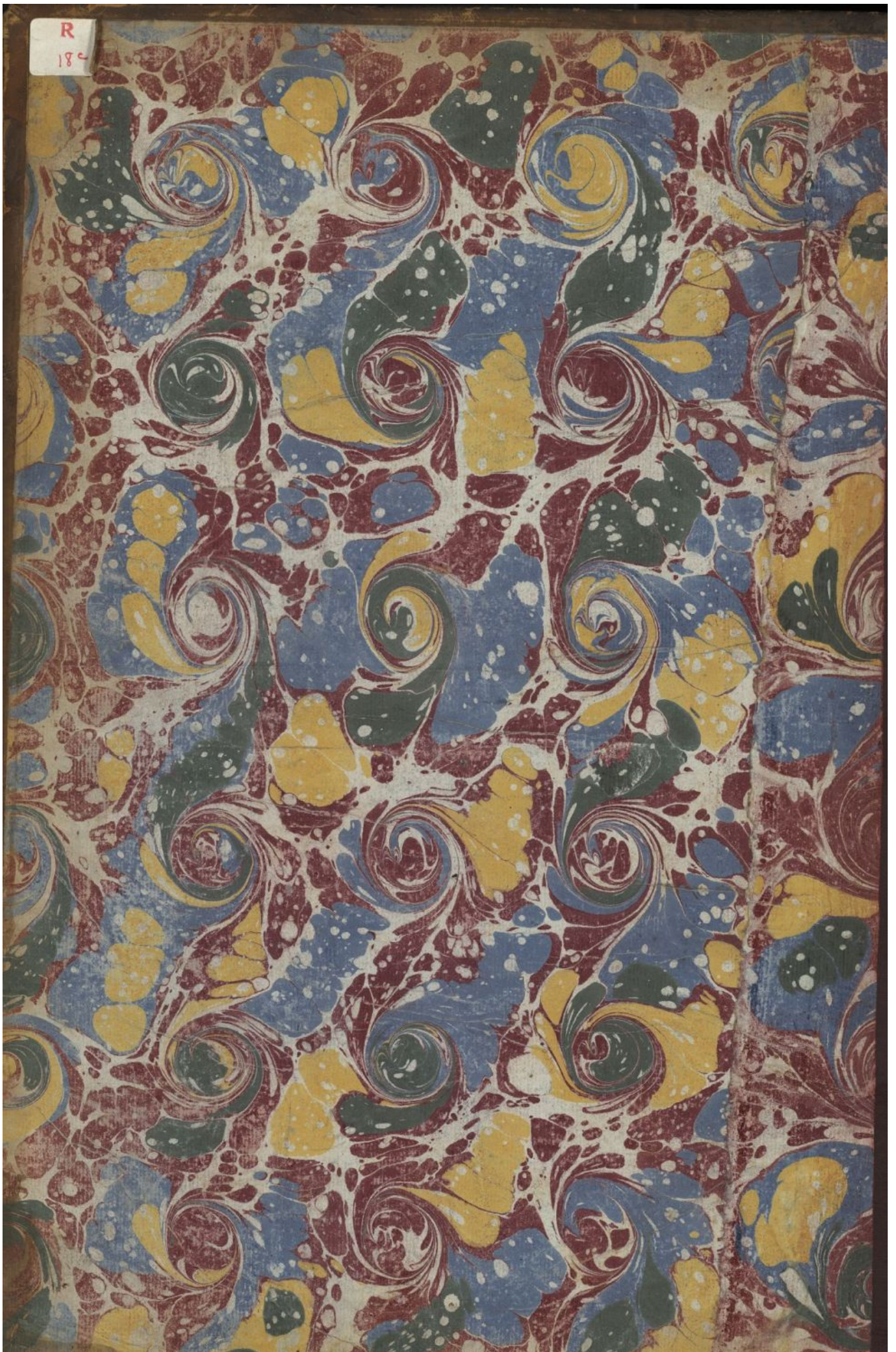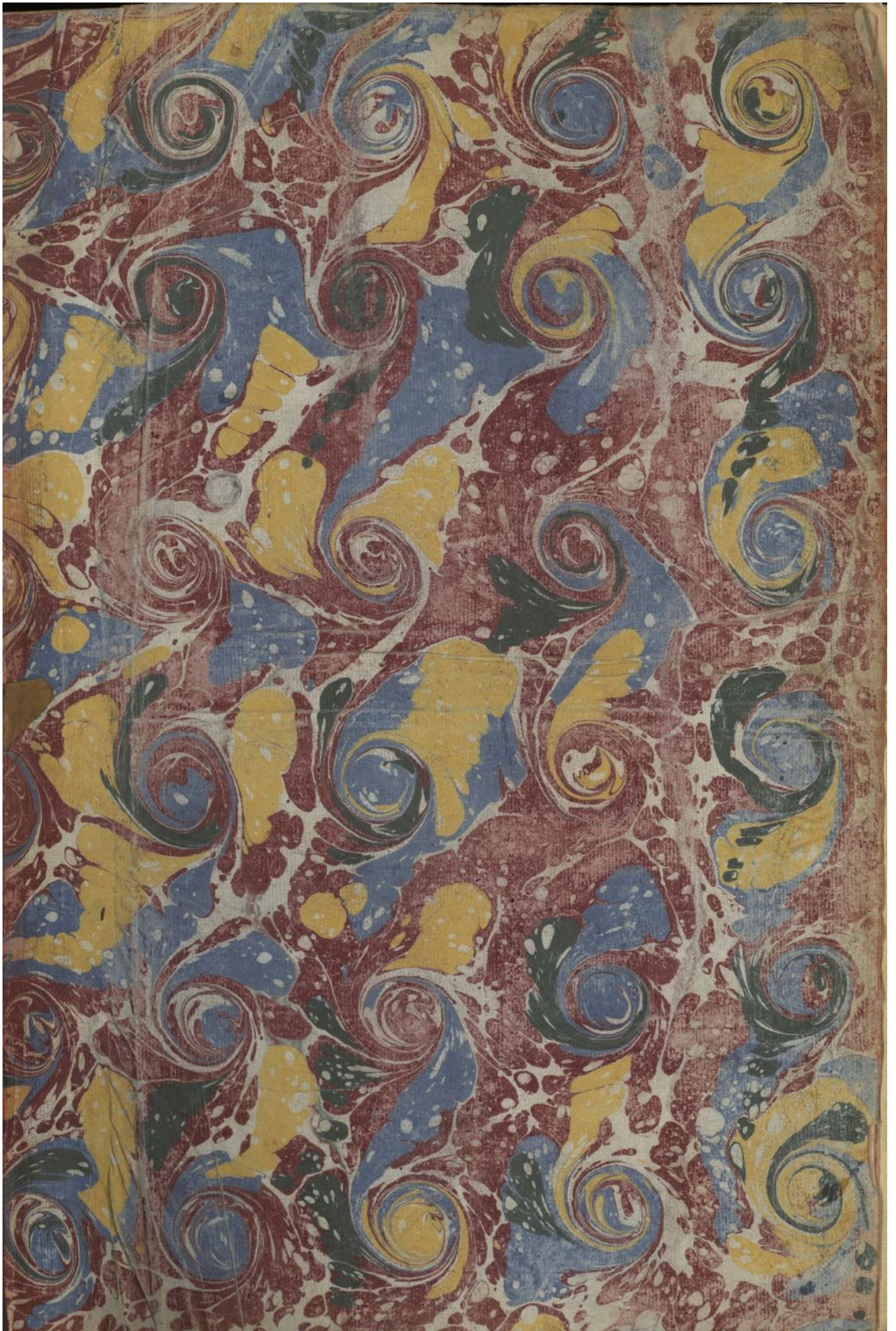**Cowper, William.** Myotomia reformata : or an anatomical treatise on the muscles of the human body. Illustrated with figures after the life. By the late Mr. William Cowper, Surgeon, and Fellow of the Royal Society. To which is prefix'd an Introduction concerning muscular motion

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1892

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MYOTOMIA
REFORMATA

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OR AN

ANATOMICAL

TREATISE

ON THE

MUSCLES

OF THE

HUMAN BODY.

Illuſtrated with FIGURES after the LIFE.

By the late Mr. WILLIAM COWPER,
Surgeon, and Fellow of the Royal Society.

To which is prefix'd

An INTRODUCTION

CONCERNING

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An INTRODUCTION

CONCERNING

MUSCULAR MOTION.

LONDON.

Printed for Robert Knaplock, and William and John Innys,
in St. Paul's Church-Yard, and Lincoln Inne, in the
Avenue. MDCCXXIV.

ADVERTISEMENT.

IT is a Matter of no Importance to the Publick, to be acquainted with the Reasons why the printing of this Work has been delayed for so long a time as thirteen Years since the Death of the Author; but the Reader may expect to be informed in what Condition it was left by Mr. Cowper, and by what Care and Pains it has been brought into the Form, in which it now appears.

THE Author had finished the Plates of this Book a little before his Death, and was preparing to put in order the Text, when he found his Weakness, occasioned by frequent Fits of an Asthma, which had brought him into a Dropsy, to grow upon him so fast, that he should not be able to complete his Design. He therefore resolved to retire and end his Days in the Country, having first delivered his Papers into my Hands, and desired me, with the Assistance of his intimate Friend Mr. Joseph Tanner, an ingenious Anatomist and skilful Surgeon, to take Care of the Publication of his Book.

THE Method Mr. Cowper had taken in this Work was to put down from time to time, in an interleav'd Copy of the Treatise he formerly published on the Muscles, such Alterations and Additions as he thought proper. But it required a finishing Hand to connect and digest all these into right Order: This Task has been performed by the learned Dr. Jurin, Secretary to the Royal Society, who thought himself obliged to preserve not only the Meaning, but also, as much as was possible, the Words of the Author; although Mr. Cowper had always greater Regard to the Truth of his Descriptions, than to the Easiness and Politeness of his Style.

THE Author's Preface ends abruptly, and is otherwise defective; for besides the Additions, which are here made to the Preface of his former Book, he intended some others; particularly there were found in his Papers a few Sketches concerning the Usefulness of Anatomy in Painting and Statuary; but these were so imperfect, that they were not fit to be printed.

THE

THE Introduction concerning Muſcular Motion is not the ſame with that, which was prefixed to the former Book; though Care has been taken here to preſerve whatever Diſcovery in Anatomy was contained in that. Mr. Cowper was ſo ſenſible of the Defects of his own Performance on that Head, that he engaged me to get ſomething more full ſubſtituted in its room. I have been inabled to make good this my Promiſe, by the Aſſiſtance of my Friend Dr. H. Pemberton, who is no leſs skill'd in Mathematicks and Philoſophy, than in Anatomy and whatever relates to the Animal Oeconomy.

AS the Character of Mr. Cowper, who was univerſally allowed to be as eminent an Anatomiſt as any of his Time, will ſufficiently recommend this Work, ſo I am perſuaded it may be ſaid to have loſt nothing by the other Hands, through which it has paſſed: And certainly it will be no ſmall Satisfaction to all who may have a Concern for the Memory of the Author, that although this Work has been long expected, yet nothing has in all this time appeared, which can render it leſs uſeful or acceptable to the Publick: The Knowledge of the Human Body is indeed a large Field, which doubtleſs will continually reward the Labour of thoſe, who cultivate it, with the Pleaſure of new Diſcoveries; and ſome Improvements have been lately made in relation to the Muſcles; but no Book, that I know of, has in any Language been yet publiſh'd on this part of Anatomy, that is ſo complete as this Treatiſe; not but that this, like all other human Performances, may have its Imperfections, which will perhaps entertain the ill Nature of ſuch Readers, who take more Pleaſure in finding Faults, than they do in being inſtructed.

Dec. 30. 1723.

RICHARD MEAD.

THE

PREFACE.

I N the Contemplation of Nature *we meet with nothing that affords us a more invincible Argument of the* Wisdom of the Divine Architect, *than the Structure and Composition of* Animal Bodies; *nor is this* Infinite Understanding *less manifested in the* Instruments of Voluntary Motion, *than in any other Parts whatever of the* Animal Body.

NO *wonder therefore, that* Anatomical Disquisitions *should be exceedingly entertaining ; but besides it behoves* Philosophers, *who inquire into the* Nature of Things, *and* Physicians *especially,*

* B   *whose*

The PREFACE.

whofe Province it is to preferve the Curious Fabric *of the* Human Body, *to acquaint themfelves fully with the Nature and Conftitution of that* Noble Subject ; *for that is the only way to learn what are the fecret Springs by which the myfterious Operations of* Senfe *and* Motion *are performed, to difcover by the* Symptoms *of* Difeafes *the feveral* Caufes *and* Seats *of them, together with the proper Methods for their* Prevention *and* Cure.

W HAT Efteem the Judicious *have always had for Enquiries of this nature, we may learn from our Great Mafter* Hippocrates, *who was fent for to* Democritus *the Founder of the* Mechanical Philofophy, *to cure him of his fuppofed Madnefs ; and finding* Democritus *diffecting the* Bodies *of Animals to difcover the Seat of the* Bile, *and affign the Reafons of its Effects,* Hippocrates *was fo far from looking upon him to be mad, that he pronounced him one of the* Wifeft *of Men.*

NOR is the Story that is told of our Modern Philofopher Des Cartes *lefs remarkable, who fhew'd a Gentleman, that came to fee his* Library, *nothing but a* Calf, *which he defign'd to diffect.*

BUT it is needlefs at this time to enlarge either upon the Ufefulnefs *of* Anatomy *in general, or the particular Advantages of an Exact Knowledge of* Myology, *in order to the* Practice *of* Chirurgery ; *and therefore I fhall wave what might be faid upon thofe Heads, and only give a fhort Hiftory of the Advancements that have been made in* Mufcular Anatomy *in feveral Ages, and the Reafons why I undertook to write upon that Subject.*

WITHOUT doubt Hippocrates *was well skill'd in* Anatomy, *as appears by his Book* De Fracturis, &c.

ARI-

The PREFACE.

ARISTOTLE *diffected many* Animals *before he began to compofe their Hiftory ; and* DIOGENES LAERTIUS, *in his Life of this Philofopher, informs us, that he writ alfo a Treatife of* Anatomy, *tho' it be now loft.*

RUFFUS EPHESIUS *had alfo made fome Progrefs herein, and gave the* External Parts *their proper Names.*

GALEN *and the* Anatomifts *of his time were indefatigable in their* Anatomical Labours, *as appears not only from thofe excellent Books of his* Of Anatomical Adminiftration, *and* Of the Ufe of the Parts ; *but in that compendious Syftem of the* Mufcles *collected out of them by* ORIBASIUS. *After* GALEN *we find no confiderable Progrefs made in* Anatomy, *till the Accurate* JACOBUS SYLVIUS *and* ANDREAS VESALIUS, *about the middle of the fixteenth Century.*

THERE *were indeed, even before* GALEN, *others who wrote of* Anatomy, *as* ALCMÆUS CROTONIATA, DIOCLES CHARYSTIUS, ERASISTRATUS, *and* HEROPHILUS, *of which the two latter are faid to have taught* Anatomy *publickly, and to have diffected many hundreds of* Human Bodies *in* Greece, Syria *and* Ægypt. GALEN *was a Difciple of the laft ; but we have none of their Writings now extant. Befides thefe there are others mentioned by* GALEN, *as* LYCUS, QUINTUS, *who was* LYCUS's Mafter, MARIANUS, *and others ; but we fhall not repeat any more of their Names, fince their Obfervations afford us no occafion to mention them hereafter.*

MANY *Arabians have alfo written on this Subject, of whom* AVICENNA *is efteemed the chief.*

SINCE *the Reftoration of Letters,* MUNDINUS *is reckon'd the firft* Anatomift, *whofe Works are commented on by* JACOBUS BERENGARIUS CARPENSIS, *and* CURTIUS ; *but neither of thefe furnifh us with any Difcoveries in* Myology.

GABRIEL

GABRIEL DE ZERBIS *is also mentioned, but his Writings are mostly collected from the Observations of others.*

NICOLAUS MASSA, *a* Physician *of* Venice, *not only writ an accurate and compendious* Introduction *to* Anatomy, *so far as it was known in his Time ; but being himself a Dissecter of human Bodies, he corrected some Errors of former Anatomists.*

STEPHANUS RIVERIUS, *a* Chirurgeon, *made several Drawings of the Parts of human Bodies, he dissected ; which were put forth by* CAROLUS STEPHANUS, *a* Physician, *with three Books of his own, in Folio, in the Year* 1545, *some time after the excellent Figures of* VESALIUS *had been published ; but as these Figures, by reason of their great Stiffness, are no wise to be compared with those of* VESALIUS, *so we learn from the Preface, that they were drawn, before those others had seen the light,* viz. *in the Year* 1539.

JACOBUS SYLVIUS *was an accurate* Anatomist *of his Time : He wrote an admirable* Commentary *on* GALEN's Book Of the Bones, *and likewise against* VESALIUS, *in defence of* HIPPOCRATES *and* GALEN. *After his Death was published that incomparable Piece entituled* Isagoge Anatomica, *wherein he digested the* Muscles *and* Vessels *into order, which were treated of confusedly before by* GALEN, VESALIUS, COLUMBUS, *and* FALLOPPIUS, *and distinguished them by those Names that are still in use.*

BEFORE SYLVIUS, *or at the same time,* FERNELIUS *and* JOHANNES GUNTHERUS ANDERNACUS *were Cotemporaries ; but neither of them have made any Improvements in the Knowledge of the* Muscles.

ANDREAS VESALIUS *began very young to examine the Parts of several Animals, in which Study by a wonderful*

Saga-

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Sagacity and Peculiarity of Genius, *he made a swift and successful Progress.* He was Scholar to GUNTHERUS, *as we learn from two Treatises of the latter, viz. his* Institution. Anatom. *and his Book* de Veteri & Nova Medicina; *and a Disciple to* SYLVIUS, *as is acknowledged in the* Preface *to his first Impression* De Fabrica Humani Corporis, *printed in the Year* 1543, *which Passage is left out in the second, published in the Year* 1555. *And here it may not be amiss to take notice by the by of another difference between these two Editions, to wit, that the Figures of the former are much finer, but the Descriptions are more correct in the latter.*

INDEED *much is owing to this Great Man, whose Accounts of the* Muscles *as well as of all other Parts, that were known to him, are generally very faithfully delivered.* He was Cotemporary *with* REALDUS COLUMBUS, GABRIEL FALLOPPIUS, BARTHOLOMÆUS EUSTACHIUS, *and* VALVERDA, *all excellent* Anatomists, *especially the three former; the first of which and* CÆSALPINUS *started early Hints of their Knowledge of the* Circulation of the Blood; *which perhaps for some Reasons they afterwards concealed.*

FALLOPPIUS *was a most accurate Dissecter of the* Muscles, *and was no mean Admirer of* VESALIUS, *tho' he made several Corrections of his Descriptions of the Muscles and other Parts, discovering several things that had escap'd that great Man's Observation.*

FROM *these the Myology has received its greatest Improvements; and tho' there are divers others who have written on this Subject, yet none except* HIERONYMUS FABRICIUS AB AQUAPENDENTE, *and* JULIUS CASSERIUS PLACENTINUS, *have given any true Marks of their Knowledge herein.*

BOTH *the* RIOLANS Pretensions *are great; but we trace them in* FALLOPPIUS.

*C   THERE

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THERE are divers others in repute with the Vulgar for their Descriptions of the Muscles, amongst which Spigelius *is the chief; but there seems to be nothing extraordinary in his Book, besides the Figures of* Julius Casserius Placentinus, *some of which are very ill done. Since our last named Author, there has been nothing discover'd in* Myotomy, *except M.* Du Verny's *Oblique Muscle of the Ear.*

THE Sculptures of Bidloo *are not to be forgotten, since they express divers* Muscles, *and other Parts so near the Life.*

THE many that have lately written on this Subject, especially our English *Writers, have rather increas'd than diminished former Errors; and particularly that Treatise of Mr.* William Molins, *and that most erroneous one of* John Brown, *are chiefly Collections of the Mistakes of others.*

THE greatest part of Books now extant are mere Copies, *or* Extracts, *and useless Rhapsodies Originals are few and rare; Mankind finding it much easier to transcribe and steal, than to invent and improve, though* Nature *affords an unexhaustible and yet hidden Treasure, sufficient to employ the Search and Industry of all the* Hands *and* Wits *in the World. One great Mistake has much obstructed the Advancement of true Knowledge, and that is a general Opinion, that the Senses are gross and ignoble, and that abstracted Contemplations are the Perfections of Human Nature; and so it comes to pass that Man's Mind is fed and pleased with Chimæra's and Shadows, instead of true substantial Knowledge, which is only to be learnt from the true Physical Examination of things by Sense and Experiment.*

IN the former Edition I gave the Figures of a few Muscles only, being either such as had not been before discovered, or at least not well express'd, in the Figures of Vesalius, Casserius *and other Authors: In this you have all the Muscles hitherto describ'd drawn in* situ, *with some Muscles I have discover'd since*

the

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the Publication of the former Edition. The Outlines of some of these Figures are drawn after RAFAEL, Sir PETER PAUL RUBENS, GUIDO RENI, Monf. LE FAGE; but the Muscling is done after several Human Subjects, and not copied from any Anatomical Book whatever. All these Figures are engrav'd on Copper, and where the Parts they represent are very small, there is a prickt Line continued from such Parts of the Figure, to which the Characters or Arithmetical Numbers are affixed, that refer to the Explications; by which is avoided Confusion on those Plates. You'll sometimes find the same External Muscles represented in several Figures, but always in different Positions; and this I think cannot be unacceptable to some, whatever others may say of its being needless. That the External Muscles are oftener the Subject of our Consideration than the Internal, is sufficiently known. Wherefore we cannot be over curious in representing them in various Positions. But besides the exact Knowledge of the External Parts, that's required in the Practice of Surgery, I am apt to think those who bend their Studies to the admirable Arts of Sculpture and Painting, may receive some Hints at least from these Anatomical Figures.

BESIDES the Figures grav'd in Copper, to make the Anatomy as intelligible as I could, I have added Figures of the Muscles, as they appear after Separation from the Body, with their Series of Fibres, as they are seen on their internal Surface. This was attempted by CAROLUS STEPHANUS or rather STEPHANUS RIVERIUS; but with what Success, may be seen by comparing what is there done with the Life.

