, chronic, infectious, and other affections, without any medical arrangement as to the cure of them—where the patients were only separated according to their payment—where the rooms or wards were indeed kept clean, and every hurtful accident prevented, but where all care was confined to a good physical and, as it is called, moral treatment—where the permanent direction of the institution was entrusted to a man who had no idea of any disease, and who considered this object only as a pecuniary affair—and where the plan of distribution of such institutions was committed to architects? Is it not then shocking to be obliged to say, that all these faults may be observed in many institutions for the insane? A great deal is spoken of moral treatment; it is considered as more important than the medical; but I cannot call it rational, because it is not adapted to the nature of man. Even the most obvious idea, the indispensable necessity of separating the patients, is neglected. The most furious and the most gloomy and melancholy, the most imperious and the most fearful and anxious, the idiot and the most vociferous, the most religious and most villanous, are put together. If this be moral treatment, then that expression seems to me synonymous with ignorant and stupid. I shall not detail other defects which may be observed in such institutions. These cannot be perfectly regulated before the nature of the mind and of its manifestations is pointed out. In general it was impossible, till the present time, to conceive the derangements of the manifestations of the mind, because the conditions necessary in the healthy state were not known. But as it is certain that all the manifestations of the mind take place by means of the organization, and as the organization may be deranged, (not the mind itself which is immaterial,) the derangements of the manifestations of the mind are easily understood. It follows then that the physiology and pathology of the brain are submitted to the same principles as those of the other parts of the body, and all that may be taught of these is also applicable to the brain. I shall elucidate this assertion by certain examples.

The manifestations of all the faculties of the mind, or of any one of them, may be deranged in the same way as the whole of automatic life, or certain functions in particular. The diseased state of the brain is sometimes perceptible and sometimes imperceptible on dissection. It is perceptible in the brain in the same cases as in other parts. A defective developement of the whole or of its parts, a too rapid developement, inflammation and its consequences, as serous secretion, suppuration, dropsy &c., are perceptible in the brain as well as in other parts. Many other diseased affections of the brain, as gout, hydrophobia, violent concussion followed by death &c., leave no perceptible traces in the brain any more than blindness by worms is perceptible in the optic nerve, or convulsions in the muscles, or an idiosyncrasy of digestion in the stomach. Hence it is impossible to deny the diseased state of the brain, because it cannot always be seen or touched.

Among the perceptible diseases of the brain, I mentioned its defective or too rapid developement. This latter ought to be adverted to by all parents whose children increase rapidly, principally if this be the case with their head. On account of such rapid increase the organs are not sufficiently strengthened, and such children are exposed to different accidents, particularly to inflammation, and acute dropsy of the brain. I am convinced of this truth by numerous dissections. During the period of dentition they require particular attention. At this age the inflammation of the brain is very dangerous, and easily overlooked, because it is not accompanied with violent delirium, fury and similar signs. Physicians are generally wrong in thinking that violent delirium and fury are the only signs of inflammation of the brain. The bodily strength of children indeed seems to be weakened and even exhausted, and the apparent weakness is often accompanied with numbness, convulsions, coldness, and paleness. It is evident that those who then administer stimulating things do great harm. Did I not think that it would be tedious to the reader, I should describe this diseased state in all its details. But as it is merely medical, I shall not venture beyond the limits of this work. I need only mention, that the mind of delicate children who have a large head, or even of those whose head increases rapidly, though they are in good health, ought not to be occupied too early and too seriously; and whatever carries the blood toward the head ought to be avoided. The faculties of the mind in those children act commonly with too great energy. Certain physicians are wrong in maintaining that round heads are more subject to this disease than those of other forms. Very different and very beautiful configurations of the head are no security against this evil. It takes place most frequently from two to nine years. In general it happens with the brain as with all other parts: the frequency of disease coincides with developement, and the greatest energy of faculty.

Moreover, the brain suffers idiopathically, that is, is diseased by itself, or sympathically, that is, is deranged by the influence of other parts. The abdominal viscera and the brain are in intimate connexion. If the functions of the viscera are disturbed, the actions of the mind are not perfect; and, on the other hand, the affections of the mind disturb the functions of the viscera. If, for instance, we feel grief, the digestion is less perfect. The law of sympathy then between the brain and viscera is the same as between other parts. In the same way as one gets a cold, another a tooth-ache, a third an ophthalmia, a fourth a diarrhœa, and all from the influence of cold and wet feet, so in different persons who feel grief, the functions of different viscera are disturbed, and *vice versá*.