IN doing these Figures I was not contented to sketch them after Drawings I had made of them in their proper Situation, but from the Muscles themselves after Dissection. And Care is taken, that all those Muscles that are done less than the Life, bear a Proportion to one another: And all those that are express'd as big as the Life have this Mark to them ✛.

THE Muscles of the Internal Ear only are done bigger than the Life, to make them the more distinctly visible.
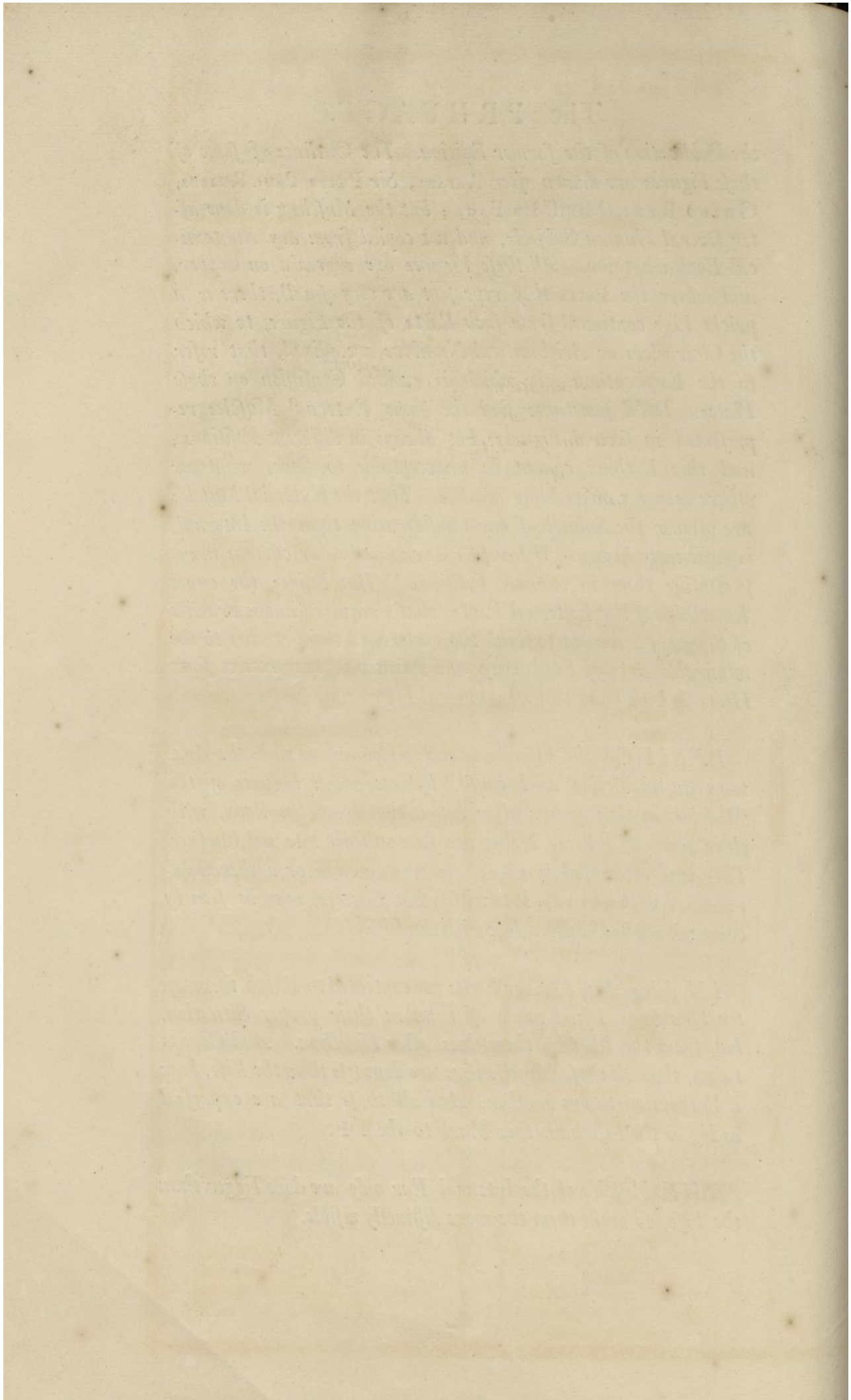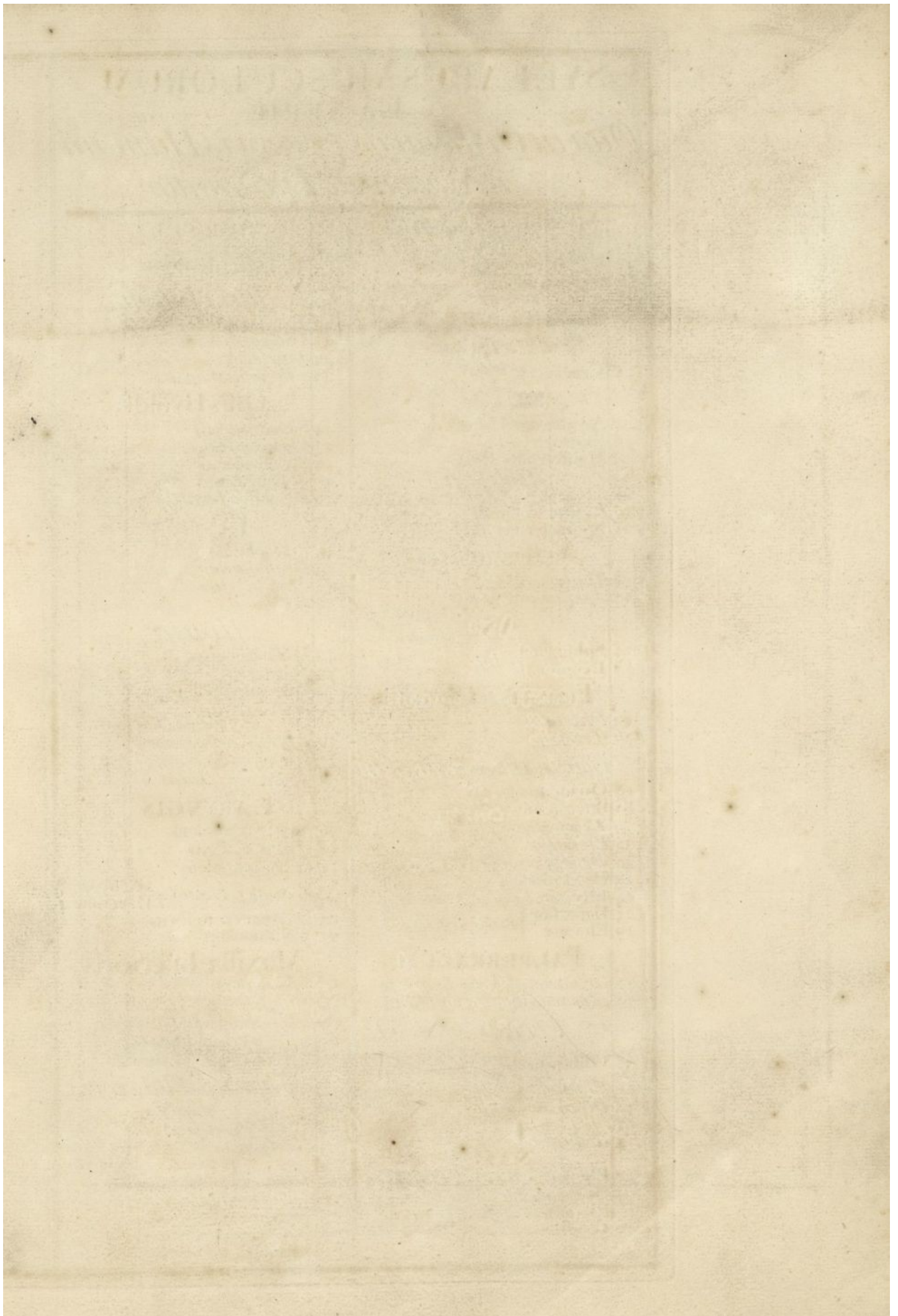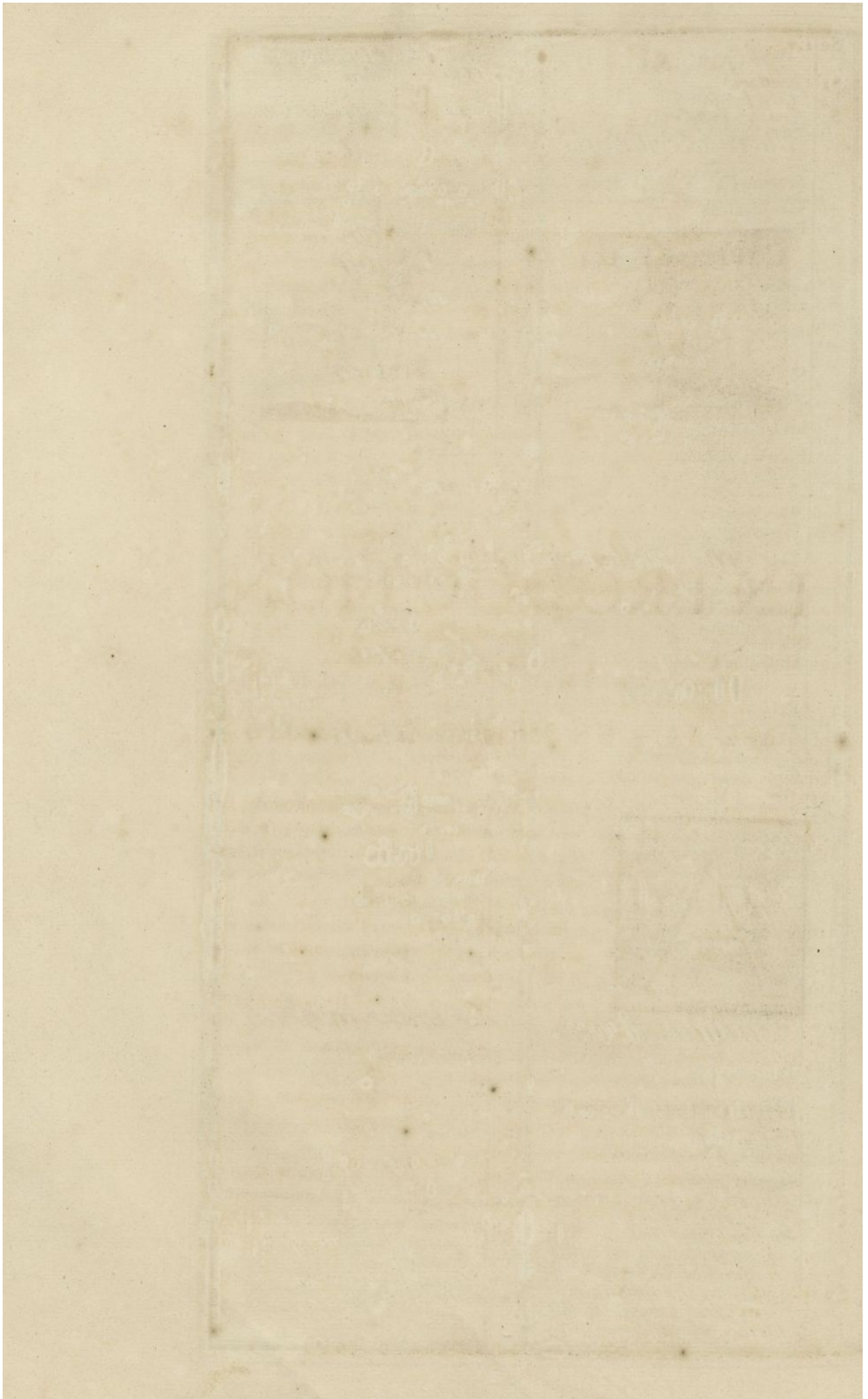
SYLLABUS MUSCULORUM
EÂ SERIE
Qua in Ordinarijs Corporis Humani Ἀνατομαῖς Dissecantur.

MUSCULI Abdominis

1	Obliquus	{ Descendens / Ascendens
2		
3	Pyramidalis	
4	Rectus	
5	Transversalis	

TESTIUM

6 Cremaster

Penis

7 Accelerator Urinæ
8 Erector Penis
9 Transversalis Penis

Clitoridis

10 Erector Clitoridis
11 Sphincter Vaginæ

Vesicæ Urinæ

12 Detrusor Urinæ
13 Sphincter Vesicæ

ANI

14 Sphincter } Ani
15 Levator }

FRONTIS et Occipitis

16 Occipitalis
17 Frontalis

Genarum et Labiorum

18 Quadratus Genæ
19 Buccinator
20 Zygomaticus
21 Elevator }
22 Depressor } Labiorum
23 Orbicularis }
24 Elevator Labij Superioris
25 Depressor } Labij Inferioris
26 Elevator }

PALPEBRARUM.

27 Orbicularis Palpebrarum
28 Aperiens Palpebram Rectus

Oculi

29 Obliquus { Superior / Inferior
30
31 Elevator
32 Depressor } Oculi
33 Adductor }
34 Abductor }

NASI

35 Elevator Alæ Nasi
36 Dilatator Alæ Nasi
   Elevator et Labij Superioris
37 Constrictor Alæ Nasi

AURICULÆ.

38 Attollens } Auriculam
39 Retrahens }

Auris Internæ

40 Externus }
41 Obliquus } Auris
42 Internus }
43 Musculus Stapedis

Ossis Hyoidis

44 Sternohyoideus
45 Coracohyoideus
46 Stylohyoideus
47 Mylohyoideus
48 Geniohyoideus

LINGUÆ

49 Genioglossus
50 Ceratoglossus
51 Styloglossus
52 Basioglossus

Uvulæ

53 Glossostaphylinus
54 Sphenostaphylinus
55 Pterygostaphylinus

Faucium

56 Stylopharyngæus
57 Oesophagæus
58 Vaginalis Gulæ

LARYNGIS

59 Sternothyroideus
60 Hyothyroideus
61 Cricothyroideus
62 Cricoarytænoideus { Posticus / Lateralis
63
64 Thyroarytænoideus
65 Arytænoideus

Maxillæ Inferioris

66 Temporalis
67 Masseter
68 Digastricus
69 Pterygoideus { Internus / Externus
70

Thoracis Anterioris

71 Serratus { Minor / Major } Anticus
72
73 Subclavius
74 Scalenus { Primus / Secundus / Tertius
75
76
77 Triangularis
78 Diaphragma
79 Intercostales Interni

by thofe very few, who through the Courfe of all the learned Ages, at great Inter-
vals of Time, have diftinguifhed themfelves by purfuing their Searches into Nature
upon true Principles, had occafioned Philofophers wholly to defpair of arriving at
any Certainty in the more recluse Parts of Phyfics. For now our great Philofopher
has at length in fo furprizing a manner enter'd into the Depths of Nature, we find
much lefs reafon to admire, that his Difcoveries had lain fo long concealed, than
that they fhould ever have been fearched out. Difcoveries that have given a proof
of the moft flowing and abounding Invention, of the profoundeft Penetration, and
of the fublimeft Force of Reafon: Not only where it was neceffary to apply the
fubtleft Parts of Geometry, and even to improve that Science much beyond its for-
mer Bounds; as where he has difclofed the Nature and Operations of Fluids, and
difcovered the great Principle, that keeps in motion the large Bodies of the Uni-
verfe; but if poffible, yet more in thofe Advancements he has made from the con-
fideration of Light into a more hidden part of Nature, by the moft refined and
powerful Reafonings upon the moft obvious Obfervations, even to the deducing
many wonderful Secrets of Nature from things, which appeared wholly barren not
only to common Capacities, but to the Philofophers of the greateft Penetration.

Even fully to perceive the Progrefs this excellent Perfon has made in the real
Knowledge of Nature, calls for the utmoft Application and Thought; infomuch
that many, who would have formerly paffed for no mean Philofophers, have inge-
nuoufly owned themfelves unable to comprehend fome of Sir *Ifaac Newton*'s moft
fublime Speculations. But however difficult the fearching into Nature may appear,
doubtlefs when this true Method of Philofophy comes to be generally underftood,
it will entirely put a ftop to the falfe way, that has prevailed in the World. When
we fee thofe Principles of natural Operations, that are now difcovered, are fo wide-
ly diftant from our moft refined Conjectures concerning them, it will be impoffible
for us for the future to receive any kind of Hypothefis with the leaft approbation.
If in one of the moft fimple Productions of Nature, the Motions of the heavenly
Bodies, the Principle by which they are preferved, is fo much above the reach of
our Conceptions, that we hardly find any one, that can reconcile it to his Thoughts,
who does not fee the full Force of the Demonftrations, by which it is proved; how
can we conceive the briſkeſt Imagination ever able to difcover any of the more con-
cealed Springs of natural Effects? Thefe Confiderations furely will intirely free us
from that Miſtake the Philofophers feem to have laboured under, who imagined it
was required of them to account for almoft all the Appearances of Nature; info-
much that we find the very manner how a World or an Animal might be formed, is
frequently attempted by the Framers of Hypothefes, who yet were fo far from being
qualified for fo daring an Enterprize, that on the contrary they have fhewn them-
felves not really able to difcover the obvious Laws of Motion. But we ought to be
more modeft in our Inquiries, and not go fo precipitantly to work. If we can truly
difcover any one ftep, Nature takes in her Productions, we ought to look upon it
as a confiderable Attainment, without repining at our not being able to trace her

through

INTRODUCTION.

Concerning the

MUSCLES and their ACTION.

AS all the Appearances of Nature furnish matter for Speculation worthy of a rational Mind; so those of the Animal Œconomy more particularly recommend themselves to our Consideration. For the knowledge of the Causes, from whence the various Operations and Changes wrought within our selves do arise, may be of more immediate use, as it may aid us in the discovery of proper means to guard against, or to remedy the many Disorders, the human Body is constantly subject to. But since the animal Machine is one of the most curious and delicate of all Nature's Productions, that come under our Observation; and consequently to determine the use of its Structure and Parts requiring the greatest Sagacity and Judgment; it is no wonder that the arriving at any tolerable degree of Knowledge in this Subject, has more effectually been prevented by the false Methods of enquiry, that have for many Ages prevailed among Philosophers. Even the gross occult Qualities of the Ancients have hardly given a greater obstruction to the Improvement of this most useful Branch of Science, than the more refined Species of such Qualities

a

lities

lities introduced by the Moderns, under the denomination of Hypotheſes. The only remedy againſt this Inconvenience is the ſame here, as in the other Parts of Philoſophy; to lay aſide all myſterious and unintelligible forms of Speech, nor any longer to be employed in determining the Operations of Beings, to whoſe very Exiſtence we are altogether Strangers; but to enquire after ſuch real Cauſes, as the Phænomena neceſſarily imply, and to endeavour by a farther ſearch to diſcover the degree and manner of the Action of thoſe Cauſes; purſuing theſe ends by the proper Means of attaining them, which are only Experiments and juſt Reaſonings drawn from Mathematical Principles.

ALTHOUGH the immenſe Difficulty of this way of proceeding has hitherto prevented great Improvements in this Subject, yet ſome parts of the animal Body, and ſome few of its Operations, have been by theſe Methods ſucceſsfully ſearched into. From the time that the invention of the Teleſcope occaſioned the effects of Diaphanous Bodies upon Light carefully to be examined, very conſiderable advances have been made in the Diſcovery of the uſe of the ſeveral parts of the Eye, which aſſiſt in Viſion. And to come nearer to our preſent Purpoſe, Mechanicks applied to the Muſcles have largely inſtructed us in their Action. But indeed in theſe, as well as in every other part of the Body, we have a proof of the Deficiency of our Capacity to penetrate very far into the Secrets of Nature. For notwithſtanding we are able exactly to trace the Species of things manifeſted by Sight to their Impreſſion on the Optick Nerve, and have diſcovered by what Principles, and by what Mediums, the Images of external Objects are formed in the Eye; yet what effects thoſe Images have on the Nerve, whereby the Perception of the things themſelves is cauſed, remains wholly a Secret to us. In like manner in our preſent Subject, while we can reduce to rule, and determine the effects of the Muſcles upon the Parts they belong to, we continue altogether in doubt concerning the Cauſe, that puts them in action; both which laſt Reflections in relation to the Muſcles I deſign in this Diſcourſe particularly to illuſtrate.

BUT in the firſt place, it may not be improper to ſay ſomething of the Muſcles in general. Theſe taken at large are perhaps the moſt immediate Inſtruments of all the Motions, that are produced in the Body; for it is not improbable that every Coat, Membrane and Fibre thereof, exert their ſeveral Motions, by much the ſame Principle, as thoſe parts do, that have more generally been called Muſcles. Amongſt theſe laſt, ſome are the Inſtruments of voluntary, others of involuntary Motion, and others again of a Motion compounded of both theſe. But we ſhall here chiefly conſider the Inſtruments of voluntary Motion; for if they be not of themſelves the ſimpleſt, yet as their Operations are moſt obvious to us, ſo we are better acquainted with the manner and degree of their effects on the Parts, their Action is employed about, than with the like Properties of the other ſorts. The principal Muſcles then, that ſerve for voluntary Motion, are what chiefly give Subſtance

to

to the Body, and what cloath the Bones of the Trunk and Limbs, with what is called Flesh. This Flesh is not one continued Mass, but is distinguish'd into divers Portions. Each Portion of Flesh is called a Muscle. These Muscles are disposed of in such a proper manner all over the Body, as to conduce to the elegance and beauty of its Structure, as well as to the execution of each particular Muscle's office. Though these Muscles lie in a manner contiguous to one another, yet each of them is separated from the rest, either wholly or in part, by a Membrane proper to it. This Membrane, though very thin, in robust and well fed Bodies is filled with Fat, and in hydropical Subjects charged with Serum.

As the office of these Muscles is to change the Situation of some parts of the Body in respect to others, each Muscle must be annexed to the different Parts, between which its Action is divided. And these are generally the Bones. And whereas upon the ordinary Action of any Muscle, one of the Parts, to which it is annexed, remains more stable, with regard to the Trunk of the Body, than the other; the extremity of the Muscle, annexed to the more stable part, is called either the Head or the Origine of the Muscle, as the other Extremity, inserted into the most moveable part, is called the Tail or Insertion of the Muscle, and the middle part lying betwixt these two, which swells, while the Muscle acts, is called its Belly.