Finally, the curative method must here be modified according to the individual, in the same way as the treatment of every other disease. Hence it is obvious that the brain is subjected to the same laws of nutrition, increase and disease, as every other part of the body; and if other parts may be cured, the brain must be curable too. It is also obvious that the propensities, sentiments and intellectual ideas, are to the brain what food is to the stomach, and air to the lungs; and that therefore the moral treatment of insanities belongs also to their curative method. Those therefore are certainly wrong who permit to madmen a kind of mental occupation, about which their mind is deranged. It is on the other hand a great mistake to think that moral treatment alone is sufficient.

It may now be conceived why we cannot accede to the common division of mental diseases. This is founded upon a division of the faculties of the mind. But I have shown that, till the present time, the particular faculties of the mind were not known; and hence it was impossible to make a true division of their derangements. If my division of the faculties be true, the derangements of the mind will be divided in the same manner. There will be derangements of propensities, of sentiments, and of intellectual faculties. All derangements will be considered as the result of the disturbed organs immediately or mediately. Every reasonable mode of treatment then must be determined according to the cause; and if this cannot be pointed out, the whole curative proceeding will be vague and merely experimental.

The following consideration relative to the derangements of the mind may show how little the spirit of our doctrine is known, even by those who oppose it. Pinel supposed, that we pretend to know in general the disposition to mental alienation by the external form of the head. To illustrate this matter, he caused two skulls to be drawn which have almost the same form. One of these skulls belonged to a madman, the other to a person of sound faculties. Pinel intends, by this, to prove that it is impossible to distinguish madness by the configuration of the head. Yet he measured the skulls in all their dimensions, compared both halves one with another, and all their dimensions according to the proportions of the Apollo de Belvidere, in order to point out the reason of madness. At the end however he says, "I must be on my guard against hasty conclusions. I confine myself to historical details, without pronouncing that there is a connexion between idiotism and faults of conformation."

I have explained that the size and form of the whole head do not at all indicate the particular faculties of the mind; and on this account also the form of the skull cannot indicate the derangement of the faculties. We except however idiotism from birth; for we are not of the opinion of Pinel, who perhaps did not see a sufficient number of such heads. If we find any observation confirmed and proved at all times and every where, we consider it established, being convinced that the laws of nature are constant. If we do not admit this conclusion, there will be no physical truth. We think that in a too small and defective brain, the mind cannot manifest itself. Moreover, I ask Pinel, whether a tongue which gives an appetite for coal, chalk, dirt &c., has a peculiar form? whether eyes which see during night differ in shape from eyes which see only in day-light? Every one before he falls into any disease has the same shape of the bodily parts. In the same way, brains of all forms may fall into disease; and the heads of madmen therefore must be different as well as those of persons endowed with sound faculties. It is, however, a positive fact, that certain configurations of the head are observed in certain derangements of the mental faculties. In idiots from birth, the head is too small, or too large, that is, extended by water. Epileptic persons have in general small heads, and the vertex very high in comparison to the rest of the head. Moreover, if any organ be extremely developed, and the person become weak and irritable, it is natural that this developed organ should manifest a greater activity than the other organs. However, it cannot be maintained that other organs, which are less developed, cannot become extremely irritable and produce fixed feelings or ideas.

I shall farther speak only of one circumstance, which is of the highest importance, and deserves the attention of all observers, but which is too much neglected. Many diseased affections appear particularly at certain periods. The cause of any disease may be permanent, but it produces greater derangements at certain times than at others. These periods of irritability have also the greatest influence upon madmen. Certain authors consider the moon as the cause of this periodical excitement; but it coincides with all the phases of the moon, and therefore its real reason seems to be unknown. It is indubitable that these periods of irritability exist. They affect all persons, men and women, at least once within twenty-eight days. Weak and irritable persons feel their influence twice within the same time. Almost every one is from time to time, during a few days, more irritable; his mind is not disposed to any application, it is easily fatigued; his thoughts are not consecutive; he wishes to remove all impressions of the senses, and is sometimes offended by things which at other times seem indifferent; he is morose without reason, and more disposed to quarrel or to dispute; his appetite is less, and all his excretions more copious &c.

At this period of irritability a greater number of quarrels, disputes, duels, and of certain crimes, as murders from revenge, take place. Therefore, such periods never are the moments the most favourable for conciliating two disunited persons. Moreover, at these periods there is an exacerbation of symptoms in all chronical diseases. Those who suffer by piles are more tormented. Hemoptesis, abortions, and natural births, are more frequent. It is an ancient observation, that in certain weeks there are few births, in others they are numerous. This is now explained, since the delivery coincides with the period of the tenth menstruation, and the menses coincide with these periods of irritability. This explains also, why, at certain periods, many women have their menses, and at other times very few. At these periods, women deserve also more indulgence on account of their irritability.

These periods are shorter or longer, weaker or stronger, according to the season, weather, temperature, and the individual irritability of men and women. But a great number of individuals of both sexes, and always the same individuals, are subjected to the same periods; and every one according to his own sensations may determine, whether the effect of the periods are weaker or stronger, shorter or longer, in other persons who belong to his class. The cause seems to be quite general. Its influence however is not the same upon all individuals, because strong persons feel a similar influence only once, and weak persons twice during the same time.

These periods of irritability explain why certain persons are subjected to different sorts of periodical fits; why others see spectres only once or twice in a lunar month; and why there are more suicides at one time than at another; why sometimes their melancholy seems to be cured, but returns; why such individuals being *saved* or prevented from destroying themselves, after a few days are glad of being alive; why yet a short time after, they make new attempts to finish their existence; and why they repeat them three, four, five, and more times, till at last they succeed. Suicide may be the result of despair, of offended pride, of shame &c., but it undoubtedly is very often produced by disease; for the propensity to suicide is endemical in certain countries. At Geneva, about Jena, Halle, Hamburg &c. it is very frequent; at Vienna it is very rare. Sometimes suicide is epidemical. It is more frequent at certain times than at others: hence its cause lies in the bodily constitution, excited by external influences. Finally, like many other alienations of the mind, suicide is even hereditary. Different symptoms which are observed in such unfortunate creatures prove evidently a diseased state. At the beginning there is great disorder in the functions of the viscera of the abdomen: eructations, flatulencies, an inordinate appetite, irregular evacuations; in women, derangement of the menses. The complexion becomes sallow or yellowish, and of an earthy colour, principally about the nose and mouth; the face loses all its vital lustre; the eyes are dim and weak; the white of the eyes is of leaden hue. In other individuals, the face is high-coloured, lively and much animated, and the eyes are inflamed. Certain patients of this kind grow lean, others preserve their plumpness and strength. Sometimes the whole surface of the skin is insensible, and the patients complain that their hands and feet are stiff and benumbed. More frequently the sensibility of the skin is increased; they feel either in the whole body, or only in certain parts, principally in the thighs and feet, a burning heat. Sometimes this heat disappears suddenly at one place, and appears again at another: it is often felt in the intestines. The greatest number of these patients are weak and pusillanimous, so that very strong men tremble before children. Certain patients torment other persons around them in different ways, and about inconsiderable things; they are displeased with all; they see nothing but wickedness and misfortune; even when their situation might be the happiest, and all external circumstances indicate prosperity, they despair, and fancy that they and their family may die of hunger and misery. Certain individuals imagine that they are despised or persecuted by every body. The greatest number of these patients feel a permanent pain above the root of the nose, and in the midst of the inferior part of the forehead, and sometimes at the top of the head. Others complain of an insupportable tension in the forehead, and of a painful constriction in the region of the diaphragm. Sometimes they suffer convulsions, suffocating anxieties, an involuntary inclination, or secret impulse, to kill themselves. Certain persons cannot take the resolution of communicating their feelings to other persons. Sometimes all these symptoms disappear suddenly, but a short time after they come back. Certain patients have particular ideas, inspirations, and visions. At the beginning they judge of their state exactly; they consider these feelings and ideas as illusions, and they combat them with moral and religious principles; but when the disease increases, they are persuaded of their reality, and they sometimes fancy that they see angels, or hear voices which excite them to put an end to their life.

Certain individuals are still more unfortunate. They wish not only to kill themselves, but begin to destroy other beloved persons, as children, wife, or husband. They struggle sometimes for several years against such dreadful ideas; they sometimes carry about them destructive weapons for several years, unresolved concerning the manner, place, and time, when they shall kill themselves and their relations. Certain persons keep a note book which shows evidently the derangement of their mind: they sometimes write down,—I am mad, I am distracted, and (thinking of self-destruction) I shall yet do it.