Each Muscle is made up of two different Parts, distinguished by their Colour, a fleshy part, which appears red, and a tendinous, which is white. These are continuous to one another. The fleshy Parts are composed of divers slender Portions, which are likewise still composed of very fine Fibres, that lie along each other. But of the Structure of the smaller Parts of the Muscles we shall speak more hereafter. These fleshy parts appear furnished with Blood Vessels, Nerves and Lymphaducts.

The other sort of Fibres, that constitute the Tendons of the Muscles, are more compactly joined together than those of the fleshy Parts; insomuch, that in a human Body there is no appearance to the naked Eye of the Interposition of Blood Vessels, Nerves, or the like; though these may be here discovered by the aid of a Microscope; and may be seen without Magnifying Glasses in the Tendons of larger Animals, in particular in the Tendon of the *Gasterocnemius* Muscle of a Horse.

The Blood Vessels belonging to the Muscles are Arteries and Veins, with both of which each Muscle is furnished. The first brings to the Muscle Blood from the Heart, which Blood is returned thither again by the Veins. As by this circulating Fluid all parts of the Body are kept in repair, so to it the Muscles owe the redness of their fleshy Fibres, which appear white after frequent washings.

washings. To the Nerves, the Muscles, as well as the other parts of the Body, owe their Sense, and likewise their Motion.

THESE Blood Vessels, and Nerves, usually enter the Muscle nearer to the Head thereof than to the other Extremity, which has occasioned another Definition of the Head of the Muscle, than that before given, namely, that it is the part, at which the Blood Vessels and Nerves enter; but this is a very imperfect Characteristic to determine this Part of a Muscle, seeing many Muscles have Vessels entring into them in two or three different Parts; and moreover, the present Description joined with the other, that the Head or Origine of a Muscle is its least moveable Part, has given rise to very false reasoning in respect to the use of some Muscles. In particular it has been argued concerning some of the Muscles of the Larynx, that the inferior part of them is the least moveable, by reason that the Nerves enter them at that end; whereas this is no consequence at all: for the fixedness of any part of a Muscle cannot be caused by such tender and flexible Bodies as the Nerves and Blood Vessels, but by the stability of the solid Part, to which it is affixed.

OF the Lymphaducts, which we observed to belong to the Muscles, it will be sufficient just to take notice, that these fine and transparent Vessels receive from the Blood its more limpid Parts; which however proper to be carried off at the places, where these Lymphatics arise, is not a Fluid become wholly useless to the Animal; but is returned again into the Veins; and in its Passage thither mixing with the Chyle, seems to have a particular Use in rendring the alimentary Juice more fluxile, and facilitating its Assimilation with the Blood.

AND this may suffice in general concerning the Structure of the Muscles. But the manner and degree of their Action I design to consider more at large: In order to which, it must be observed, that the Muscles perform their Office by the contraction of their Fibres, that Contraction producing the Decurtation of the whole Muscle. From hence arise two Questions to be discussed, relating to the Action of the Muscles. The one enquires into the Cause of the Contraction of a muscular Fibre; the other, how this Decurtation of the Muscles is conducive to the Production of the several Motions thence arising. The first of these Questions relates chiefly to the use of the Nerves and Blood in the Contraction of the Muscles; and the second has reference to the Situation and Disposition of them in respect of the Parts, they move. These two Questions I shall here treat of separately in two distinct Parts; and as the latter Question falls most easily under Examination, it may conveniently be spoke to in the first place.

PART I.

PART I.

THE firſt caſe, I ſhall conſider, is that of a Muſcle appropriated to the Inflection or Extenſion of a Joint, being connected only to the Bones of that Joint, by each of its Extremities to one of them. Now the Joints are for the moſt part, in the Limbs eſpecially, a Conjunction of two Bones in the following manner. One of the Bones is terminated in a round Head, approaching either to a ſpherical or cylindrical Form; which is received by a Cavity, called by Anatomiſts a *Sinus*, formed in the other Bone of a correſpondent Figure, and ſo received as to be moveable in it; and the Motion will be performed upon the Center of the ſpherical Head, or upon the Axis of the cylindrical one. When the Heads of the Bones deviate from a regularly ſpherical or cylindrical Figure, which they are found to do remarkably in ſome Joints, the Center or Axis of Motion is continually changing, being different in different Flexures of the Joint. But then the Center, or Axis of the Motion may be determined, in any propoſed Situation, by finding a Sphere or Cylinder of the ſame Curvity with the Head of the Bone in that Part, wherein it is in contact with the *Sinus*; which, in this caſe, it will not be in all its Parts, as when the Head is of a more regular Figure. The ſuperior Head of the Thigh Bone, by which it is joined with the *Os Innominatum*, is the moſt perfect Example in the Body, of a regularly ſpherical Figure; and the inferior Head of the *Humerus*, that part of it, which is articulated with the *Ulna* in the Joint of the Elbow, with no leſs Exactneſs cylindrical; excepting the circular Indentures made in it, for the more firm Connection of the Joint, which do not anywiſe influence the Axis of the Motion, they being concentrical to it. Now a Muſcle connected by each of its Extremities to one of the Bones, which conſtitute a Joint, muſt be more extended in ſome Angles, which the Bones ſhall make with each other, than will be required in other Angles; except only when the Muſcle is connected to the very Axis of the cylindrical Joint. Hence, when the Muſcle exerts its contracting Power, if the Direction in which the Muſcle will contract, be not in a right Line paſſing through the Center or Axis of Motion, it will endeavour to reduce the Joint into that Diſpoſition, wherein the leſſer length of the Muſcle is required.

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Let *ABCDA* be a Bone, having a round head *BCD*; the Center of this Head *F*, if the Head be spherical; if cylindrical, let the Axis of it pass through *F*, and be perpendicular to the Plane of this Scheme. Let *GHKIG* be a Bone, having a hollow *Sinus HKI* adapted to the Head *BCD*; so as to form a Joint. Let *LMN* be a Muscle not passing through the point *F*, nor yet the Axis drawn through *F* perpendicular to the Plane of this Scheme. Let the Joint be bent, till the Bone
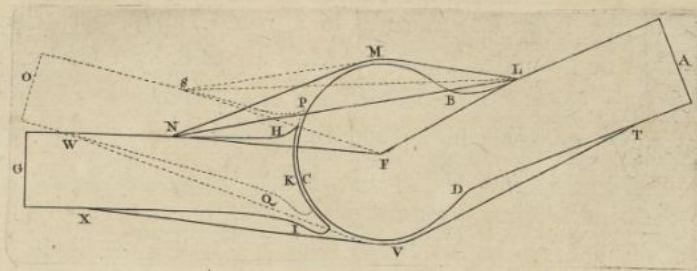
GK be removed into the Situation *OPQO*, and the Muscle obtain the Situation *LMS*: Then, I say, the Muscle in the Situation *LMS* is shorter than in the Situation *LMN*. Draw *FL, FN, FS, LN, LS*: then in the two Triangles *LFN, LFS* the Side *LF* is common to both, and the Sides *FN, FS* equal, but the Angle under *LFN* greater than that under *LFS*; wherefore the Base *LN* is greater than the Base *LS*: And besides, the Angle under *FLN* is less than that under *FLS*; so that the point *M* is farther distant from the Line *LN* than from *LS*. Therefore if the Figure *LMS* were so applied to the Figure *LMN*, that the point *L* remained common to both, and the Line *LS* fell upon *LN*, the Line *LMS* would fall wholly within the Line *LMN*, though the point *S* were to fall upon the point *N*; but the Lines *LMS* and *LMN* would likewise be concave towards the same Part, therefore the Line *LMS* would be shorter than *LMN*, though the point *S* were to fall upon *N*, and the Line *LS* were equal to *LN*, but *LS* is less than *LN*; whence the Line *LMS* will be still shorter than *LMN*.

Upon the same Principles the Muscle *TVW*, on the other side of the Joint, connected to the Bone *AC* in *T*, and to the Bone *OPQO* in *W*, will be shortened, when the Bone *OPQO* is restored to the Situation *GK*, and the Muscle have the Situation *TVX*.

From all this it is evident, by the Principles of Mechanics, that when the Muscle *LMN* contracts itself, if it lie not directly over the Axis of the Joint's Motion, it will inflect the Joint, drawing the Bone *GK* towards the Situation *OPQO*; and the Contraction of the Muscle *TVW* will extend the Joint, by reducing the Bone into its original Situation. By its farther Contraction the Joint will be bent the contrary way, except the form of the Joint, and the Ligaments, by which the Bones are connected, prevent it.

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It is here to be obſerved, that the Muſcles are uſually connected to one of the Bones very near the Joint, by which means the Flexors of the Joints are preſerved contiguous to the Bones in all their Motions. When both the Extremities of a Muſcle are far diſtant from the Joint, the Muſcle is bound down to the Joint by a Ligament. In this caſe the Method of ſhewing, how the Inflection of the Joint ſhortens the Muſcle, muſt be ſomething different from the foregoing : But the principal Alteration required is, that inſtead of the Line *FL*, which is common to the two Triangles *LFN*, *LFS*, the Line muſt be taken, which will join the point *F*, and the place of the Muſcle inveſted by the Ligament; becauſe the diſtance of the Ligament from that Extremity of the Muſcle, connected to the Bone, from which the Ligament takes its riſe, remains always near the ſame.

But now this confining of the Muſcles down to the Bones anſwers two very valuable Purpoſes; one is, that the ſmall degree of Contraction, it was proper to allow the Muſcles, may give to the Joints a ſufficient Motion ; the other, that the Figure of the Limbs may be preſerved. But then this conſequence on the other hand follows from hence, that the Reſiſtance, which is applied to the Extremity of the moveable Bone of any Joint, and is ſupported by the Muſcles of that Joint, bears but a ſmall proportion to the force required in the ſuſtaining Muſcles. In the preſent Figure, ſuppoſing the Bone *AC* to be fixed, the other *GK* will perform the Office of the mechanical Power, called the Lever; of which *F* is the Fulciment, by which it is ſuſtained, *N* the point to which the moving Power is fixed, acting obliquely in the direction of the right Line *NM*. If a Reſiſtance be applied to the Extremity of the Bone *G*, then by the Principles of Mechanics the force of the Muſcle, acting in the direction *MN*, will be to the Reſiſtance in *G*, when the force of the Muſcle and Reſiſtance are in *Æquilibrio*, as the Perpendicular let fall from the point *F* upon the Line, in whoſe direction the Reſiſtance in *G* is applied, to the Perpendicular let fall from the ſame point *F* upon the Line *MN*. For inſtance, if the Bone *GK* be held parallel to the Horizon, and a Weight be ſuſpended, by the action of the Muſcle *LMN*, at the Extremity of the Bone *G*; becauſe in this caſe the Direction, in which the Weight reſiſts, is perpendicular to the Bone, the force required in the Muſcle *LMN* to ſuſpend the Weight applied in *G* will be to that Weight, as the whole diſtance of the point *G* from the point *F*, to the perpendicular let fall from *F* upon the Line *MN*.

In the ſame manner may be found the Power required in the Muſcle to ſupport the Weight of the Limb in any Situation; for that Power of the Muſcle will be to the Weight of the Limb, as the Perpendicular let fall from the Center of the Joint upon the Line drawn perpendicular to the Horizon, through the Center of Gravity of the Limb to the Perpendicular let fall from the Center of the Joint upon the part of the Muſcle, that lies in the direction of its Action.

BORELLI

BORELLI in his Treatife concerning the Motion of Animals * contends that the force of the Mufcle is double to that which is affigned by this Rule. He collects this from the following Affertion, which he takes great pains to demonftrate; That if a String be connected to a Peg, and diftended by a Weight hung at it, the Refiftance of the String fhall be equivalent to double the Weight; or if a Stick be erected perpendicularly upon the Ground, or upon one's Hand, and compreffed by a Weight placed upon the upper end of it; the Refiftance of the Stick fhall be equivalent to double the Weight fupported. Though *Borelli* is very large upon this, and has drawn out his Proof into feveral Propofitions; yet all he has advanced feems to me little more than a playing upon Words. The whole of what he fays amounts to this, That the Reaction of the Peg, to which the String is fixed, and of the Hand or Ground, which fupports the Stick, is equal to the Weight, by which the String is diftended, and the Stick compreffed; and the String and Stick are affected by both. But may one not with as much Reafon fay, that the String is diftended, and the Stick compreffed by the Weight only, becaufe the Weight being removed, the Diftenfion and Compreffion entirely ceafe. It is true likewife, if the Peg or Ground be removed, the String will not fuffer Tenfion, nor the Stick be compreffed by the Weight connected to them: It may therefore be afked, whether the Tenfion of the String and Compreffion of the Stick may not be afcribed to them. And certainly they may; though this being to refer the Effect of an active Power to the Refiftance, which fupports its Action, the ufual manner of fpeaking favours the other way of expreffing it. But if the Stick be fupported by the Hand, the Powers applied to both its Extremities are equally active, and the Compreffion of the Stick may be attributed to either. Yet it is altogether as proper, I think, to fay that this Compreffion is equivalent to one of them only, becaufe if one be removed, the Action of both upon the Stick will ceafe, and if, in the room of the active Power of the Hand, the Ground which is paffive, be fubftituted, the Compreffion of the Stick will remain the fame; as to fay, with *Borelli*, that becaufe whether the Ground or Hand fupport the Stick, the Compreffion will not be different, and when the Hand is ufed, there are applied to the Stick two active equal Forces; therefore when the Ground fupports it, its Compreffion is equivalent to twice the fingle active force applied to it. The fame may be faid of the other Method he takes to confirm his Opinion, drawn from the Confideration of a String inflected over a Pulley with an equal Weight hung at each end, the Tenfion of which will remain the fame, if one of the Weights were removed, and the end of the String, to which it was faftened, tied to a Peg. Whence he concludes, that when there is but one Weight, and the other end is faftened to a Peg, the Refiftance of the String may be faid to be equivalent to twice that fingle Weight, becaufe the String is ftretched as much by that, as it is, when the other Weight equal to the firft is hung to the end before tied to the Peg. But may it not as well be faid, that the Refiftance or Tenfion of the String is

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* De Motu Animal. Par. I. c. 10.

equivalent

equivalent to one of the Weights only, when two are tied to the String, becaufe the prefence of the other Weight is neceffary in order for the action of one of them; and if one be removed, and its place be fupplied by a Peg, the Tenfion of the String will be no greater in the former Cafe than in the latter? Certainly thefe two different ways of Expreffion amount only to this, that according to *Borelli* you affirm the String to be diftended as much by one Weight as by both; in the other way you affirm the String to be no more diftended by both the Weights than by one.

BUT now if this be fo, that *Borelli* does only difpute for an uncommon manner of Expreffion, while the fame thing is fignified, as by the ufual way of fpeaking, I fhould chufe to keep to that; fince that can hardly draw us into any Error, which the other may, if we are not very carefully attentive to the Idea fignified by it; for it has actually mifled *Borelli* himfelf, as will hereafter appear.

THUS much of computing the Force, with which the Mufcles act, that lie over one Joint. It next follows to fhew how to determine the Direction of their Action; which is eafily deducible from what has been faid. For in the Figure it is evident that the Direction, in which the Mufcle *LMN* acts, will be always according to the Line *MN*, which denotes the part of the Mufcle lying over the Joint, and
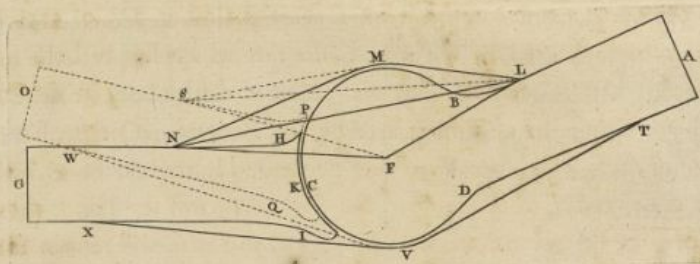
out of contact with the Bones; whatever the Pofition be of the part *LM*, included between the point *M*, where the Mufcle leaves the Bone *AC* in order to pafs over the Joint, and the Point *L*, its Connection with the fame Bone.

SEVERAL Mufcles lie very oblique to the Direction, in which they act; tho' none, perhaps, more than the Mufcles of the Foot. From which an Inftance or two taken will fufficiently illuftrate the Rule here laid down. To mention in the firft place the *Peroneus primus* or *longus*, in which neither its Body, nor all that part of its Tendon from the *Os Cuboides*, under which it is inflected to its Infertion into the innermoft Bone of the *Metatarfus* fupporting the great Toe, is direct to its Action. The Tendon efpecially lies very remarkably oblique; the action of this Mufcle being not very different from that of the *Peroneus fecundus*.

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I am therefore surprized that *Riolan* * should ascribe to the first of these Muscles, which he calls *Peroneus posticus*, the Office of extending the Foot; and to the other, the *Peroneus secundus*, called by him *Anticus*, the contrary Office of bending it: For their Tendons lie contiguous upon the hinder and inferior part of the *Fibula*, and remain so during their Inflection under the outer Ancle, till the Tendon of the *Peroneus secundus*, which is the exterior one, is inserted into the external part of the Root of the outermost Bone of the *Metatarsus*; and the other Tendon, at the same time inflected under the *Os Cuboides*, in a *Sinus* of which it is included by a Ligament, as it passes to its Insertion. And by the Rule just now laid down, that part only of the Tendon of the *Peroneus secundus* between the outer Ancle, and its Insertion, lies in the direction of its Action; and that part only of the Tendon of the *Peroneus primus* from the outer Ancle to its Inflection under the *Os Cuboides* lies in the Direction, in which that Muscle acts. Which evidently shews both these Muscles to give the Foot almost the same oblique Motion; the principal difference is, that the *Peroneus primus* does something more extend the Foot; the Root of the outermost Bone of the *Metatarsus* by the one, and the *Os Cuboides*, which supports the internal part of the Root of that outermost Bone of the *Metatarsus*, by the Action of the other will be moved nearly in the same Direction, that is to say, upwards and backward. They both conspire with the Extenders of the Foot in raising the Body, in walking, upon the Ball of the great Toe. It appears therefore from what has been said, that the Action of the *Peroneus primus*, of which we undertook principally to speak, is the same, as if its Tendon were connected to the *Os Cuboides*. Though the carrying this Tendon across the Foot, and inserting it into the Bone of the *Metatarsus*, which supports the great Toe, answers a very considerable End: For the Junctures of the Bones of the *Tarsus* are more effectually strengthened and secured by this Contrivance, than if a Ligament of equal Strength had connected the *Os Cuboides* and innermost Bone of the *Metatarsus* together.

THE *Tibialis posticus* affords another Instance of a Muscle, whose greatest part lies oblique to its Action; that being in the Direction of the Part of its Tendon, between the Inflection of it under the inner Ancle, and its Insertion; to which the whole Body of the Muscle lies very oblique. The use of this Muscle is to enable the Extenders of the Foot, by acting in conjunction with them, to raise the Body upon the Balls of the lesser Toes; an Action which in walking we are obliged to perform, as often as the inner part of the Foot has received any hurt.

THUS far in the general of the Action of Muscles passing over one Joint. Before I proceed, I think it not amiss, upon the making mention of these Muscles of the Foot, to observe how admirably the Flexors of the Foot are contrived to

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* Anthropograph. Lib. V. cap. 43.

be proper Antagonifts to them. Thefe Flexors are two, the *Tibialis anticus*, and that parcel of Fibres, which *Vefalius* * and Mr. *Cowper* obferve to arife from the *Extenfor Digitorum Pedis longus*, and to fend a Tendon to the outfide of the Foot. The Action of the *Peronei* with the Extenders of the Foot being the moft common, the Tendon of the *Tibialis anticus* is not inferted into the middle of the Foot, but chiefly into the innermoft Bone of the *Metatarfus*, by which means it is rendered directly the Antagonift to that Action; and yet by the affiftance of the other parcel of Fibres, may become, when Occafion requires, the Antagonift to the other Motion of the Foot, when the Extenders and *Tibialis pofticus* act together.

I SHALL further add to what has been faid in the general, before I proceed to the Mufcles lying over two or more Joints, which are next to be fpoke to, a diftinct Explication of one Cafe, which does not readily come under the general Rule. This is the Cafe of the *Digaftric* Mufcle of the lower Jaw; which lies over one Joint only, *viz.* that of the lower Jaw Bone with the Skull: but in a manner fomething particular. It is of that kind of Mufcles, which are inflected in their Paffage from their Origine to their Infertion; but not by the Bones forming the Joint, as thofe before treated of; but by its paffing through an annular Ligament of the *Os Hyoides*, and retained in its inflected Situation by the Mufcles of that Bone. Whence in this Mufcle, not only its own Force, and Direction, in which it acts, are to be explained; but likewife the Force required in the Mufcles of the *Os Hyoides* to fupport its Action.

LET *A e B* be the *Digaftric* Mufcle, inflected at *e* through the Ring *D*, connected to the *Proceffus Styloides* in *A*, and to the Jaw Bone in *B*. Now the Mufcle *AB* having a free Paffage through the Ring *D*, it will always contract fo much,
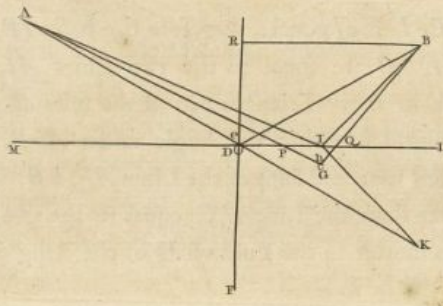
as to render it felf the fhorteft, that can be for any given Tenfion of the Mufcles fupporting the Ring *D*, and given Pofition of the Extremity *B* of the Jaw Bone. Which being confidered, I fay the right Line, in whofe Direction the Ring *D* acts upon the Mufcle *AB*, always divides the Angle under *A e B* into two equal Parts:

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* De Corp. human. fabric. Lib. II. cap. 59. Mufculus pedem moventium nonus.

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For when the Angle under AeB is so divided, the Line AeB will be the shortest; as is thus demonstrated.

LET eF be the Line, in whose Direction the Muscles of the *Os Hyoides* support the Ring D. Draw MeL perpendicular to eF, and produce Ae to K, till eK be equal to eB. Then because the Angles under AeF, FeB are equal, and MeL is perpendicular to eF, that is the Angles under MeF, FeL are equal, the Angles under MeA, LeB are likewise equal: But the Angle under LeK is equal to the Angle under MeA; therefore the Angles under KeL, BeL are equal. Now let the Ring D change its Position to that of G: Then because the Line ML is perpendicular to the Line, in whose Direction the Ring in the Position D is supported, and the Muscles which support it, are supposed to have no additional degree of Tension given them by the changing of the Position of the Ring, the Ring must fall without the Line ML, and the Muscle inflected through it obtain the Situation AbB, cutting the Line ML in two points P, $\mathcal{Q}$. Take at pleasure in the Line ML between P and $\mathcal{Q}$ the point I, and join AI, IB, and IK. Then in the two Triangles BeI, KeI the side eI is common to both, and the sides eB, eK, as likewise
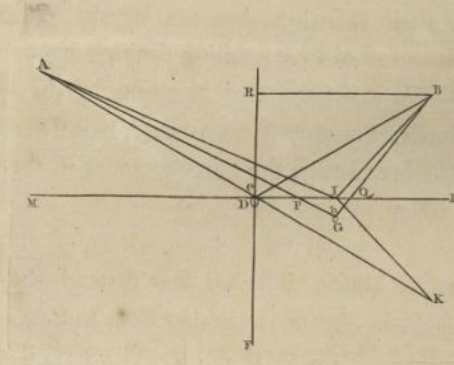
the Angles under BeI, KeI equal: therefore the Bases IB, IK are equal. Whence the two Lines AI, IB are equal to the two Lines AI, IK, which exceed the Line AK; because in every Triangle two of the sides are always greater than the third; but the point I is within the Angle under AbB, so that the Sum of the Lines AI, IB is less than the Sum of the Lines Ab, bB: Therefore the two Lines Ab, bB are greater than the Line AK, equal to the two Lines Ae, eB. Hence the Muscle AeB is shorter in the Position D of the Ring than in any other.

BUT now from hence will be easily determined all that is to be enquired into relating to this Muscle. The Ring D being at rest, when the Angle under AeB is divided into two equal Parts by the Line eF, the Action of the Muscle AeB will be the same, whether it be connected to the Ring D in the point e, or disengaged from it, as has hitherto been supposed. For the Angles under AeF, FeB being equal, the Tensions of the two parts Ae, eB of the Muscle would be equal, if it were connected to the Ring D in e, as well as when disengaged from it; and will

will likewife be juſt as great in one caſe, as in the other. Therefore if from the point B the perpendicular BR be let fall upon the Line Fe, the force of the Part eB of the Muſcle, or, which is the ſame thing, the force of the whole Muſcle, will be to half the force, with which the Ring D is ſupported in the Direction Fe, as Be to eR. For this the Writers of Mechanics have demonſtrated in the Caſe of the Muſcle's being connected to the Ring D in e. So that the force of the Muſcle AeB is to the whole force, with which the Ring D is ſupported, as Be to twice eR.

AGAIN, the two Parts of the Muſcle Ae, eB, and the Ring D, are three Powers applied to the point e of the Muſcle, acting in the reſpective Directions of eA, eB, and eF. But the Part eB is ſuſtained by the point B, the moveable Extremity of the Jaw; upon which therefore it will act in the Direction oppoſite to that, in which it acts upon the point e. That is, the part of the *Digaſtric* Muſcle between its Connection with the Jaw, and the annular Ligament of the *Os Hyoides*, through which it paſſes, lies in the Direction of its Action upon the Jaw.

THE Rule juſt laid down for aſſigning the Proportion of the force, with which the annular Ligament of the *Os Hyoides* is ſupported, to that of the *Digaſtric* Muſcle, ſhews how a ſmall degree of Force applied to this Ligament, may retain the Muſcle in an inflected Situation: for the Angle under AeB may be taken of ſuch a Magnitude, that twice eR ſhall be to eB in any *ratio* leſs than that of 2 to 1. And the Force, with which this Ligament is ſuſtained againſt the Action of the *Digaſtric* Muſcle, is in reality conſiderably leſs than the Force of the *Digaſtric* Muſcle it ſelf; the *Muſculus Coracohyoideus* with a ſmall Aſſiſtance from the *Stylohyoideus* being the principal, or rather the ſole Supporter of that Ligament.

NOW it follows to treat of thoſe Muſcles, which lie over two or more Joints. The Influence theſe Muſcles have upon one of the Joints, over which they paſs, is eaſily determined; for they will contribute to the Motion of any one of the Joints, if the reſt be fixed and held inflexible by other Muſcles, in the ſame manner, as if they lay over none but that: and the Method of judging of their Direction, and eſtimating their Force is entirely the ſame: for the fixing the reſt of the Joints determines the Action of the Muſcle to that Joint, which is left moveable, as much as if thoſe fixed Joints were one continued Bone. But the effect of ſuch a Muſcle upon thoſe other Muſcles, which ſecure the reſt of the Joints, is ſomething leſs obvious, and muſt diſtinctly be conſidered. For which purpoſe two Caſes are ſeparately to be examined; both attempted by *Borelli*, but neither ſufficiently explained by him. One is, when a Muſcle lies over two Joints, which bend the contrary way; the other when the Joints, over which the Muſcle lies, bend the ſame way.

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THE Joints of the Knee and Foot, covered by the *Gaſterocnemius externus*, are an inſtance of the firſt Caſe. For explaining this Caſe therefore, let *AB* repreſent the Thigh Bone, *B* the Knee, *BC* the *Tibia*, *C* the Joint of the Foot, *ED* the Foot it ſelf, *GF* the *Muſculus Gaſterocnemius externus* connected to the Thigh Bone
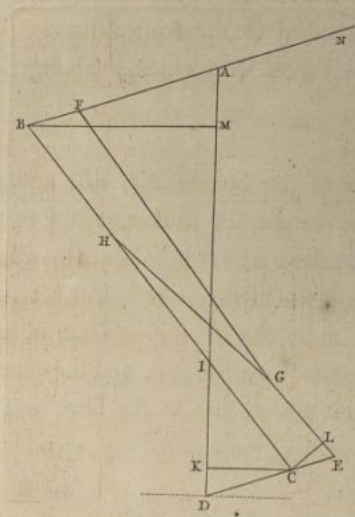
in *F*, *GH* the *Gaſterocnemius internus*, called by ſome the *Soleus*, connected to the *Tibia* in *H*, their common Tendon *GE* affixed to the *Os Calcis* in *E*. Let the Extremity of the Foot reſt upon the Ground in *D*; and a Power be applied to the point *A* of the Thigh Bone *AB*, in the Direction of *AD*; let the Joint of the Knee *ABC* be held firm by its proper Muſcles: then if a Stick or other rigid Body were laid in the Line *AD*, that one of its Extremities ſhould touch, and reſt upon the *Tibia BC* in *I*, and the other Extremity touch the Thigh Bone in *A*, ſuſtaining the Power applied in that point *A*, the point *I* of the *Tibia BC* would be acted upon with the ſame Force, and in the ſame Direction as now, when the Power in *A* is ſuſtained by the Angle under *ABI*: for by the fixing and rendring unalterable the Angle under *ABI* the Magnitude and Poſition of the Line *AI*, in whoſe Direction the Power in *A* acts, is as much ſecured, as by a rigid Body directly interpoſed between *A* and *I*: the point *I* therefore is preſſed with the ſame Force, and in the ſame Direction in both Caſes. But by the Intervention of a rigid Body between *A* and *I*, the Power in *A* preſſes the point *I* with the ſame Force, and in the ſame Direction of the Line *AID*, as if the Power in *A* were applied to the point *I* in the Direction of *ID*. Therefore by fixing, and ſecuring the Angle under *ABI* from alteration, the point *I* is preſſed with the ſame Force, and in the ſame Direction by the Power in *A*, as if that Power were applied to the point *I* in the Direction of *ID*. Now the *Muſculi Gaſterocnemii, externus* and *internus*, act in ſupporting the Angle under *BCD* in the Direction of their common Tendon *EG*; and the Force, with which they muſt act to ſuſtain the Joint *C*, is to the Power applied in *A*, or *I*, by the Rule before laid down for Muſcles lying over one Joint, as *CK* the perpendicular let fall from *C* to the Line *ID*, in whoſe Direction the Power

acting

acting againſt the Muſcles is applied, to *CL* the perpendicular let fall from the ſame point *C* upon *EG*, the part of the Muſcles ſupporting the Joint *C*, which lies in the Direction of their Action.

BUT this Force thus found muſt be divided between the *Gaſterocnemius internus* and *externus*. That part of it, which appertains to the *Gaſterocnemius internus*, has no Influence upon the Joint *B*, becauſe the *Gaſterocnemius internus* is connected to the *Tibia*. But the *Gaſterocnemius externus* being connected to the Thigh Bone in *F*, its Action, which is no other than drawing the points *E, F* towards each other, tends as well to diminiſh the Angle under *FBC*, as to augment the Angle under *BCD*. Whence though the Power applied in *A* were actually applied in *I*, yet there would be required ſome degree of Force to ſuſtain the Angle under *FBC* againſt the Action of the *Gaſterocnemius externus*. But the Power, againſt which theſe Muſcles act, not being applied in *I*, but in *A*, the Muſcles, whoſe Office it is to ſupport the Joint *B*, which are the Extenders of the *Tibia*, are required to exert a certain degree of Force to ſuſtain the Angle under *ABC*, and preſerve it from Diminution by the Preſſure of the Power in *A*. And to the Force, which they exert upon this account, muſt be ſuperadded that Force, which is required in them, to ſuſtain the Heads of the *Gaſterocnemius externus*.

AND this is what is to be ſhewn in this firſt Caſe, that when a Muſcle, deſigned for the Motion of any Joint, paſſes over another Joint, and is inſerted into the ſecond Bone from the Joint whoſe Motion it is deſigned for; when the Joints bend contrary ways, it is a ſtrain upon the Muſcles of that other Joint, over which it paſſes, and requires a greater degree of Force in thoſe Muſcles, when a Power is ſupported by the united Action of the Muſcles of both Joints, than otherwiſe would be needful.

FURTHER, the Force exerted by a Muſcle, paſſing over two ſuch Joints, in ſuſtaining the Joint, to which it properly belongs, being given, the degree of Force required in the Muſcles of the other Joint to ſupport its Action is eaſily determined. For inſtance, the Force required in the Extenders of the *Tibia* to ſupport the *Muſculus Gaſterocnemius externus* is to the Force, with which the *Gaſterocnemius externus* contracts, as the perpendicular let fall from *B* upon the Line *FG*, in whoſe Direction the *Gaſterocnemius externus* acts, to the perpendicular let fall from *B* upon that part of the Extenders of the *Tibia*, which lies in the Direction of their Action, that is the part of their Tendons which lies over the Joint. Otherwiſe, if from the Weight in *A* be deducted that part of it, which is ſuſtained by the *Gaſterocnemius internus*, the Ratio of the remaining Part to the Force required in the Muſcles of the *Tibia* to ſuſtain the Action of the *Gaſterocnemius externus*, will be compounded of the Ratio of *CL* to *CK*, and of the Ratio of the Perpendicular

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let fall from *B* upon the Line *FG* to the Perpendicular let fall from the fame Point *B* upon the Extenders of the *Tibia*.

BESIDES, as this laſt named Perpendicular to *BM*, the pependicular let fall from *B* upon the Line *AI*, in whoſe Direction the Power in *A* is applied, ſo is this Power applied in *A* to the Force required in the Extenders of the *Tibia* to ſuſtain the Angle under *ABC* againſt the action of this Power. And theſe two Proportions give the whole Force required in the Extenders of the *Tibia* for the Support of the Limb *ABCD* againſt the Power in *A*.

THIS Method of computing the Force required in the Muſcles, which ſuſtain the Angle *ABC* is agreeable to the Rule laid down above. *Borelli* * attempts the ſame after a manner ſomething different. He compares theſe Muſcles to a String connected by one end to the Thigh Bone, and by the other to the *Tibia*; and

inflected over the Extremity of a Line drawn from the Joint: like as the Line *NOP* is connected to *AB* in *N*, to *BC* in *P*, and inflected over the Extremity *O* of the Line *BO*, drawn from the Point *B*. He does not expreſſly ſay whether he takes the Line *BO* to make a given Angle with one of the Lines *AB*, *BC*, or to be moveable at liberty about the point *B*. If he deſigned the latter Caſe, he treats of it very defectively, and is farther blameable for propoſing a Caſe, which does not correſpond to the Joints; if he deſigned the firſt Caſe, the Rule he gives is erroneous. His Rule is, that *BQ* being let fall from *B* perpendicular upon the Part *NO* of the String *NOP*, and *BR* drawn perpendicular to the Part *PO*, the Tenſion of the String *NOP* is to the Power applied in *A* as *MB* the perpendicular let fall from *B* upon the Line *AD*, in whoſe Direction the Power in *A* is applied, to the fourth Part of the Sum of *BQ* and *BR* †. He ſays the

* De mot. Animal. Part. I. Prop. XLIX, & LIII. pag. 91, & 97.
† De motu Animal. Part. I. Prop. XXXVIII. pag. 69. & Prop. XLIX. pag. 91.

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fourth Part, upon the account of his afcribing to Strings a Tenfion double to the Power, by which they are directly diftended; which Opinion, or manner of Expreffion, I have before objected againft *: Otherwife he would have taken half the Sum of the Perpendiculars BQ, BR. Now in cafe BO be moveable upon the Center B, and its Angle neither with the Line AB nor BC determined, this Rule is free from Error, but defective, becaufe it does not obferve the Perpendiculars BQ, BR to be equal, which they muft be in order to the Suftenfion of the Angle under ABC: for every part of the String NOP is equally diftended, and the Tenfion of the Parts NO, OP being equal, they prefs upon the Point O, againft which the String is diftended in the Direction of the Line, which divides the Angle under NOP into two equal Parts; and that this Preffure may be in the Direction of the Line BO, which is required in order to the Stability of the Line BO, and that it be held fixed by this Preffure, the Line BO muft divide the Angle under NOP into two equal Parts; that is, the Angles under NOB, POB muft be equal. But in the Triangles BOQ, BOR, the Angles under BOQ, BOR being equal, as likewife the Angles under BQO, BRO, becaufe both are right, and the Side BO being common to both Triangles, the Bafes BQ, BR are equal; but the Diftenfion of the String is to the Power applied in A, as MB to either BQ, or BR, and therefore to half the Sum of them. · Confequently the Rule laid down by *Borelli* in this Cafe is not erroneous: Though, as I obferved before, the Cafe it felf is not applicable to the Joints, in which we find nothing fupporting the Tendons, in fuch manner as to preferve conftantly the fame Diftance from the Center or Axis of the Motion, at leaft on the convex Side of the Joint. And even on the concave Side, the Ligaments, by which the Tendons are often tied in the Flexures of the Joints, are not ufually connected with the Bones near enough to the Axis of the Motion to perform fuch an Office.

IN the other Cafe, when the Line BO is fuppofed to retain always the fame Angle, either with the Line AB, or BC, fuppofe with BC, then the Perpendiculars BQ, BR may be unequal; in which Circumftance *Borelli*'s Rule will be erroneous: for the Perpendicular BR let fall upon the Part PO of the String NOP, which fubtends the given Angle, has no relation to the Tenfion of the String, that being performed in the Direction of NO, and therefore will be to the Power in A as MB the Perpendicular let fall from B upon the Line AD, in whofe Direction the Power in A is applied, to BQ the Perpendicular let fall from the fame Point B upon the Line NO, in whofe Direction the String NOP is diftended.

I DIFFER from *Borelli* likewife in computing the Force, with which the Mufcles GF, GH, which fupport the Angle under BCD, are diftended. I have declared it to be the fame, as if a Power were applied to the Point I in the Direction of the Line ID, equal to the Power applied in A. *Borelli* affirms it to be the fame, as if a Power were applied in the fame manner, which fhould be to the Power applied in A as MB to CK. This he collects from the following Propofition, which

* Pag. 8, 9.

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he attempts to demonſtrate, That a trilineal arched Figure as *MBCK*, compoſing two alternate Angles under *MBC*, *BCK*, and having two of its Sides *MB*, *CK* parallel, being given, if its extream Points *M* and *K* are impelled by two contrary Forces acting in the Direction of the ſame Line, *viz.* the Line *MK*, theſe Powers will be reciprocally proportional to the extreme Lines of the Arch, to which they are applied ; that is to ſay, the Power applied in *M* will be to that applied in *K* as *CK* to *BM* *. Thus *Borelli* expreſſes himſelf. But this is a very indefinite manner of ſpeaking, and carries no determinate Meaning with it. Certainly Powers may be applied to the Points *M* and *K* in the Proportion aſſigned ;
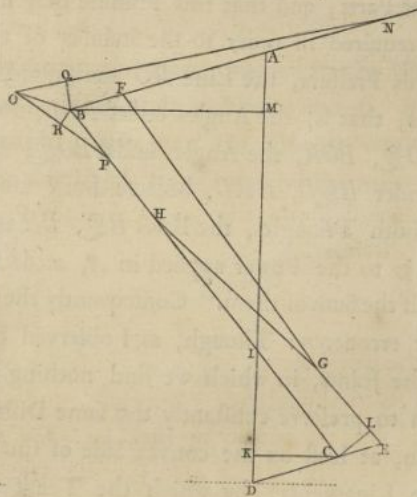
and in any other Proportion likewiſe. He ought to have expreſſed what Conſequence he expected from the Application of Powers in this Proportion. What is ſhewn, though very obſcurely, in that which he ſubjoins as a Demonſtration to the Propoſition, ſeems to me to be this : That if the Point *I*, in which the middle Line *BC* interſects the Line *MK*, in whoſe Direction the Powers act, be fixed by a third Power, and the Angles under *MBI*, and *KCI* be equally ſtrained by the Powers applied in *M* and *K*, then thoſe Powers will be in the aſſigned Proportion. And the Propoſition, which immediately ſucceeds this we are ſpeaking of, and depends entirely upon it, is expreſſed in the ſame confuſed Manner, but ſhews only this, That if inſtead of the trilineal arched Figure *MBCK*, in which the extreme Sides *MB*, *CK* are parallel, be taken the trilineal Arch *ABCD* in which the extreme Sides *AB*, *CD* may not be parallel, and in *A* and *D* be applied two ſuch contrary Powers, acting in the Direction of the ſame Line *AD*, as the Point *I* being fixed by a third Power, ſhall equally ſtrain the Joints *B* and *C*; then the Power applied in *A* will be to that in *D* in the aforeſaid Proportion of *CK* to *MB* †. But this is a Caſe widely different from that under Conſideration at preſent, to which *Borelli* compares it. For in that neither is the Point *I* fixed

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* De motu Animal. Part. I. Prop. XLVI. pag. 86.
† De motu Animal. Part. I. Prop. XLVII. pag. 87.

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by any third Power, nor the Angles under *ABC, BCD* neceffarily ftrained in an equal Degree. In neither of the Propofitions of *Borelli*, I have mentioned, is any thing faid of a third Power applied in *I*, but muft of neceffity be fupplied; for when the contrary Powers applied to the extremities of the Arch are not equal, the Machine cannot be fupported without the Affiftance of fuch a third Power.

BUT thefe Miftakes of *Borelli*, though proper to be animadverted upon in this Place, yet do not directly relate to the principal Defign of the prefent Head of this Difcourfe, which is to fhew, what Influence the Mufcle *FG* has upon the Extenders of the Joint *B*. But in this neither has he proceeded with fufficient Caution: For having affigned to the Mufcle *FG* a Tenfion double to the Power, by which it is diftended, he affumes the Mufcle to act upon the Point *F* with the whole Tenfion he afcribes to it *, contrary to his own Principles, and to the Reafon he gives for the Tenfion of the Mufcle's being double to the diftending Power; that, as I have already remarked, being this, that the Mufcle acts upon the Point *F*, and the Point *F* reacts againft the Mufcle, as much as the Power applied to the Mufcle acts upon its other Extremity.

THUS far of the firft Cafe of Mufcles, which lie over a Plurality of Joints. It is now time to pafs to the fecond, when the Joints, over which a Mufcle lies, bend the fame way. For the explaining this, let *ABCD* be a compound Lever compofed of three Arms *AB, BC, CD*. Let the Arm *AB* be fixed, the Weight *E* hung at the Extremity *D*, and fupported by the Strings *FG, HI*; the String *FG* paffing over the two Joints *B, C*, and the String *HI* over the Joint *B* only,
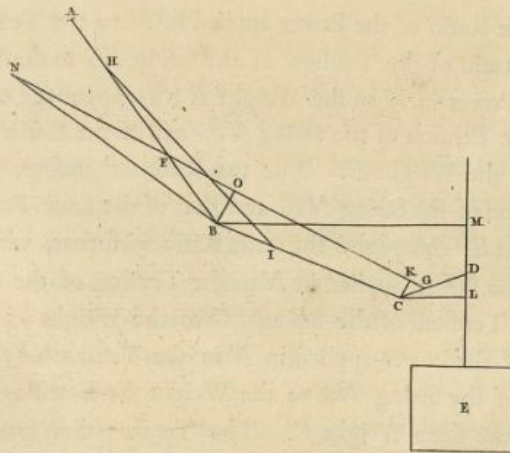
the remoteft from the Extremity *D*. Then it has been fhewn †, that the Joint *B* being fixed by the String *HI*, the other String *FG* is diftended by the Weight *E*

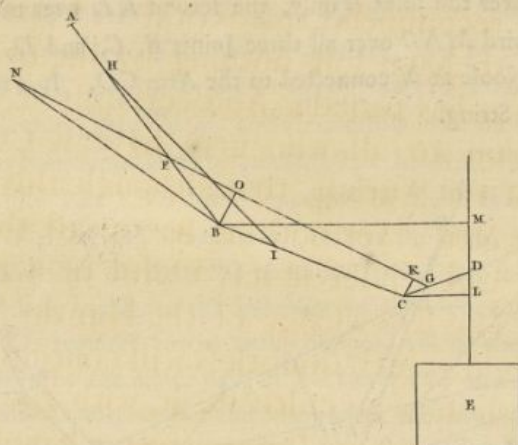* De mot. Animal. Part. I. Prop. LII. pag. 95. † Pag. 13.