Such patients are commonly considered as turbulent, exalted, whimsical and fractious men. They are ill-treated, reproached or derided; they are even accused as impious, instead of being treated with mildness, felt for, and trusted to the attendance of a philosophical physician. Those who consider this disease as incurable are mistaken, though it is true that, given up to itself, it most commonly terminates in involuntary destruction. When the catastrophe happens, different external and accidental circumstances are considered as its cause. If a husband kill his wife, or a wife her husband, or parents their children, a great number of persons consider these actions as the most horrible crimes, because they destroy the life of other individuals on being tired with their own; but the judgment of a philosophical physician is quite different. He perceives in these deplorable actions only the signs of a terrible disease, most deserving of pity. The opposition of the actions of such unfortunate persons to nature, ought to have excited the attention and reflection of every one who studies mankind. It is impossible to conceive that a wife who loves her husband, and *vice versâ*, and parents that love their children, will assassinate them as long as their mind is not at all deranged. Add to this, that murderers of this kind have neither terrestrial advantage nor revenge in view; that after those actions they kill themselves, or accuse themselves before a magistrate and ask for death. How is it possible not to observe here a derangement of the mind, especially if a true picture of the preceding symptoms be taken into consideration?

The skulls of such unfortunate creatures also prove the disease of their brain, for the bone is in general dense like ivory. From this diseased state it is easily conceived, why certain observers have found the corpus callosum altered in suicides; because, if the whole brain be in a diseased state, the corpus callosum, as the commissure of both hemispheres, must be altered too. Thus it is certain, that suicide is very often the result of disease, and is influenced by the periods of irritability.

Many other considerations relative to the derangements of the manifestations of the mind belong only to the study of medical men, and I pass them over in silence.

RECAPITULATION AND CONCLUSION.

It results from all that I have ascertained in respect to the knowledge of man, that his nature is as determinate as that of every other created being; that the manifestations of the mind depend on the organization; that even the manifestations of every particular faculty of the mind depend on a particular part of the brain, termed its organ or instrument; that this truth however does not lead to materialism; that it is possible to point out the particular functions of every cerebral part by its size, though the functions do not depend only on its size, but also on its organic constitution, on its exercise, and on the mutual influence of the faculties; and that the size of the cerebral parts is distinguished by the exterior of the head. I have determined also the special faculties of the mind, and indicated their respective organs; I have treated of the modes of action of the special faculties, and of the effects of their mutual influence; of moral liberty; of the morality of our actions in general; of the modifications of the manifestations of the mind in every individual; of different characters and talents; of the difficulty of judging exactly the actions of other persons; of the law of sympathy and antipathy between different individuals; and of the external expressions or mimical signs, which indicate the activity of every faculty. Finally, I have entered into certain general considerations on education, on the correction of malefactors, and on the derangements of the manifestations of the mind.

Explanation of the Numbers referring to the various Organs marked in the Frontispiece and other Plates.

I. Organ of amativeness, (*physical love.*)
II. ——— philoprogenitiveness, (*love of offspring.*)
III. ——— inhabitiveness.
IV. ——— adhesiveness.
V. ——— combativeness.
VI. ——— destructiveness.
VII. ——— constructiveness.
VIII. ——— covetiveness.
IX. ——— secretiveness.
X. ——— self-love.
XI. ——— approbation.
XII. ——— cautiousness.
XIII. ——— benevolence.
XIV. ——— veneration.
XV. ——— hope.
XVI. ——— ideality.
XVII. ——— conscientiousness.
XVIII. ——— firmness or determinateness.
XIX. ——— individuality.
XX. ——— form.
XXI. ——— size.
XXII. ——— weight.
XXIII. ——— colour.
XXIV. ——— space.
XXV. ——— *order ?*
XXVI. ——— *time ?*
XXVII. ——— number.

4

Explanation of the Numbers and Signs marked in the Anatomical Plates.

1. Decussation of the pyramidal bundles.
2, 3. Accessory nerve.
4. Hypoglossal nerve.
6. Vocal nerve.
7. Glossopharyngeal nerve.
9. Auditory nerve.
10. Abductor nerve.
11. Facial nerve.
12. Fifth pair of nerves.
16. Corpus mammillare.
20. Optic nerve.
18, 19, 21. Roots of the olfactory nerve.
23. Bulb of the olfactory nerve.
34, 35, 37, 38. Transverse bands.
47, 48. Place of the organ of amativeness.
48, 49. ——— philoprogenitiveness.
49, 50. ——— inhabitiveness.
50, 51. ——— self-love.
51, 52. ——— firmness.
52, 53. ——— veneration.
53, 54. ——— benevolence.
54, 55. ——— comparison.
55, 56. ——— individuality.

57, 58, 59. Septum lucidum.
61. Commissura anterior.
62. Centre of the fundamental part of the cerebellum.
63. Fibres which are connected with the septum lucidum.
70. Nervous bundles of the organs of the feelings.
86, 87, 88, 90. Layer of fibres in the middle line of the nervous apparatus.
E. Pineal gland.
M. M. Third ventricle.
S. Ganglion or corpus dentatum of the cerebellum.
a. Corpus olivare.
b. Great commissure of the cerebellum (pons Varolii.)
c. Entrance of the anterior pyramids into the pons.
e—*e*. Corpus restiforme.
f. Interior of the pons.
g. Crura cerebri.
m. *m*. Fourth ventricle.
λ μ λ. Corpus callosum.
φ. Canal of communication between the third and fourth ventricle or aqueduct of Sylvius.

THE END.

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ERRATA.

Page 24, line 17, *for* internal *read* external.
—— 55, —— 30, — Zups *read* Lups.
—— 126, —— 12, — Laneisi *read* Lancisi.
—— 129, —— 14, — long *read* bony.
—— 205, —— 31, — sure *read* surer.
—— 258, —— 20, — Rudolphe *read* Rudolphi.
—— 349, in the note, *for* huc *read* luce.
—— 351, ———, — de acribus Aquis *read* de Aeribus, Aquis et Locis.
—— 371, line 11, *for* exite *read* excite.
—— 444, —— 20, — Hadyn *read* Haydn.
—— ——, —— 21, — Zumstey *read* Zumsteg.
—— 455, —— 30, — Scheak *read* Schenk.
—— 511, —— 31, — and is invented *read* and invented.

Fig. 1.

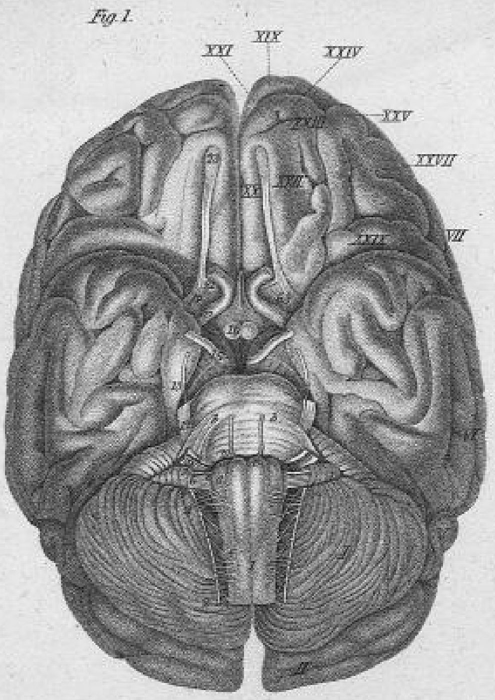

Fig. 2.