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in the fame Degree, as if that String were connected to the Arm BC, inftead of AB; that is, CK being let fall from C perpendicular upon FG, and CL perpendicular to DE, the Line, in whofe Direction the Weight E acts, the Tenfion of the String will be to the Weight E as CL to CK. It is required to find the Tenfion of the String HI. This *Borelli* affirms to be as great, as if there were no Joint in C to be fuftained by the String FG, but that BCD were one continued Arm of the Lever, and the String FG were removed *. What the Tenfion of the String HI really is, may be found thus. From the Point B let fall upon the Line DE, produced if needful, the perpendicular BM; and the Connection of the String FG being continued, let the String FG be produced beyond F in a right Line, till the Diftance of its Extremity N from the Point B be equal to the Perpendicular BM. To the Lever let another Arm be added BN, turning upon the Center B, and connected to the String GF produced in N. Then is the new Arm BN equal to the Perpendicular BM. Let fall from B upon the String FG the Perpendicular BO, and to the Extremity of the Arm BN, and perpendicularly to it, let a Power be applied, whofe Ratio to the Weight E fhall be compounded of the Ratio's of BO to BM or BN, and of CL to CK. Then the Power in N will diftend the String NF, and being applied perpendicularly to the Arm BN, and BO being a Perpendicular let fall upon the String NF produced, the Power applied in N will be to the Tenfion of the String NF as BO to BN: but as CL to CK, fo is the Tenfion of the String FG to the Weight E. Therefore the two Ratio's of BO to BN, and of CL to CK, compound the fame Ratio with that, which is compounded of the Ratio of the Power applied in N to the Tenfion of the String NF, and of the Ratio of the Tenfion of the String FG to the Weight E. But the Ratio of the Power in N to the Weight E is compounded of the Ratio of BO to BN, and of that of CL to CK. The Ratio therefore of the Power in N to the Weight E, is compounded of the Ratio of the Power applied in N to the Tenfion of the String NF, and of the Ratio of the Tenfion of the String FG to the Weight E. Again, the Ratio of the Power in N to the Weight E is compounded of the Ratio of the Power in N to the Tenfion of the String NF, and of the Ratio of the Tenfion of the String NF to the Weight E. The two Ratios therefore, that of the Power in N to the Tenfion of the String NF, and that of the fame Tenfion of the String NF to the Weight E, compound the fame Ratio with that, which is compounded of the Ratio of the Power applied in N to the Tenfion of the String NF, and of the Ratio of the Tenfion of the String FG to the Weight E. Take away the common Ratio of the Power applied in N to the Tenfion of the String NF, and as the Tenfion of the String NF to the Weight E, fo will the Tenfion of the String FG be to the fame Weight E. The Tenfion therefore of the String NF caufed by the Power applied in N is equal to the Tenfion of the String FG caufed by the Weight E. Wherefore the Point F of the String NG is drawn by the Power applied in N in the Direction FN, and by the Weight E in the oppofite

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* De mot. Animal. Prop. XLIV. pag. 79.

Direction

Direction *FG* with the same Force. So that if the Connection of the String *NG* with the Arm *AB* of the Lever in the Point *F* were loosed, yet the Point *F* of the String would be retained contiguous to the Arm *AB* by the Action of the Power applied in *N*. But since the Point *F* would remain in the same Place, whether connected to the Arm *AB* or not, it is evident that the String *HI*, by which the Arm *BC* is supported, will suffer the same Degree of Tension in both Cases. And when the String *NG* is connected to the Arm *AB* in *F*, the Power applied in *N* cannot at all affect the Tension of either String: For it can have no Influence upon the Part *FG* of the String *NG*, or upon any Part of the Lever, except the fixed Arm *AB*. From all which it follows, that the Tension of the String *HI* will remain the same, whether the String *FG* be connected to the Arm *AB* in *F*, and the added Arm of the Lever *BN* be removed with the Power applied to it in *N*, or the Connection of the String *FG* with the Arm *AB* be loosed, the String continued to *N*, and being connected to the Arm *BN*, the Power required be applied to *N*. But now the compound Lever *NBCD* will per-

form the Office of a Balance upon the Center *B*, and if the Power applied in *N* be equal to the Weight *E*, as it will be, if *BO* be to *BM* as *CK* to *CL*, the String *HI* will undergo no Degree of Tension; but the Machine would remain in *Æquilibrio* without it: if the Weight *E* exceed the Power in *N*, the Tension of the String *HI* will be that required to sustain the Excess of the Weight *E* above the Power in *N* applied in the Point *D*, and Direction of *DE*. If the Power in *N* exceed the Weight *E*, the String *HI* ought to have a Degree of Rigidity sufficient to hinder the Diminution of the Angle under *ABC*, by supporting the Excess of the Power in *N* above the Weight *E* applied at the Distance of *BN* or *BM*: or else a String must be inflected on the outside of the Angle under *ABC*, which by its Tension shall support the same Resistance.

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By this it appears, that in this Case, when a Muscle lies over another Joint besides that, whose Motion it principally presides over, and the two Joints bend the same way, the Muscle contributes to the Support of that other Joint, assisting the Muscles peculiar to that Joint; as in the other Case, when the Joints bend contrary ways, the Muscle common to both Joints was found to augment the Tension of the others.

AND this is sufficient to explain the Case of Muscles, which pass over two Joints; but when the Joints bend thus the same way, Muscles are often observed to lie over more Joints than two: the Consequence of which is to be collected much after the same manner. For this Purpose let *ABCDE* be a Lever compounded of four Arms *AB*, *BC*, *CD*, *DE* set together in three Joints *B, C, D.* Let the Arm *AB* be fixed, and the Weight *FG* suspended at the Extremity *E,* the Arms *BC, CD, DE* supported by the three Strings *HI, KL, MNO*; the first of which *HI* shall lie over the Joint *B* only, the second *KL* over two of the Joints *B* and *C,* and the third *MNO* over all three Joints *B, C,* and *D,* and besides be inflected through a Noose at *N* connected to the Arm *CD.* It is required to find the Tension of each String.
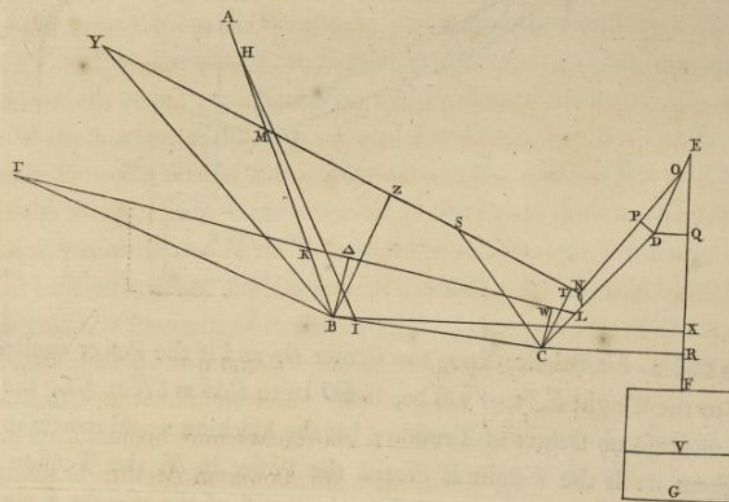
To begin with the String *MNO,* this being inflected, and passing freely through the Noose at *N,* both Parts of the String *MN,* and *NO* will receive the same Degree of Tension, but will not act, or rather resist the Power acting against them in the same Direction, but each in that Direction in which it lies: So that the Arms of the Lever *BC, CD* being supported by the proper Strings, the String *MNO* will support the Arm *DE* against the Weight *FG* in the Direction *NO.* Therefore from the Point *D* letting fall upon *NO* the Perpendicular *DP,* and the Perpendicular *DQ* upon the Line *EF,* in whose Direction the Weight *FG* acts,

acts, as DP to DQ, so will the Weight FG be to the Tenſion of the String MNO. To find the Tenſion of the String KL let fall from the Point C the Perpendicular CR, and in the Joint C apply another Arm CS to the Lever, equal in length to the Perpendicular CR, and connected by its Extremity S to the String MN. Then if a Power be applied to S, as the String NO ſupports the Arm of the Lever DE in the Direction NO, ſo will the String SN ſupport the Arm CS in the Direction SN. So that if the Power be applied in S perpendicularly to the Arm of the Lever CS, the Tenſion of the String SN by the Power applied in S will be to the Power applied in S as the Arm CS to the Perpendicular CT let fall from the Point C upon the String SN. Whence if the Power applied in S be taken to the Weight FG in the Ratio, which is compounded of the Ratio of CT to CR, and of that of DQ to DP, then the Tenſion of the String SN by the Power applied in S will equal the Tenſion of the String NO by the Weight FG. But the Part SN of the String SNO was before ſhewn to receive the ſame degree of Tenſion from the Weight FG as the Part NO, by reaſon of the free Communication of both Parts of the String through the Nooſe at N: So that the Part SN of this String will receive the ſame degree of Tenſion by the Weight FG, and by the Power applied in S. But the Directions of theſe two Tenſions are contrary, that by the Weight FG being directed from S to N, and that by the Power applied in S from N to S; being equal therefore and contrary, they ſuſtain, and counterbalance each other. Hitherto the String SNO has been ſuppoſed to be connected to the Arm AB of the Lever in the Point M; but the Part SNO being ſupported by theſe two contrary Powers in *Æquilibrio*, its Tenſion and Situation will remain the ſame, though the Connection of the String with the Arm AB be looſed. Hence it follows that the String SNO will contribute equally to the Suſtenſion of the Arm CD, and the Tenſion of the String KL required for its entire Support will be the ſame, whether the String be ſuſtained by the added Arm of the Lever CS, and the Power applied to it in S, or by the Connection of the String with the Arm AB in the Point M, the Arm CS and Power applied to it being removed; for the Arm CS has no Influence upon the Arms CD, or DE, but by the Intervention of the String SNO. But now the compound Lever $SCDE$ performs the Office of a Balance ſuſpended upon the Center C, CS and CR being equal; wherefore the String KL ſuſtains the Exceſs of the Weight FG ſuſpended in E above the Power applied in S. Take from the Weight FG the Portion FV equal to the Power applied in S, and let fall from the Point C upon the String KL the Perpendicular CW; then the Tenſion of the String KL will be to the Weight VG as CR to CW.

Thus is found the Tenſion of the String KL. To find the Tenſion of the String HI proceed thus. From the Center B let fall the Perpendicular BX upon the Line EF, and apply at the Center B a new Arm BY to the Lever, equal in length to the Perpendicular BX, and connected to the String NM produced beyond M by its Extremity Y. Then a Power being applied in Y perpendicularly to the Arm BY, this Power will be to the Tenſion of the String MY cauſed by

it,

it, as the Perpendicular BZ, which is let fall from B upon ΥN, to the Arm $B\Upsilon$; and if the Power applied in Υ be to the Weight FG in the Ratio, which is compounded of the Ratio of BZ to BX, and of DQ to DP, the Tenſion of the String $M\Upsilon$ by the Power applied in Υ, and that of the String MNO by the Weight FG will be equal, and have a contrary Direction. So that this Power being applied in Υ, the String ΥMNO will preſerve the ſame Tenſion, and Poſition, whether connected to the Arm AB in M, or not. In like manner a new Arm $B\Gamma$ being added to the Lever at the Joint B of equal length with the Perpendicular BX, and connected by its Extremity Γ to the String LK produced beyond K; if a Power be applied in Γ perpendicularly to the Arm $B\Gamma$, whoſe Ratio to the Weight VG, that being the whole Weight, againſt which the String KL acts, ſhall be compounded of the Ratio of $B\Delta$, the Perpendicular let fall from B upon ΓL, to BX, and of CR to CW; then the String ΓKL ſhall preſerve the ſame Tenſion and Poſition, whether connected to the Arm AB in the Point K, or not. Therefore the Connections of the Strings ΥMNO, and ΓKL with the

Arm AB in M, and K; $B\Upsilon$, $B\Gamma$, and BX being all equal, the Tenſion of the String HI will be that required to ſuſtain the Exceſs of the Weight FG above the Powers applied in Υ, and Γ. But if the Strings ΥMNO, ΓKL be connected in M and K, and the Powers applied to Υ and Γ be removed, the Tenſion of the String KI will be the ſame, becauſe the Powers applied in Υ and Γ have no other Effect upon the Strings MNO, KL but the ſupplying the Place of the Connections in M and K; nor any Influence upon the Arms BC, CD, DE, when the Strings are connected in M and K.

NOW from all which has been ſaid may be drawn this general Obſervation; That in theſe compound Levers, when a String lies over other Joints, beſides

fides that it is principally defigned to fupport the part of the Weight fufpended at the Extremity of the Lever, which fuch a String fupports at any other Joint, is to the whole Weight in the Ratio compounded of the Ratio of the Perpendicular let fall from that Joint upon the Part of the String, which is in the Direction of its Action upon that Joint, to the Perpendicular let fall from the fame Joint upon the Line, in whofe Direction the Weight fupported acts; and of the Ratio of the Perpendicular let fall upon this Line from the Joint, to whofe Support the String principally contributes, to the Perpendicular let fall from this Joint upon the String.

THIS is the general Rule for determining the effects of Mufcles, which lie upon feveral Joints bending the fame way; for fuch Joints do perfectly refemble the compound Levers, that have been now treated of. It next follows to apply the Rule to fome particular Inftances. And in the firft place we may learn from hence the reafon why the Flexor of the fecond Internode of the Fingers is not double in bignefs to the Flexor of the third, as according to *Borelli*'s Doctrine it ought to have been; for the Examination of thefe Mufcles alone by the foregoing Rule fhews us that the *Perforatus* needs not be much, if at all, greater than the *Perforans*; fince we fhall find that the Flexor of the third Internode fupports near half the Action upon the fecond Joint of any Power applied to the Extremity of the Finger, and acting perpendicularly againft it; efpecially if the Finger be in fome meafure bent, as moft ufually it is in its ordinary Action. By the preceding Rule the Flexor of the third Internode fupports a part of the Action of fuch a Power againft the fecond Joint, and that Part bears to the whole Action upon that Joint, the Ratio compounded of the Ratio of the Perpendicular let fall from the Center, whereupon the fecond Joint moves, upon the Tendon of the *Perforans* to the Perpendicular let fall from that Center upon the Line, in whofe Direction the Power is applied to the end of the Finger, and of the Ratio of the diftance of the Extremity of the Finger from the Center of the third Joint to the Perpendicular let fall from that Center upon the Tendon of the *Perforans*. But thefe two Ratios compound a Ratio not much differing from that of 1 to 2; fo that the *Mufculus Perforans* fupports about half the Action of the Power upon the fecond Joint. But the Tenfion of the *Mufculus Perforatus* is to the Power againft which it acts, as the Perpendicular let fall from the Center of the fecond Joint upon the Line, in whofe Direction the Power acts againft the Extremity of the Finger, to the Perpendicular let fall from the fame Center upon the Tendon of the Mufcle; and there remaining no more than about half the Weight for this Mufcle to act againft, its Tenfion will be to the whole Weight as about half the firft Perpendicular to the fecond. But this Ratio, in the Situation of the Finger and of the Line of Direction the Power acts in, which we have here fuppofed, is little different from that of the diftance of the Center of the third Joint from the end of the Finger to the Perpendicular let fall from that Center upon the Tendon of the *Perforans*; which latter Ratio is the fame with that of the Tenfion of the *Perforans* to the whole

Power

Power fupported. Hence it appears, that in thefe Mufcles are required for the ordinary Actions of the Fingers no very different degrees of Tenfion; and confequently the Mufcles themfelves on this Account ought to be about the fame Size. It is further worth notice in this Place, that the *Perforatus* acts with fomewhat greater advantage upon the fecond Joint than the *Perforans* does; for the Tendon of the *Perforans* paffing under that of the *Perforatus*, raifes the latter to a greater diftance from the Bone.

THUS far we fee, that the Flexor of the fecond Internode of the Finger needs fcarce exceed the Flexor of the third; but the firft of thefe Mufcles is found not only no greater than the other, but even confiderably lefs; the reafon whereof is to be drawn from another Confideration, namely from the Structure and Difpofition of thofe Mufcles, whofe office it is to bend the firft Joint of the Fingers. Thefe Mufcles are the *Lumbricales* and *Interoffei*, which are partly inferted into the firft Bone of the Fingers, and partly form Tendons, which paffing on the inner fide of the firft Joint, are united with the Tendons of the Extender of the Fingers, and accompany them through their whole length. By which Formation thefe Mufcles extend in fome fmall degree the fecond Joint of the Fingers, and much more powerfully the third, and at the fame time they are Flexors of the firft Joint. As *Falloppius* made a very great Difcovery in obferving that thefe Mufcles extend the fecond and third Joints of the Fingers *, fo *Vefalius*'s Sentiment that they likewife bend the firft Joint † ought not to be neglected, fince there are no other Mufcles allotted to that Office, and yet without particular Flexors of this Joint the Motion of the Fingers would be imperfect; for if the preceding Rule be applied to the *Perforans* and *Perforatus* at the firft Joint of the Finger, they will be found each to fupport about one third part of the influence upon this Joint of the Power applied to the Extremity of the Finger; and will leave one third part to be fupported by Mufcles proper to this Joint. But now thefe *Lumbricales* and *Interoffei* by the forementioned Difpofition of their Tendons, while they bend the firft Joint, act againft the Benders of the fecond and third, but chiefly againft the Flexor of the third; infomuch that the Flexor of the third Joint ought to bear a greater Proportion to the Flexor of the fecond than would otherwife have been neceffary. Moreover, the *Lumbricales* arife from the Flexor of the third Internode, whence this Mufcle ought to be ftill larger, to enable it not only to execute its own office, but likewife to fuftain the *Lumbricales* in the Performance of theirs.

WHAT has here been fhewn of the Mufcles of the Fingers contributing to the Support of all the Joints, over which their Tendons pafs, leads us to one great

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* Obferv. Anatom. in Oper. fol. 243.
† De corp. human. fabric. Lib. 11. c. 43. & Obferv. Fallop. examen. p. 71.

Defign

Defign in this Contrivance of laying Mufcles over feveral Joints, which is, that in thofe Joints, which bend the fame way together, the fame Mufcle might be fubfervient to more Joints than one. Thus the *Perforans*, befides the third Joint of the Fingers, which it alone fuftains, affifts in fupporting not only the two o- ther Joints of the Fingers, as has been faid, but likewife the Wrift: The *Perfora- tus* befides the fecond and firft Joints of the Fingers affifts in fupporting the Wrift and Elbow Joint, it arifing from the *Humerus*: and the *Lumbricales* have added to their Office of fupporting the firft Joint of the Fingers, another of affifting the Flexors of the Wrift.

Though we find too, that a Mufcle may pafs over a Joint without fenfibly contributing to the Motion of it, which I take to be nearly the Cafe of the *Pal- maris longus*, and the two Flexors of the Wrift in refpect of the Joint of the Elbow. The *Palmaris* arifes from the very Apex of the internal Tubercle of the *Hume- rus*; fo that its Origin is juft in the Axis, upon which the Joint moves, and there- fore can have no effect upon it. The two *Flexores Carpi* take their Rife from the fame Tubercle of the *Humerus*, on each fide the Head of the *Palmaris*, and contiguous to it: Wherefore they have their Origin fo near to the Axis of the Joint, that their effect upon the Motion of it muft be very inconfiderable. Befides, the fmall diftance the Heads of thefe Mufcles have from the Axis of the Joint in the *Flexor radialis* is toward the Infide, in the *Flexor ulnaris* toward the Outfide: And what the Mufcle which arifes on the Infide of the Axis, contributes to the Flexure of the Joint, that which lies on the Outfide will contribute to the Exten- fion of it. So that when thefe Mufcles act together, as they do when they bend the Wrift, or refift to the Extenfion of it, they deftroy each other's Action upon the Joint of the Elbow, and in this Cafe have more certainly little or no effect upon it.

Hence it fhould feem, that thefe Mufcles are laid over the Joint of the Elbow only for the more convenient Situation of them. Which probably is one Defign likewife in giving the *Gafterocnemius externus* its Rife from the lower Head of the Thigh Bone; for that, as has been fhewn, by paffing over the Joint of the Knee makes a greater degree of Force neceffary in the Mufcles of the Knee, which act with it, than would elfe be needful; fo that this Mufcle is fo far from affifting to the Support of the Knee, that it has the contrary effect. Though another Intent may likewife be allowed of, which is, that the Mufcle, when both the Joints over which it lies, are extended, fhould not be confiderably fhorten'd, and fo preferve the Force of its Action more entire. And this feems more evidently to be inten- ded in the Flexors of the *Tibia*. For by an Experiment of *Borelli*, which fhall prefently be more particularly fpoke to, we find thefe Mufcles by being contracted to lofe confiderably their Force *. But by giving them their Origin from the *Os*

* De mot. Animal. Part. I. cap. IX. pag. 51, 52.

Ifchii,

of the Thigh Bone ; and fuch a *Sinus* we find there. But becaufe the depreffing the Tendons in fuch a *Sinus* would in part fruftrate the principal Defign, name-ly that of removing the Tendons to the greateft diftance from the Axis of the Motion; to avoid this the *Patella* is placed under the Tendons, and connected to them, fitting the *Sinus* in the Thigh Bone, and fo fecuring the Tendons from fliding off the Joint; and yet preferving the diftance of them from the Axis of Mo-tion, nay increafing it.

BUT as this Structure of the Knee augments the Action of the Extenders of the *Tibia,* fo it will have the contrary effect upon the Flexors; for the oval Figure of the Heads of the Thigh Bone removing the Axis, upon which the Joint turns, to-ward the hinder Part of the Bone, places it nearer to the Tendons of the Flexors than it would otherwife be.

THESE are the Effects, the Structure of the Knee has upon the Mufcles, when the Joint is extended. As the Knee is bent, the oval Figure of the Heads of the Thigh Bone will force the Axis of Motion continually to recede backwards; which would caufe it to approach the Tendons of the Flexors, and become nearer to them, when the Knee was bent, than when extended; but that thofe Tendons are inferted into the *Tibia* in fuch a manner, as obliges them, at the fame time the Axis approaches toward them, to rife from the Joint; which they do fo confide-rably, that their diftance from the Axis of Motion, if not increafed, does by no means feem to be diminifhed by the Joint's being inflected. From hence may be drawn this Remark, as the Refult of what has been here faid, that thefe Mufcles do not appear lefs conveniently fituated to act upon the *Tibia* when the Knee is bent, than when extended; but that the Diminution of their Force is entirely to be afcribed to the Alteration made in the Mufcles themfelves by being contracted, and that they lofe their abfolute Force in no lefs Proportion, than that in which the Weight applied to the Heel is diminifhed.