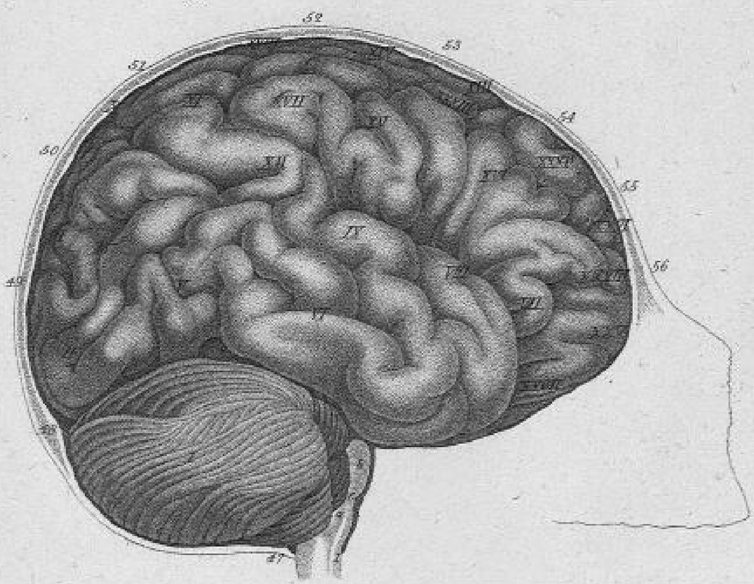

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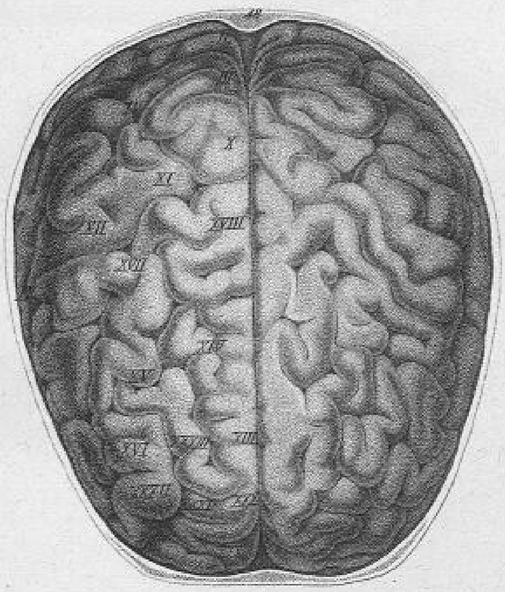
Fig. 1.



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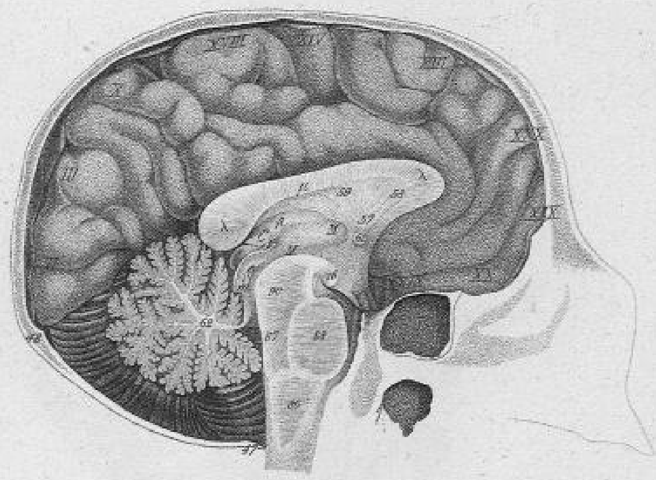

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Plate III.

Fig. 1.

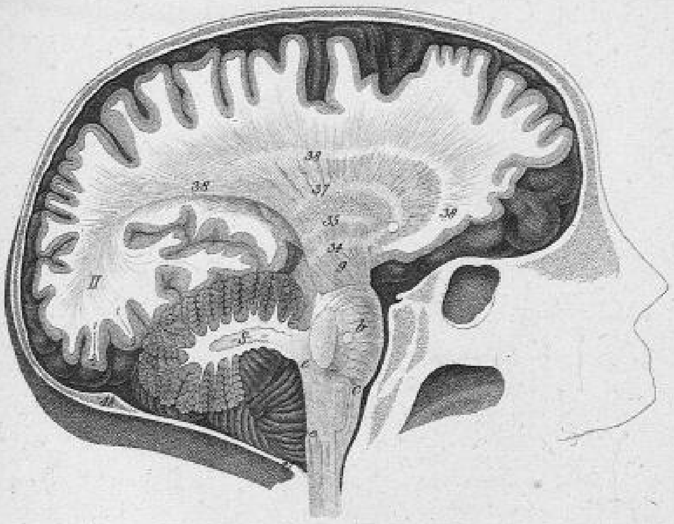

Fig. 2.

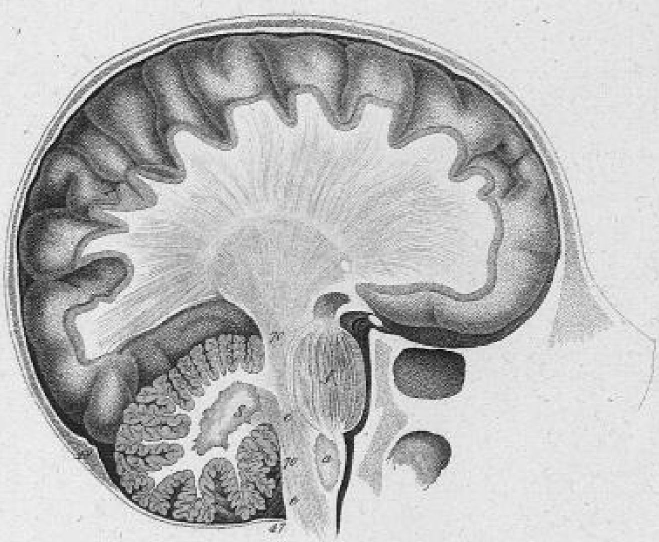

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Fig. 1.

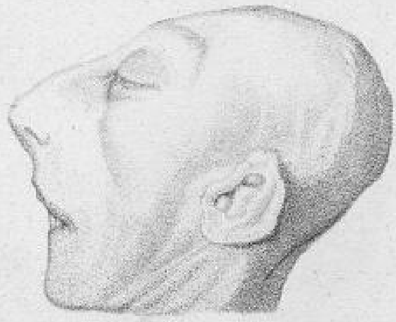

Fig. 2.

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Fig. 1.

Fig. 2.

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Fig. 1.

Fig. 2.

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Fig. 1.

Fig. 2.

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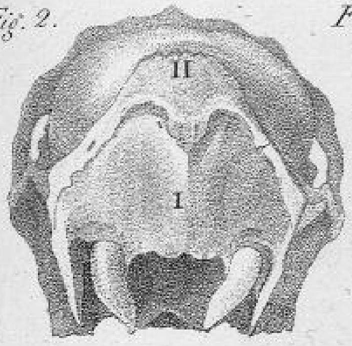
Fig. 2.



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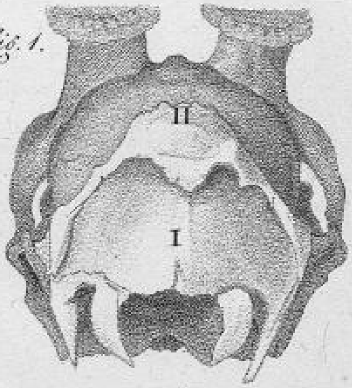
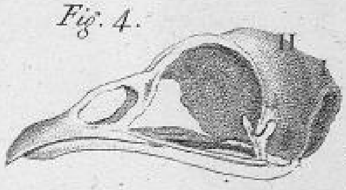


Fig. 4.



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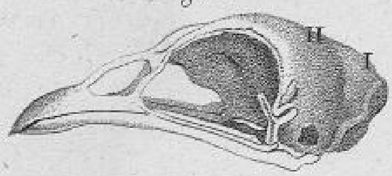

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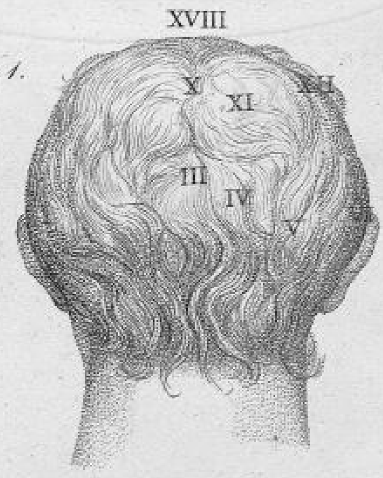
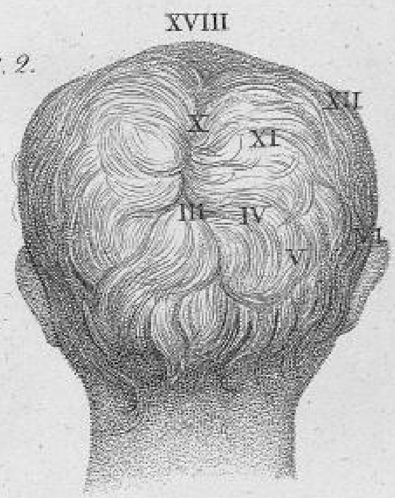


Fig. 2.



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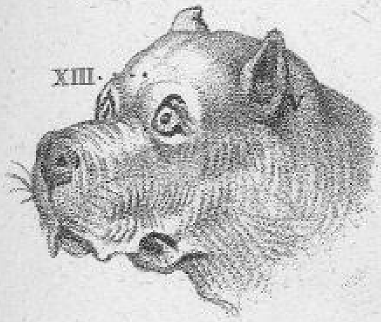

Fig. 2.

Fig. 3.

Fig. 4.

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Fig. 1.

Fig. 2.

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Fig. 1.

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Fig. 1.

Fig. 2.

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Fig. 1.

Fig. 2.

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