WHY the Flexors of the Cubit do not in the fame manner lofe part of their Action upon the Arm by the bending of the Elbow in the recited Experiment, but on the contrary have it augmented, comes next under Confideration. And in the firft place it is to be obferved, that the *Os Femoris* in the Experiment upon the Flexors of the *Tibia* has the fame Situation in refpect of the *Os Innominatum,* from whence thofe Flexors rife, in both Cafes; but in the Experiment upon the Arm the *Humerus* does not preferve in both Cafes the fame Pofition with refpect to the *Scapula*; being applied contiguous to the Side, when the Elbow is bent, and exten-ded to a right Angle with the Trunk of the Body in the other Cafe. Upon this account the *Biceps,* one of the Flexors of the Arm, arifing with both its Heads from the *Scapula,* will be no fhorter with the Elbow bent, than with it extended; and therefore however its Force might diminifh by its being fhorten'd, in this Ex-periment, it will act with no lefs a degree of Force in one Cafe than in the other;

nay,

nay, muſt act with greater Force, when the Elbow is bent, its Tendon riſing then a little from the Joint. *Borelli* does not ſay whether the Experiment was made with the Arm extended forward, or laterally, nor is it of great Importance to know that Circumſtance; for though the two Heads of the *Biceps* will not in both Caſes be at the ſame diſtance from the other Extremity of the Muſcle, yet are they ſo diſpoſed, that whenever one Part of the Muſcle is any thing relaxed, the other will be proportionally diſtended, one of theſe Heads paſſing on the Inſide, the other on the Outſide of the Shoulder Joint. Thus much of the *Biceps*. The *Brachiæus internus* ariſing from the *Humerus*, will by bending the Elbow be too much ſhortned to preſerve its Force entire, but muſt in all Probability be render'd ſo much weaker, as to make ſome farther Aſſiſtance neceſſary to move the Cubit with greater Force when bent, than when extended. For the Force of this Muſcle bears ſo great a Proportion to that of the *Biceps*, that the loſing any great part of the Action of this, if it does not leſſen the united Action of both, and diminiſh the Force with which the Arm is bent, muſt at leaſt ſo far abate their Force, as to render them incapable of ſupporting a Weight ſo much as a fourth Part greater in this Caſe than in the other, unleſs they be aſſiſted by ſome other Muſcle, which like the *Biceps* ſhould have its Force increaſed by the bending of the Arm, and be likewiſe ſo large, that the Action of the *Brachiæus internus* ſhall bear but a moderate Proportion to the whole Force with which the Arm is bent. Such a Muſcle I take to be that uſually called *Radii Supinator longus*, a large Muſcle, and without doubt a Flexor of the Arm; for it is to be perceived externally by the Touch to act very ſtrongly when the Arm is forcibly bent; and beſides, by having its Origin at a great diſtance from the Joint, it riſes when the Elbow is bent, very high from it; probably not a little more than is ſufficient to compenſate what Diminution it may ſuffer in its Action by being ſhorten'd.

THE Action of Muſcles lying over a Plurality of Joints having been thus largely explained, the firſt general Head of this Diſcourſe may now be brought to a Concluſion, by adding only a few Words concerning the Action of a ſort of Muſcles not employed in moving any ſolid Part. I mean the Sphincters; whoſe Action upon the Bodies included within them, I ſhall now explain.

LET *ABCDE* be a String in the Figure of a regular Polygon ſuſtained by Powers applied to each of its Angles *A*, *B*, *C*, *D*, *E* in the Direction of the Lines *AF*, *BG*, *CH*, *DI*, *EK*, making equal Angles each of them with the Sides of the Polygon including the Angle to which the reſpective Power is applied. I ſay in the firſt place the Powers are all equal, as likewiſe the Tenſion of every Side of the Polygon. Draw *EB* and produce *FA* to *L*; then the Angles under *FAB*, *FAE* being equal, for that is ſuppoſed, and the Power applied in *A* ſupported by the Tenſion of the Sides *AB*, *AE* of the Polygon, the Tenſion of *AB* is to half the Power applied in *A* as *AB* to *AL*. In like manner drawing *AC*, and producing *GB*

to

to M, the Tenſion of AB is to half the Power applied in B as AB to BM. But becauſe the Figure $ABCDE$ is a regular Polygon, the Lines AL and BM are e-qual; the Power therefore applied in B is equal to that applied in A. In the ſame manner the Power applied in C will be equal to that in B, and ſo of the reſt. Wherefore the Powers applied in A, B, C, D, E are all equal one to another. But the Angles under FAE, FAB, GBA, GBC, HCB, HCD, IDC, IDE, KED, KEA are all equal, whence the Powers applied in A, B, C, D, E being equal, it is evident, that every Side of the Polygon will ſuffer an equal degree of Tenſion.
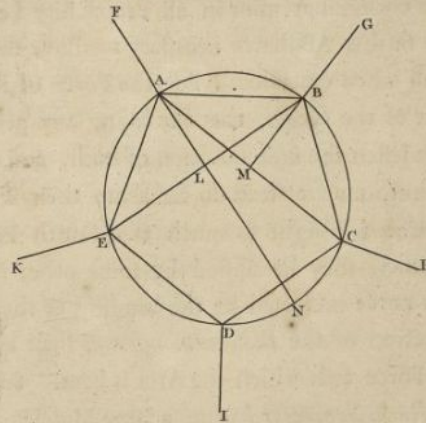
I SAY again, the Sum of all the Powers is to the Tenſion of the String, as the length of the String to the Semidiameter of the Circle circumſcribed about the Polygon.

DESCRIBE about the Polygon a Circle, and produce AL till it meet the Cir-cumference in N; then is AN the Diameter of the Circle, becauſe it divides the Angle under EAB of the Polygon into two equal Parts; and BL is perpendicular to AN, therefore as AB to AL ſo NA to AB. But as AB to AL ſo is the Ten-ſion of the Side AB of the Polygon to half the Power applied in A. Whence as AN to AB ſo is the Tenſion of the Part AB of the String to half the Power applied in A. But as AB to the whole length of the String $ABCDE$, ſo half the Power applied to half the Sum of all the Powers, they being equal to one an-other, and equal likewiſe in Number to the Sides of the Polygon. Wherefore by Equality as AN the Diameter of the Circle to the length of the String, ſo is the Tenſion of the Part AB of the String, or the Tenſion of the whole String, for every Part of it has been ſhewn to be equally tenſe, to half the Sum of the Powers applied in A, B, C, D, E. And laſtly, as half the Diameter of the Circle to the length of the String, ſo is the Tenſion of the String to the Sum of all the Powers.

FARTHER,

FARTHER, if in the room of the Powers, paſſive Reſiſtances only be applied to the Points, *A*, *B*, *C*, *D*, *E*, and the String be endued with a Power of Contraction, the Force, the String contracts with, will be to the Force, impreſſed upon all the Reſiſtances, as the Tenſion of the String in the other caſe to the Sum of all the Powers, that is, as the Semidiameter of the circumſcribed Circle to the length of the String. But if the number of theſe Reſiſtances, and of the Sides of the Polygon be continually encreaſed without limit, the Polygon will at laſt coaleſce with the Circle circumſcribed, and the Length of the String will be the Circumference of that Circle. In this caſe therefore the Force of the String's Contraction will be to the Force, with which it acts upon Reſiſtances applied to every point of the Circumference of the Circle, or to its Preſſure upon the whole Surface of a Body, which ſhould adequately fill the Circle, as the Semidiameter of that Circle to its Circumference. And the Power, with which the String contracts, will be to the Force, with which any given Part of it acts upon the Body lodged in its Concavity, as the *Radius*, with which the Arch it is formed into is deſcribed, to the length of ſuch Part. Thus therefore may be determined the action of the Sphincters upon the Bodies they encompaſs.

PART

INTRODUCTION.

PART II.

HAVING thus attempted to explain the effects of the Muscles upon the Parts they are appointed to move, I shall now proceed to the other Head of my design, and make some enquiry about the cause, that contrcts the Muscles, by taking into consideration one or two of the most received opinions concerning that matter.

As it was observed at the beginning of this Discourse, that the Muscles consist of two Parts, the Tendons and the fleshy Fibres; whereof the fleshy Parts only are found to suffer a change in the action of the Muscle; therefore to discover the immediate cause of muscular Motion, it appears necessary to enquire particularly into the Structure of these fleshy Fibres.

ACCORDINGLY most of the late writers upon this Subject have supposed these Fibres to be formed into Vesicles or Cells, whose inflation and distension by some fluid within them they conclude to be the cause, that contracts those Fibres, and the Muscle.

Now whereas this opinion has not been confirmed by any direct proofs, but is an Hypothesis only, and well received on no account so much as the extreme difficulty of conceiving any other means that might so easily produce the effect under consideration ; our first step shall be to examine what degree of probability may justly be allowed to this vesicular Structure of the muscular Fibres; and afterwards we shall likewise consider the most approved Conjectures, that have been made at the Cause, whereby the Juices contained in these Cells might be inflated. And since the vesicular Hypothesis requires the Fibres, when contracted, to encrease in Thickness by the Enlargement of their Cavities, it shall first be shewn, what increase in these Cavities of the Fibres will be consequent upon any proposed degree of the Fibres Contraction; in order to make a judgment whether the Intumescence, that may seem necessary to be ascribed to the Fibres and to the whole Muscle upon this Principle, agrees with what is observed in the motion of the Muscle.

BUT in order to this it must be first observed, that according to the degree of Contraction it shall be found necessary to assign to the Muscles, these Cavities may be supposed differently formed. If it be desired to give the Fibres as great a contractile Power as this Hypothesis can admit of, we must suppose the Fibres to be composed of compleat Bladders connected together by a small part only of their superficies in the manner they are usually delineated*: And upon this supposition the Fibre may contract into less than to half its length, as shall hereafter be shewn. But if a less degree of contraction be sufficient to answer all the appearances of muscular Motion, then the Fibres may be supposed hollow Cylin-

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* Vid. Fig. 2, 3, 4, 5. in Jo. Bernoulli Dissert. de Mot. Muscul.

ders

ders as *ABCD*, divided into cells as *ABFE*, *EFGH*, *GHDC*, either by tranf-
verfe membranes of fufficient Strength, or by being invefted at the proper Intervals by
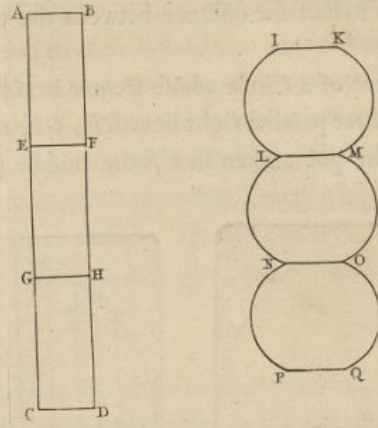
annular Ligaments, that may hinder the parts they bind from yielding to the expan-
ding Fluid, while the intermediate parts are protruded outwards, and the Fibre re-
ceive the Figure *IKLMNOPQ*.

In the next place we muft enquire into what kind of Figure the fides of thefe
Veficles will be expanded. The celebrated *John Bernoulli* attributes to them a cir-
cular Figure; but the calculations, upon which he grounds his affertion, are thus
far deficient; that he confiders thefe cells as plane Figures, and not as Solids made
by the revolution of a plane Figure about an Axis, as they really are. Accordingly
upon a ftrict Enquiry we fhall find this circular Figure fomething diftant from the
truth. If the cells of the Fibres are diftended by an included Fluid, it is evident
that the Figure they muft take, will be that, which will admit of the largeft Cavity,
that can be in any given diftance between the Bafes of the Cells; and the Coats of
thefe Cells being fuppofed to yield without refiftance to their dilatation in breadth,
and only in length to remain undiftendible, the Enlargement or Diminution will
wholly depend upon the Figure of the Arch, into which their Sides are bent.

In order therefore to determine this Figure we muft have recourfe to the Pro-
blem concerning ifoperimetrical Curves long fince celebrated among the Geometers;
fo much of which Problem, as relates to our prefent purpofe, fhall here likewife be
confidered in the following Propofitions.

PROPOSITION I.

THREE Points in the circumference of a Circle being given, and from them
three parallel right lines being drawn, as likewife two Chords from the middle point to
the two others; then if any point be taken in the middle parallel, from whence
perpendiculars fhall be let fall upon the Chords, I fay, the Diftances between the
parallels being diminifhed without limit, the ultimate *Ratio* of the Segment of the
middle

middle parallel, intercepted between the point laſt aſſumed and the circumference of the Circle, to the difference between the Segments, cut off from the Chords by the perpendiculars let fall upon them, will be the ſame, as the *Ratio* of the ſemidiameter of the Circle to half the diſtance between the extreme parallels.

In the Circumference of a Circle whoſe Center is *A* let the three points aſſumed be *B*, *C*, *D*, and the three parallel right lines *BE*, *CF*, *DG*, as likewiſe the Chords *BC*, *CD*; Let *H* be the point taken in *CF* the middle parallel, the perpendiculars
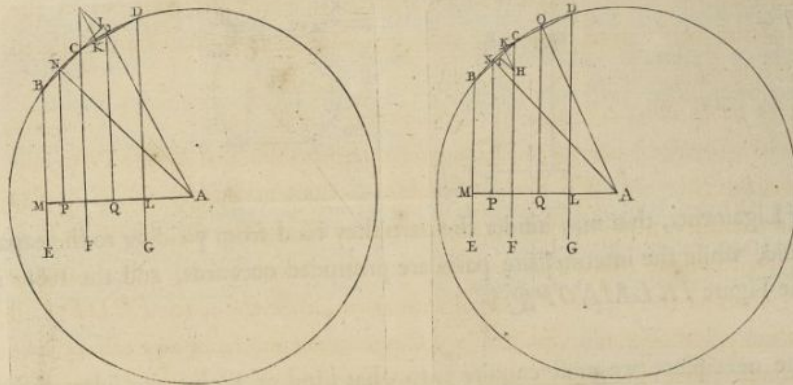
HI, HK being let fall from this point *H*, upon the Chords *BC*, *CD*, cutting off from thoſe Chords the Segments *CI*, *CK*. If the Diſtances between the parallels *BE*, *CF*, *DG* are diminiſhed without limit, I ſay the ultimate *Ratio* of *CH* to the difference between *CI*, *CK* is the ſame with that of the ſemidiameter of the Circle to half the Diſtance between the parallels *BE*, *DG*.

Let *ALM* be drawn perpendicular to *DG*, *CF* and *BE*. Let the ſemidiameters *AN*, *AO* be drawn perpendicular to the Chords *BC*, *CD*, and let *NP*, *OQ* be drawn perpendicular to *AM*. This preparation being made, becauſe *AN* and *HI* are both perpendicular to the ſame line *BC*, they are parallel; and *NP*, *HC* are alſo parallel, being likewiſe perpendicular to the ſame line *AM*, therefore the Angles under *ANP*, *IHC* are equal. Whence the rectangular triangles *IHC*, *NAP* are ſimilar, ſo that *HC* ſhall be to *CI* as the ſemidiameter *AN* to *AP*: In like manner the triangles *OQA*, *HKC* are ſimilar, and *HC* to *CK* as the ſemidiameter *AO* to *AQ*. Therefore becauſe *HC* was to *CI* as the ſemidiameter *AN* to *AP*, it follows that *HC* is to the difference between *CI* and *CK* as the ſemidiameter of the Circle to *PQ*. But now the points *B*, *C* and *D* approaching without limit the ultimate *Ratio* of *PQ* to *ML* the diſtance between the parallels *BE*, *DG* will be that of 1 to 2, whence the ultimate *Ratio* of *HC* to the difference between *CI*, *CK* will be that of the ſemidiameter of the Circle to half the diſtance between the extreme parallels *BE*, *DG*.

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PROPOSITION II.

TWO Curves, deſcribed to the ſame Abſciſſe with their reſpective Ordinates perpendicular to it, being ſo related to each other, that every Ordinate of one Curve bear conſtantly the ſame relation to that Ordinate of the other Curve, which lies in a direct Line with it, independent on any other variable Magnitude; I ſay if one of the Curves be of that Form, whereby the other Curve ſhall comprehend a greater Space than if the firſt Curve received any other Form, while it continued of the ſame length, then this firſt Curve ſhall be concave towards the Axis, when the Ordinates of the two Curves encreaſe together, otherwiſe it ſhall be convex to its Axis.

LET the two Curves * be AB, CD, their common Abſciſſe EF, the Perpendiculars to this Abſciſſe, AE, BF being Ordinates in the Curve AB, and EC, FD Ordinates in the Curve CD; the adjoining Ordinates of the Curves AB, CD bearing conſtantly the ſame relation to each other independent on any other variable Magnitude; then let the Curve AB be of that Form, that the ſpace $ECDF$ ſhall be greater than could be comprehended by a Curve generated from any other Curve paſſing through the Points A, B, and of the ſame length with the Curve AB; in the ſame manner as the Curve CD is generated from this Curve AB: This being ſuppoſed, I ſay, when the Ordinates of the two Curves bear ſuch a relation to each other, that the greater Ordinates in one of the Curves correſpond to the greater Ordinates of the other, then the Curve AB is concave to the Axis EF, otherwiſe it is convex to it.

IF poſſible let the Curve AB be convex to the Axis, when the Ordinates of the two Curves are ſo related to each other as to increaſe and decreaſe together. Take in the Curve AB two Points G, H, and to the Abſciſſe EF ordinately apply GIK, HLM. Divide IL into three equal parts in the Points N, O, ordinately applying PNQ, ROS. Join the Chords GP, PR, RH, and draw three other Lines GT, TV, VH, whoſe ſum ſhall be equal to the ſum of the three Chords GP, PR, RH; ſo that NT be greater than NP and OV leſs than OR. Through the Points G, T, V, H, let ſome Curve Line be deſcribed equal in length to the Curve paſſing through the points G, P, R, H, and let the Curve $KWXM$ be generated from the Curve paſſing through G, T, V, H in the ſame manner as the Curve $KQSM$ is generated from the Curve $GPRH$. Now the Curve CD being ſo formed from the Curve AB, that the greater Ordinate in the Curve CD correſponds to the greater Ordinate in the Curve AB; NP being leſs than NT, NQ ſhall be leſs than NW; and OV being leſs than OR, OX ſhall be leſs than OS. Again, becauſe the ſpace $ECKQSMDF$ generated from the Curve $AGPRHB$ is greater than the ſpace

generated in like manner from any other Curve drawn through the points A, B, of the same length with the Curve $AGPRHB$, the space $ECKQSMDF$ is greater than the space $ECKWXMDF$, and the space $IKQSML$ greater than the space $IKWXML$. In the next place, let the Points I, L approach without limit, and the space $IKQSML$ will coalesce with the space included by the Lines KI, IL, LM, and the parabolical Line described by Sir *Isaac Newton's* Method of Differences through the Points K, Q, S, M; in like manner the space $IKWXML$ will also coincide with the space included by the Lines KI, IL, LM, and such a parabolical Line described through the Points K, W, X, M. Therefore the space contained by the parabolical Line passing through the Points K, Q, S, M is greater than that comprehended by the parabolical Line passing through the Points K, W, X, M. But the first of these parabolical spaces is one eighth part of the Rectangle under IL, and under the sum of IK, LM together with three times the sum of NQ, OS; likewise the latter parabolical space is one eighth part of the Rectangle under IL, and under the sum of IK, LM together with three times the sum of NW, OX. Therefore the sum of IK, LM together with three times the sum of NQ, OS is greater than the sum of IK, LM together with three times the sum of NW, OX; and the sum of NQ, OS is greater than the sum of NW, OX; and in the last place, deducting OX and NQ, SX will be greater than QW. Again, NQ, NW, OS, OX bearing the same relation to NP, NT, OR, OV respectively, the Points N, O approaching without limit, when the ultimate *Ratio* of QW to SX is a *Ratio* of lesser inequality, the ultimate *Ratio* of PT to VR shall likewise be a *Ratio* of lesser inequality; that is, PT shall be less than RV. Farther, let PR, TV intersect each other in Υ, and let $H\Upsilon Z$ be drawn; then between P and Z taking any Point Γ, let the three Lines $G\Gamma$, $\Gamma\Delta$, ΔH be drawn, whose sum shall be equal to the sum of the three Chords GP, PR, RH. Which being done, as it has now been proved, that when NT is greater than NP, and OV less than OR, PT is less than VR; so after the same manner it will appear, that $N\Gamma$ being less than NP, and $O\Delta$ greater than OR, $P\Gamma$ is greater than $R\Delta$. Moreover, let $\Gamma\Upsilon\Theta$ and ΘH be drawn; then PT being less than RV, $P\Gamma$ which is greater than $R\Delta$, shall be less than $R\Theta$, and therefore $R\Theta$ greater than $R\Delta$; and in the last place the sum of the Lines $\Gamma\Delta$, ΔH greater than the sum of the Lines $\Gamma\Theta$, ΘH, because the point Θ falls within the Triangle made by the Lines $\Gamma\Delta$, ΔH and the right Line that would join the points Γ, H.

Now with the Center Υ describe the circular Arches $T\alpha\beta$, $V\varepsilon\zeta$; with the Center G describe the Arch $T\eta\varkappa$, GP being produced to η, and $G\Gamma$ to $\varkappa$; lastly, with the Center H describe the Arch $V\lambda\mu$, HR being produced to λ, and $H\Theta$ to μ. Draw $\Gamma\xi$ parallel to GP, and the Chord $T\nu\xi$; then is $\Gamma\xi$ greater than $\Gamma\varkappa$ and $P\nu$ less than $P\eta$; so that the *Ratio* of ΓT to TP, which is the same with the *Ratio* of $\Gamma\xi$ to $P\nu$, is greater than the *Ratio* of $\Gamma\varkappa$ to $P\eta$. Likewise, drawing $P\pi$ parallel to $\Gamma\Upsilon$, since $P\pi$ is greater than $P\alpha$, the *Ratio* of $\Gamma\beta$ to $P\alpha$ exceeds the *Ratio* of $\Gamma\beta$ to $P\pi$, and therefore yet more exceeds the *Ratio* ΓT to TP; in like manner

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ner the *Ratio* of ΘV to VR is greater than the *Ratio* $\Theta\mu$ to $R\lambda$, and the *Ratio* of $\Theta\zeta$ to $R\varepsilon$ greater than the *Ratio* of ΘV to VR. Therefore becaufe ΓT is to TP as ΘV to VR, the *Ratio* of ΓT to TP is greater than the *Ratio* of the fum of $\Gamma\varkappa$,

$\Theta\mu$ to the fum of $P\eta$, $R\lambda$, and the *Ratio* of the fum of $\Gamma\beta$, $P\alpha$ to the fum of $\Theta\zeta$, $R\varepsilon$ greater than the *Ratio* of ΓT to TP. Whence the *Ratio* of the fum of $\Gamma\beta$, $\Theta\zeta$ to the fum of $P\alpha$, $R\varepsilon$ is greater than the *Ratio* of the fum of $\Gamma\varkappa$, $\Theta\mu$

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to the fum of $P\eta$, $R\lambda$. But the fum of GP, PR, RH being equal to the fum of GT, TV, VH, and alfo GT equal to $G\eta$, TV equal to $\alpha\epsilon$, and VH equal to $H\lambda$, deducting from the preceeding fums the fum of GP, TV and RH, there will remain the fum of $P\alpha$, $R\epsilon$ equal to the fum of $P\eta$, $R\lambda$. Since therefore the *Ratio* of the fum of $\Gamma\beta$, $\Theta\zeta$ to the fum of $P\alpha$, $R\epsilon$ is greater than the *Ratio* of the fum of $\Gamma\varkappa$, $\Theta\mu$ to the fum of $P\eta$, $R\lambda$, the fum of $\Gamma\beta$, $\Theta\zeta$ is greater than the fum of $\Gamma\varkappa$, $\Theta\mu$. Hence $\beta\zeta$ being equal to TV, $G\varkappa$ equal to GT, and $H\mu$ equal to HV, if to both the preceeding fums be added the fum of $G\Gamma$, TV, ΘH, the fum of $G\Gamma$, $\Gamma\Theta$ and ΘH will be found greater than the fum of GT, TV and VH; which latter fum is equal to the fum of GP, PR and RH, equal to the fum of $G\Gamma$, $\Gamma\Delta$, and ΔH: Therefore taking away $G\Gamma$ from the firft and laft of thefe fums, there remains the fum of $\Gamma\Theta$, ΘH greater than the fum of $\Gamma\Delta$, ΔH; but it has been likewife fhewn that the fum of $\Gamma\Delta$, ΔH is greater than the fum of $\Gamma\Theta$, ΘH, which is an abfurdity: Therefore the Curve AB is not convex to its Axis, when the Ordinates of the two Curves AB, CD increafe and decreafe together. And after the fame manner is fhewn that the Curve cannot be concave to its Axis, when the Ordinates in one of thefe Curves increafe, while the Ordinates in the other decreafe. It remains therefore that the Curve AB be concave to its Axis in the firft cafe, and convex to it in the latter.

PROPOSITION III.

THE fame things remaining as before, if one of the Curves includes the greateft fpace that can be included by a Curve generated in the manner propofed from any Curve of the fame length with the other; the *Ratio* of the *Radius* of the Curvature of this latter Curve in any point to the *Radius* of the Curvature in any other point, will be compounded of the *Ratio* of the *Momentum* of its Ordinate in the firft point to the fimultaneous *Momentum* of the correfpondent Ordinate of the former Curve, and of the *Ratio*, which the *Momentum* of the Ordinate in the former Curve correfponding to that Ordinate in the other Curve, which belongs to the fecond point, bears to the fimultaneous *Momentum* of that Ordinate in the other Curve.

LET the two Curves be AB, CD, their common Abfciffe EF, the fpace $ECDF$ the greateft that can be included by any Curve fo generated from a Curve paffing through the points A, B, and equal in length to this Curve Line AB, that every Ordinate in the Curve CD bear conftantly the fame relation to the adjoining Ordinate of the Curve AB, independent on any other variable Magnitude. Let any two points G, H, be taken in the Curve AB, and the Ordinates GIK, HLM be drawn: Then I fay the *Ratio* of the *Radius* of the Curvature in the point G to the *Radius* of the Curvature in the point H is compounded of the *Ratio* of the *Momentum* of IG to the fimultaneous *Momentum* of IK, and of the *Ratio* of the *Momentum* of LM to the fimultaneous *Momentum* of LH.

I F

IF possible let the *Ratio* of the Radius of the curvature in *G* to the Radius of the curvature in *H* be less than that which is compounded of these two *Ratios*. Take on each side the point *I* two points *N, O* equally distant from it, and at the same distance from the point *L* take on each side of it two points *P, Q*; then
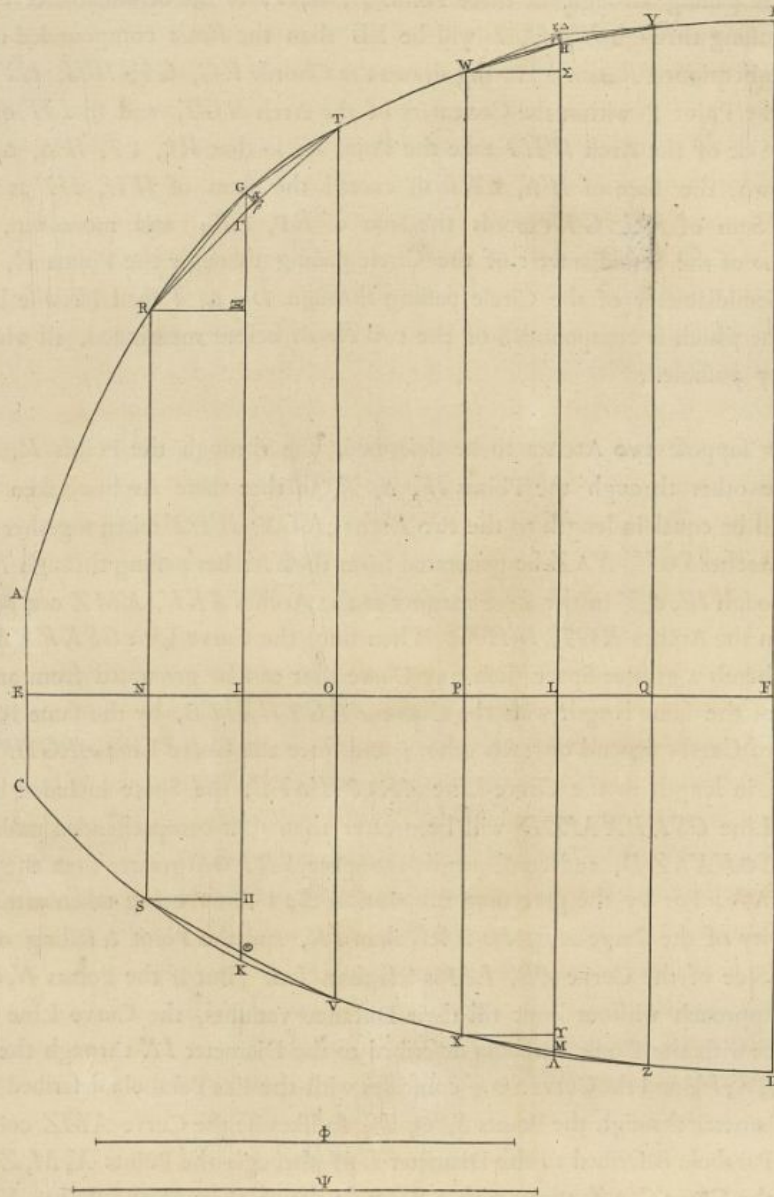
draw the Ordinates *RNS, TOV, WPX, YQZ*. Now if the Intervals *IN, IO* are diminished without limit, till they vanish, the Radius of the Curvature in the Point *G* will coincide with the Semidiameter of the Circle passing through the three Points *R, G, T,* and the Intervals *LP, LQ* being likewise diminished without limit till they vanish, the Radius of the Curvature in the Point *H* will coincide with the Semidiameter of the Circle passing through the three Points *W, H, Y*.

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If therefore the *Ratio* of the Radius of the Curvature in the Point G to the Radius of the Curvature in H be lefs than the *Ratio*, which is compounded of the *Ratio* of the *Momentum* of IG to the *Momentum* of IK, and of the *Ratio* of the *Momentum* of LM to the *Momentum* of LH, the *Ratio* of the Semidiameter of the Circle paffing through the three Points R, G, T, to the Semidiameter of the Circle paffing through W, H, Y will be lefs than the *Ratio* compounded of the two forementioned *Ratios*. Having drawn the Chords RG, GT, WH, HY, take in IG the Point Γ within the Concavity of the Arch RGT, and in LH on the convex Side of the Arch WHY take the Point Δ; fo that $R\Gamma$, ΓT, $W\Delta$, ΔY being drawn, the Sum of $W\Delta$, ΔY fhall exceed the Sum of WH, HY as much as the Sum of RG, GT exceeds the Sum of $R\Gamma$, ΓT; and moreover, that the *Ratio* of the Semidiameter of the Circle paffing through the Points R, Γ, T to the Semidiameter of the Circle paffing through W, Δ, Y fhall likewife be lefs than that which is compounded of the two *Ratios* before mentioned, all which is evidently poffible.

Now fuppofe two Arches to be defcribed, one through the Points R, Γ, T, and the other through the Points W, Δ, Y, fo that thefe Arches taken together fhall be equal in length to the two Arches RGT, WHY taken together; and let two Arches $S\Theta V$, $X\Delta Z$ be generated from thefe Arches paffing through R,Γ,T, and through W, Δ, Y in the fame manner as the Arches SKV, XMZ are generated from the Arches RGT, WHY. Then fince the Curve Line $CSKVXMZD$ comprehends a greater Space than any Curve that can be generated from another Curve of the fame length with the Curve $ARGTWHYB$, by the fame Rule as thefe two Curves depend on each other; and fince the Curve Line $ARGTWHYB$ is equal in length to the Curve Line $AR\Gamma TW\Delta YB$, the Space included by the Curve Line $CSKVXMZD$ will be greater than that comprehended under the Line $CS\Theta VX\Delta ZD$, and confequently the Space $SKV\Theta S$ greater than the Space $XMZ\Delta X$: For by the preceding Propofition the Point Γ being taken within the Concavity of the Curve AB, $I\Theta$ is lefs than IK, and the Point Δ falling on the convex Side of the Curve AB, LM is lefs than $L\Delta$. But if the Points N, O and P, $\mathcal{Q}$ approach without limit till their Diftance vanifhes, the Curve Line SKV coincides with the Conic Parabola defcribed to the Diameter IK through the three Points S, K, V; and the Curve $S\Theta V$ coincides with the like Parabola defcribed to the fame Diameter through the Points S, Θ, V; fo likewife the Curve XMZ coincides with a Parabola defcribed to the Diameter LM through the Points X, M, Z; and laftly, the Curve $X\Delta Z$ agrees with a Parabola drawn through the Points X, Δ, Z, and having the fame Diameter $L\Delta$. Hence the Space $SKV\Theta S$ being greater than the Space $XMZ\Delta X$, and NO equal to $P\mathcal{Q}$, $K\Theta$ is greater than $M\Delta$.

Farther, draw $G\alpha$ perpendicular to $R\Gamma$, $G\beta$ perpendicular to ΓT, $H\epsilon$ perpendicular to $W\Delta$, and $H\zeta$ perpendicular to ΔY, then $R\alpha$ is lefs than RG, and $T\beta$ lefs than TG; as likewife $W\epsilon$ lefs than WH, and $Y\zeta$ lefs than YH. Therefore

fore the Excefs of RGT above $R\Gamma T$ is greater than the Excefs of the Sum of $R\alpha$, βT above $R\Gamma T$, that is greater than the Difference between $\Gamma\alpha$, $\Gamma\beta$; and the Excefs of $W\Delta\Upsilon$ above WHY is lefs than the Excefs of $W\Delta\Upsilon$ above the Sum of $W\varepsilon$, $\zeta\Upsilon$, or than the difference between $\Delta\varepsilon$, $\Delta\zeta$: Hence the Excefs of RGT above $R\Gamma T$ being equal to the Excefs of $W\Delta\Upsilon$ above WHY, the difference between
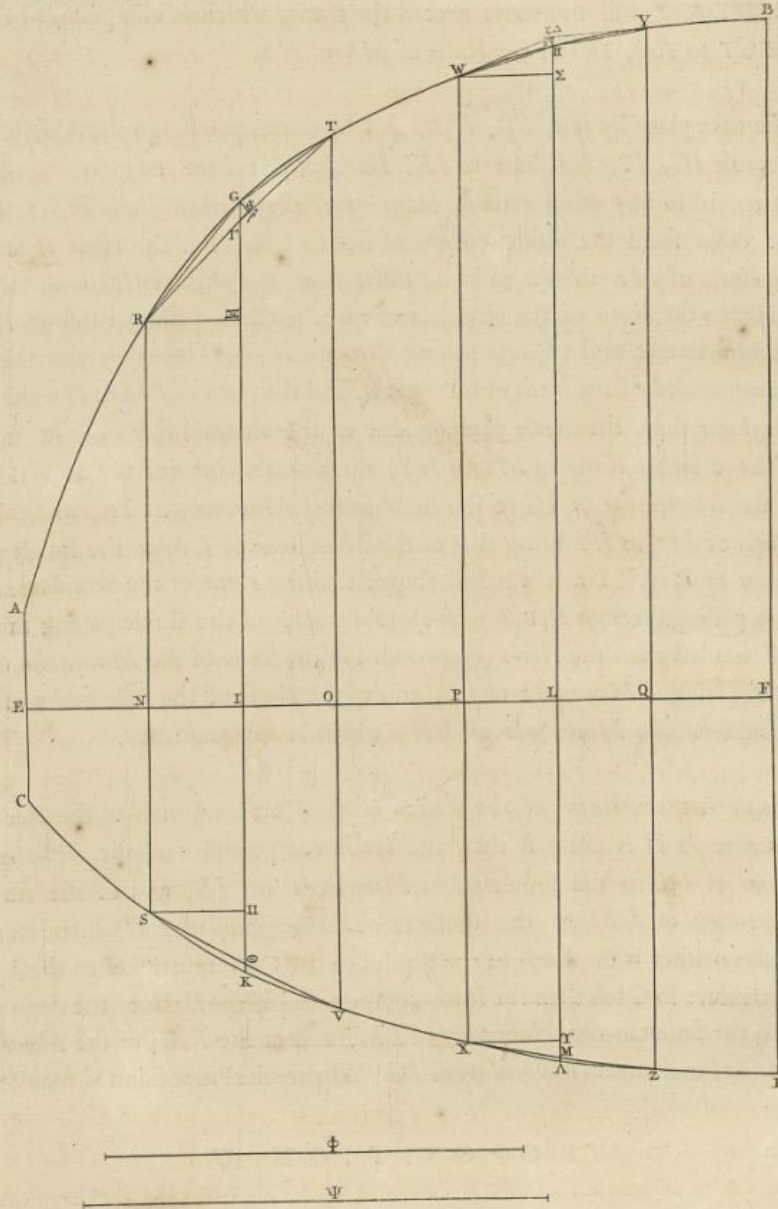
$\Gamma\alpha$, $\Gamma\beta$ is lefs than the difference between $\Delta\varepsilon$, $\Delta\zeta$. Again, the Semidiameter of the Circle paffing through the three Points R, Γ, T is to half NO as $G\Gamma$ to the difference between $\Gamma\alpha$, $\Gamma\beta$, and the *Ratio* of half $P\mathcal{Q}$, equal to half NO, to the Semidiameter of the Circle paffing through W, Δ, Υ is the fame with the *Ratio* of the difference between $\Delta\varepsilon$, $\Delta\zeta$ to $H\Delta$, and therefore greater than the *Ratio* of the

difference

difference between $\Gamma\alpha$, $\Gamma\beta$ to $H\Delta$. Confequently by equality the *Ratio* of the Semidiameter of the Circle paffing through the three Points R, Γ, T to the Semidiameter of the Circle paffing through W, Δ, Υ is greater than the *Ratio* of $G\Gamma$ to $H\Delta$: and moreover, $K\Theta$ being greater than $M\Lambda$, the *Ratio* of the Semidiameter of the Circle paffing through R, Γ, T to the Semidiameter of the Circle paffing through W, Δ, Υ will ftill more exceed the *Ratio*, which is compounded of the *Ratio* of $G\Gamma$ to $K\Theta$, and of the *Ratio* of $M\Lambda$ to $H\Delta$.

In the next place let $R\Xi$, $S\Pi$, $W\Sigma$, $X\Upsilon$ be drawn parallel to the Abfciffe EF; then becaufe IG, $I\Gamma$, NR bear to IK, $I\Theta$, NS the fame relation refpectively without regard to any other variable Magnitude, the ultimate *Ratio* of $G\Gamma$ to $K\Theta$ will not differ from the ultimate *Ratio* of $G\Xi$ to $K\Pi$. For the fame reafon the ultimate *Ratio* of $M\Lambda$ to $H\Delta$ will not differ from the ultimate *Ratio* of $M\Upsilon$ to $H\Sigma$. Hence the *Ratio* of the Semidiameter of the Circle paffing through R, Γ, T to the Semidiameter of the Circle paffing through W, Δ, Υ being greater than the *Ratio* compounded of the *Ratio* of $G\Gamma$ to $K\Theta$, and the *Ratio* of $M\Lambda$ to $H\Delta$ the fame will be greater than the *Ratio* compounded of the ultimate *Ratio* of $G\Xi$ to $K\Pi$, and of the ultimate *Ratio* of $M\Upsilon$ to $H\Sigma$, the ultimate *Ratio* of $G\Xi$ to $K\Pi$ being that of the *Momentum* of IG to the fimultaneous *Momentum* of IK, and the ultimate *Ratio* of $M\Upsilon$ to $H\Sigma$ being that of the *Momentum* of LM to the fimultaneous *Momentum* of LH. But it was faid above, that the *Ratio* of the Semidiameter of the Circle paffing through R, Γ, T to the Semidiameter of the Circle paffing through W, Δ, Υ was lefs than the *Ratio* compounded of the *Ratio* of the *Momentum* of IG to the fimultaneous *Momentum* of IK, and of the *Ratio* of the *Momentum* of LM to the fimultaneous *Momentum* of LH; which is a Repugnancy.
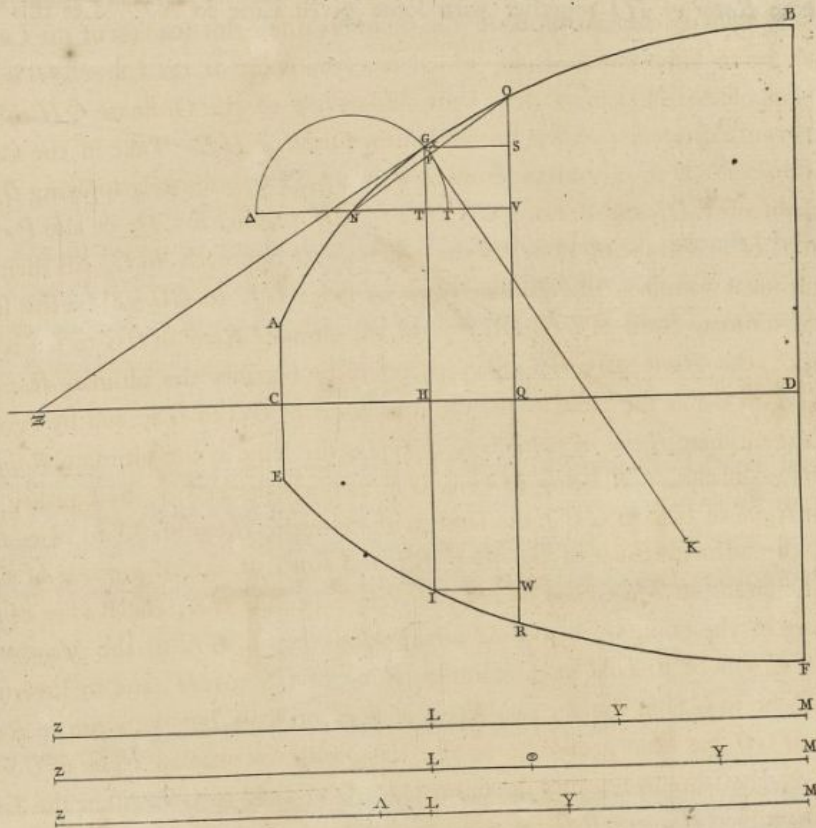
Therefore the *Ratio* of the Radius of the Curvature in G to the Radius of the Curvature in H is not lefs than the *Ratio* compounded of the *Ratio* of the *Momentum* of IG to the fimultaneous *Momentum* of IK, and of the *Ratio* of the *Momentum* of LM to the fimultaneous *Momentum* of LH. And for the fame reafon neither is the *Ratio* of the Radius of the Curvature in H to the Radius of the Curvature in G lefs than the *Ratio* compounded of the *Ratio* of the *Momentum* of LH to the fimultaneous *Momentum* of LM, and of the *Ratio* of the *Momentum* of IK to the fimultaneous *Momentum* of IG. Whence the Propofition is manifeft.

PROPOSITION IV.

THE fame things remaining, I fay the Radius of the Curvature in every Point of the Curve AB is to one and the fame Line as the *Momentum* of its Ordinate in that Point to the fimultaneous *Momentum* of the correfpondent Ordinate in the Curve CD.

I F

IF not, let the Radius of the Curvature in the Point *G* be to the Line Φ as the *Momentum* of the Ordinate *IG* to the simultaneous *Momentum* of the Ordinate *IK*, and the Radius of the Curvature in the Point *H* be to some other Line Ψ as the *Momentum* of the Ordinate *LH* to the simultaneous *Momentum* of the Ordinate *LM*; then the *Ratio* of the Radius of the Curvature in *G* to the Radius of the
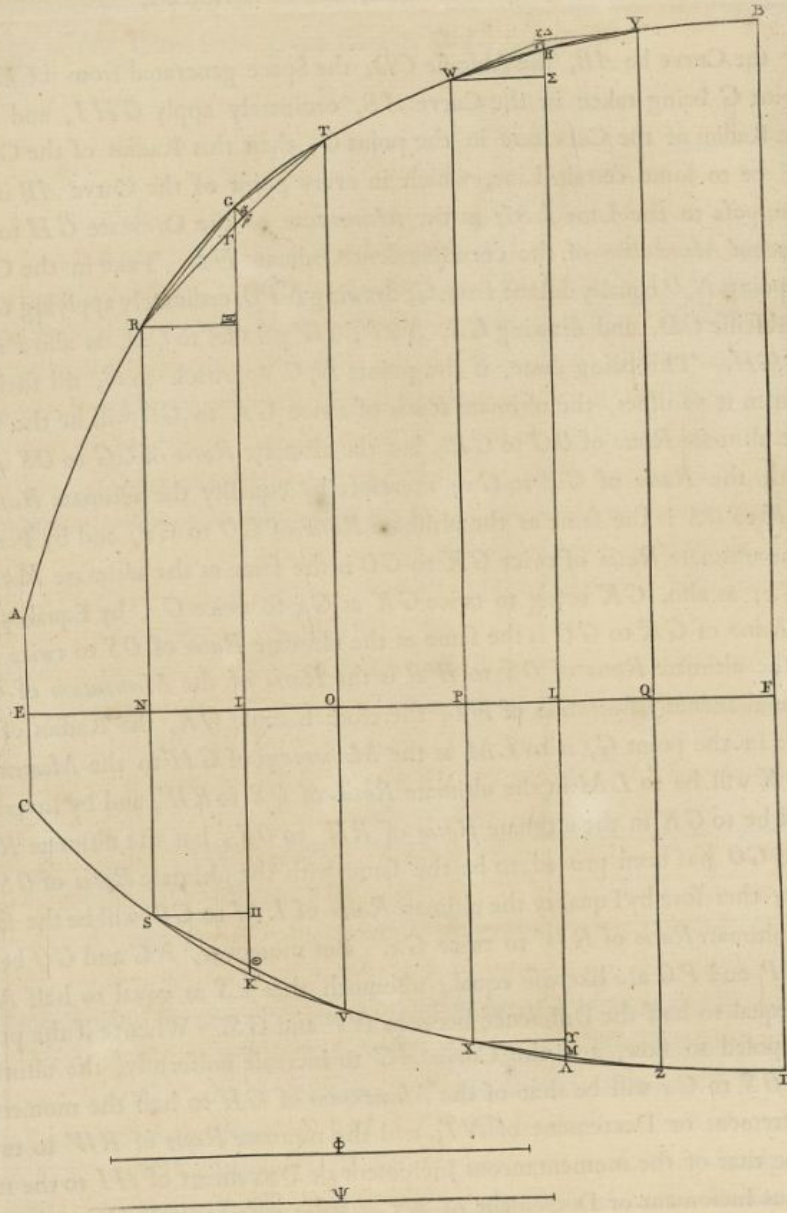
Curvature in *H* not being compounded of the *Ratio* of the first Radius to Φ, and of the *Ratio* of Ψ to the second Radius, the same will not be compounded of the *Ratio* of the *Momentum* of *IG* to the simultaneous *Momentum* of *IK*, and of the *Ratio* of the *Momentum* of *LM* to the simultaneous *Momentum* of *LH*; which is absurd.

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PROPOSITION V.

IN the Curve, which of all Curves of the same length with it self generates the greatest Space in the manner before specified, to assign the relation between the *Momentum* of the Curve, of its Ordinate, and of its Abscisse.

LET the Curve be *AB*, the Abscisse *CD*, the Space generated from it *CEFD*. Any point *G* being taken in the Curve *AB*, ordinately apply *GHI*, and draw *GK* the Radius of the Curvature in the point *G*; then this Radius of the Curvature will be to some certain Line, which in every point of the Curve *AB* is the same, suppose to the Line *LM*, as the *Momentum* of the Ordinate *GH* to the simultaneous *Momentum* of the correspondent Ordinate *HI*. Take in the Curve *AB* the points *N, O* equally distant from *G*, drawing *NPO*, ordinately applying *OQR* to the Abscisse *CD*, and drawing *GS, NTV, IW* parallel to *CD*, as also *Px* parallel to *GH*. This being done, if the points *N, O* approach to *G*, till their distance from it vanishes, the ultimate *Ratio* of twice *GK* to *GO* will be the same with the ultimate *Ratio* of *OG* to *GP*; but the ultimate *Ratio* of *OG* to *OS* is the same with the *Ratio* of *GP* to *Gx*; therefore by Equality the ultimate *Ratio* of twice *GK* to *OS* is the same as the ultimate *Ratio* of *GO* to *Gx*, and by Permutation the ultimate *Ratio* of twice *GK* to *GO* is the same as the ultimate *Ratio* of *OS* to *Gx*; as also, *GK* being to twice *GK* as *Gx* to twice *Gx*, by Equality the ultimate *Ratio* of *GK* to *GO* is the same as the ultimate *Ratio* of *OS* to twice *Gx*. Again, the ultimate *Ratio* of *OS* to *WR* is the *Ratio* of the *Momentum* of *GH* to the simultaneous *Momentum* of *HI*; therefore because *GK*, the Radius of the Curvature in the point *G*, is to *LM* as the *Momentum* of *GH* to the *Momentum* of *HI*, *GK* will be to *LM* in the ultimate *Ratio* of *OS* to *RW*, and by Inversion *LM* will be to *GK* in the ultimate *Ratio* of *RW* to *OS*; but the ultimate *Ratio* of *GK* to *GO* has been proved to be the same with the ultimate *Ratio* of *OS* to twice *Gx*; therefore by Equality the ultimate *Ratio* of *LM* to *GO* will be the same with the ultimate *Ratio* of *RW* to twice *Gx*. But moreover, *NG* and *GO* being equal, *NP* and *PO* are likewise equal; infomuch that *xS* is equal to half *NV*, and *Gx* equal to half the Difference between *NT* and *GS*. Whence if the point *G* be supposed to flow, and the Curve *AG* to increase uniformly, the ultimate *Ratio* of *OS* to *Gx* will be that of the *Momentum* of *GH* to half the momentaneous Increment or Decrement of *NT*, and the ultimate *Ratio* of *RW* to twice *Gx* will be that of the momentaneous Increment or Decrement of *HI* to the momentaneous Increment or Decrement of *NT*. Now whereas it has been demonstrated that the Curve *AB* is concave towards its Abscisse, when the Ordinates *GH, HI* increase or decrease together, but convex towards its Abscisse, when one of these Ordinates increases at the same time that the other decreases, it is evident that *NT* and *HI* in every Case increase and decrease together. But moreover, if the Curve *AG* increases uniformly, the ultimate *Ratio* of *LM* to *GO* will

be

be always the fame; therefore, fince the ultimate *Ratio* of *LM* to *GO* is the fame with the ultimate *Ratio* of *RW* to twice *Gx*, or with the *Ratio* of the *Momentum* of *HI* to the *Momentum* of *NT*, all which appears from what has been faid above; it follows that the ultimate *Ratio* of *LM* to *GO*, may either be the fame with the ultimate *Ratio* of *HI* to *NT*; or the fame with the ultimate *Ratio* of *HI* together with fome given Line to *NT*; or laftly, the fame with the ultimate *Ratio* of the Excefs of *HI* above fome given Line to *NT*.

IN the firft place let the ultimate *Ratio* of *LM* to *GO* be the fame with the ultimate *Ratio* of *HI* to *NT*. Take *LY* equal to *HI*; then the ultimate *Ratio* of *LM* to *GO* or *GN* will be the fame with the ultimate *Ratio* of *LY* to *NT*, and by Permutation the *Ratio* of *LM* to *LY* will be the fame with the ultimate *Ratio* of *GN* to *NT*; therefore *LZ* being made equal to *LM* by Compofition and Divifion, the *Ratio* of *ZY* to *YM* will be the fame with the ultimate *Ratio* of the Sum of *GN* and *NT* to the Difference between them. But the Semicircle Δ *GT* being defcribed to the Center *N*, it appears that *GT* is a mean Proportional between Δ*T* and *T*Y, that is between the Sum and Difference of *GN* and *NT*. Hence the *Ratio* of *ZY* to *YM* is duplicate of the ultimate *Ratio* of the Sum of *GN* and *NT* to *GT*, and alfo duplicate of the ultimate *Ratio* of *GT* to the Dif-

ference

ference between BN and NT; that is, the *Ratio* of ZY to YM is duplicate of the *Ratio* of the Sum of the *Momentum* of the Curve AG, and of the Abscisse CH to the *Momentum* of the Ordinate HG; and the same *Ratio* also duplicate of the *Ratio* of the *Momentum* of the Ordinate HG to the Difference between the *Momentum* of the Curve AG, and of the Abscisse CH. And thus is the relation between these *Momenta* assigned in this first Case.

IN the next place, let the ultimate *Ratio* of LM to GO be the same with the ultimate *Ratio* of HI together with some given Line to NT. Let this given

Line be $L\Theta$, and take ΘY equal to HI. Then will the ultimate *Ratio* of LM to GO or GN likewise be the same with the ultimate *Ratio* of LY to NT, and as before taking LZ equal to LM, the *Ratio* of ZY to YM will be duplicate of the *Ratio* of the Sum of the *Momentum* of the Curve AG and of the Abscisse CH to the *Momentum* of the Ordinate HG, and the same *Ratio* also duplicate of the *Ratio* of the *Momentum* of the Ordinate HG to the Difference between the *Momentum* of the Curve AG and of the Abscisse CH. Thus the relation of these *Momenta* is assigned in this second Case.

LASTLY,

LASTLY, let the ultimate *Ratio* of *LM* to *GO* be the fame with the ultimate *Ratio* of the Excefs of *HI* above fome given Line to *NT*. Let *LΛ* be that Line, and *ΛY* be taken equal to *HI*; then is the ultimate *Ratio* of *LM* to *GO* or *GN* in like manner the fame with the ultimate *Ratio* of *LY* to *NT*; and as before, *LZ* being taken equal to *LM*, the *Ratio* of *ZY* to *YM* is duplicate of the *Ratio* of the Sum of the *Momentum* of the Curve *AG* and of the Abfciffe *CH* to the *Momentum* of the Ordinate *HG*; the fame *Ratio* being alfo duplicate of the *Ratio* of the *Momentum* of the Ordinate *HG* to the Difference between the *Momentum* of the Curve *AG* and of the Abfciffe *CH*. And hence the relation between thefe *Momenta* is affign'd in this laft Cafe.

COROLLARY.

IF *GΞ* be drawn to touch the Curve *AB* in the point *G*; becaufe the ultimate *Ratio* of *LM* to *GO* is the fame with the ultimate *Ratio* of *LY* to *NT*, and by Permutation *LM* to *LY* in the ultimate *Ratio* of *GO* to *NT*, *GΞ* will be to *HΞ* as *LM* to *LY*.

THUS much concerning Ifoperimetrical Curves in general will fuffice for our prefent Purpofe; as to what farther relates to thefe Curves, the great Geometers, who have already treated of them, may be confulted *. I fhall now proceed forthwith to apply what has been here delivered to the Subject under Confideration.

PROPOSITION VI.

TO a given Axis to defcribe a Curve through two given Points, fo that Perpendiculars being let fall from thofe Points upon the Axis, the Space included by thofe Perpendiculars, by the Axis, and by the Curve to be defcribed, fhall generate in revolving round the Axis a greater Solid, than can be generated by any Space included under the fame Axis, the fame Perpendiculars, and any other Curve Line of the fame length with the Curve to be defcribed, and paffing through the fame given Points.

LET the given Axis be *AB*, the Points given *C, D*, from whence are drawn *CA, DB* perpendicular to the Axis, and let it be required to defcribe the Curve *CD* having the Property here fpecify'd.

* The two *Bernoulli*'s and Dr. *Taylor*.

n   TAKE

Take at pleasure the Line *EF*, and let the Curve *GH* be such, that any point *I* being taken in the Curve *CD*, and the Ordinate *IKL* being drawn, the Rectangle under *KL*, and a Line equal to half the Circumference of the Circle described with the Radius *EF* be equal to the Circle described by *IK* in the Revolution
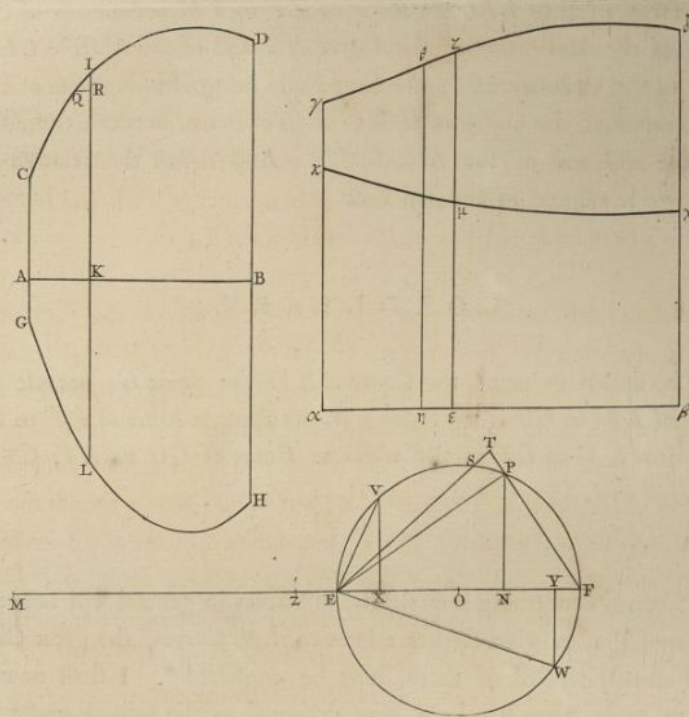
of the Space *ACDB* about the Axis *AB*. Then the solid generated by the Revolution of the space *ACDB* about *AB* shall be equal to the Solid whose Base is the Space *AGHB*, and Altitude equal to half the forementioned Circumference. And whereas the Solid generated by the Curve *CD*, is to be greater than the Solid generated in like manner by any other Curve drawn through the Points *C, D*, of the same Length with *CID*; therefore the Solid whose Base is the Space *AGHB*, and Altitude that now mentioned, and consequently the Space it self *AGHB*, must be greater than can be produced by Curves derived from any other Curve passing through the Points *C, D*, and of the same Length with the Curve *CD*, those Curves being derived from such a Curve in the same manner as the Curve *GH* is derived from the Curve *CD*. Moreover, because the Circle described by *IK* is equal to the Rectangle under *IK*, and a Line equal to half the Circumference described by the Point *I*, and the Circumferences of Circles are proportional to their Diameters; since the Circle described by *IK* is equal to the Rectangle under *KL*, and half the Circumference of a Circle whose Radius is *EF*, therefore the Square of *IK* will be equal to the Rectangle under *KL* and *EF*. But because the Space *AGHB* is greater than any other, that can be comprehended by Curves deduced as aforesaid from any other Curve of equal Length with *CD*; if any Point

M

M be taken in the Line FE, and EN be taken equal to KL, the momentaneous Increment of the Sum of DI and BK may be to the *Momentum* of KI in the fubduplicate *Ratio* of MN to NF; and the *Ratio* of the *Momentum* of IK to the *momentaneous* Increment of the Difference between DI and BK fubduplicate of the fame.

Upon EF as a Diameter defcribe a Circle, its Center being O, erect NP perpendicular to EF, drawing EP. Then becaufe the Square of IK is equal to the Rectangle under KL, EF, and the Square of EP equal to the Rectangle under FEN; EN being taken equal to KL, EP fhall be equal to KI. Farther, take in the Curve DI the point Q, and draw QR parallel to AB, and likewife in the Circle EPF, draw ES equal to KR, and alfo FPT.

Now it has been declared, that the ultimate *Ratio* of the Sum of IQ and QR to IR may be taken fubduplicate of the *Ratio* of MN to NF, and the ultimate *Ratio* of IR to the Difference between IQ and QR fubduplicate of the fame. But if the Points S and P approach without Limit, the ultimate *Ratio* of EP to ET fhall be the *Ratio* of Equality, and ST equal to IR, becaufe the Angle under EPF in the Semicircle is a right one. Hence the ultimate *Ratio* of the Sum of IQ and QR to ST may be fubduplicate of the *Ratio* of MN to NF. But the ultimate Ratio of ST to PS is the fame with the *Ratio* of PF to FE, by reafon that the Triangle TPS, when it vanifhes, becomes fimilar to the Triangle FEP; and NF being to FP as PF to FE, the *Ratio* of PF to EF is fubduplicate of the *Ratio* of NF to FE; therefore the ultimate *Ratio* of ST to PS is fubduplicate of the *Ratio* of NF to FE. Whence when the ultimate *Ratio* of the Sum of IQ and QR to ST is fubduplicate of the *Ratio* of MN to NF, by Equality the ultimate *Ratio* of the Sum of IQ and QR to PS will be fubduplicate of the *Ratio* of MN to EF.

Now in the Circle EPF draw EV equal to AC, and EW equal to BD, letting fall the Perpendiculars VX and WY. Then taking the Line $\alpha\beta$ equal to the Arch VFW, erect the Perpendiculars $\alpha\gamma$, $\beta\delta$, that $\alpha\gamma$ be a mean proportional between MX and EF, and $\beta\delta$ a mean proportional between MY and EF. Moreover, taking $\beta\varepsilon$ equal to the Arch WFP, and the Perpendicular $\varepsilon\zeta$ equal to the mean proportional between MN and EF, defcribe the Curve $\gamma\zeta\delta$, that fhall pafs through all the Points found in the fame manner as ζ. This being done, take $\varepsilon\eta$ equal to PS, and erect $\eta\theta$. And fince the ultimate *Ratio* of the Sum of IQ, QR to PS may be fubduplicate of the *Ratio* of MN to EF, it may be the fame with the *Ratio* of $\varepsilon\zeta$ to EF, this laft *Ratio* being fubduplicate of the *Ratio* of MN to EF, by reafon that $\varepsilon\zeta$ is the mean proportional between MN and EF. But when the ultimate *Ratio* of the Sum of IQ, QR to PS is the fame with the *Ratio* of $\varepsilon\zeta$ to EF, the Rectangle under EF and the Sum of IQ, QR will be equal to the Rectangle under $\varepsilon\zeta$ and PS or $\varepsilon\eta$, when thefe Rectangles vanifh.

nifh. Confequently the Rectangle under EF and the Sum of DI, BK is equal to the Space $\beta\delta\zeta\varepsilon$. And thus may be affigned the Sum of any Portion of the Curve and of the Correfpondent Abfciffe.
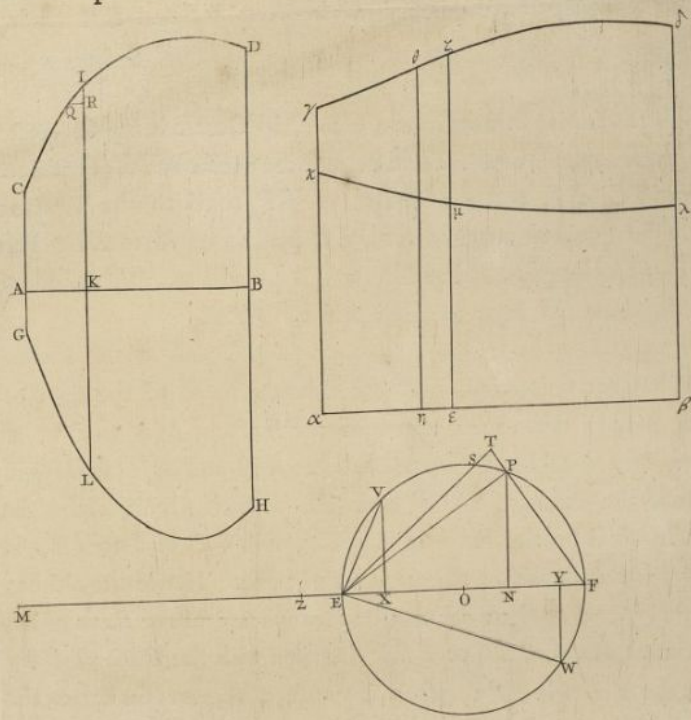
AGAIN, the ultimate *Ratio* of the Sum of IQ, QR to IR being fubduplicate of the *Ratio* of MN to NF, and the ultimate *Ratio* of IR to the Difference between IQ, QR fubduplicate of the fame; the ultimate *Ratio* of the Sum of IQ, QR to the Difference between them is the fame as the *Ratio* of MN to NF, and by Compofition the ultimate *Ratio* of the Sum of IQ, QR to twice IQ the fame with the *Ratio* MN to MF; and likewife, if MF be divided into two equal Parts in Z, the ultimate *Ratio* of the Sum of IQ, QR to IQ will be the fame with the *Ratio* of MN to ZF. But the ultimate *Ratio* of the Sum of IQ, QR to IR being the fubduplicate of the *Ratio* of MN to EF, and $\varepsilon\zeta$ the mean proportional between MN and EF, the ultimate *Ratio* of IR to the Sum of IQ, QR will be the fame with the *Ratio* of $\varepsilon\zeta$ to MN; therefore fince the ultimate *Ratio* of the Sum of IQ, QR to IQ is the fame with the *Ratio* of MN to ZF; by Equality the ultimate *Ratio* of IR or PS to IQ will be the fame with the *Ratio* of $\varepsilon\zeta$ to ZF.

THEREFORE let $\alpha\kappa$ be taken to EF as ZF to $\alpha\gamma$, $\beta\lambda$ to EF as ZF to $\beta\delta$; likewife $\varepsilon\mu$ to EF as ZF to $\varepsilon\zeta$, and let the Curve $\kappa\mu\lambda$ be defcribed, that fhall pafs through all the points found as μ. Which being done, fince the ultimate *Ratio* of PS or $\varepsilon\eta$ to IQ is the fame with the *Ratio* of $\varepsilon\zeta$ to ZF, it will be the fame with the *Ratio* of EF to $\varepsilon\mu$, and the Rectangle under $\varepsilon\eta$, $\varepsilon\mu$, or the Space $\eta\mu$, equal

equal to the Rectangle under EF, IQ; fo that the Space $\beta\epsilon\mu\lambda$ will be equal to the Rectangle under EF and DI. Thus may be found the Length of any Portion DI of the Curve DC correfponding to any given Ordinate IK, as before was affigned the Sum of the Curve DI and of its Abfciffe BK.

Hence to any given Ordinate IK the correfpondent Abfciffe BK may be found; and the Curve commodioufly be defcribed; the Spaces $\alpha\gamma\delta\beta$, $\alpha\kappa\lambda\beta$ being meafured by Sir *Ifaac Newton*'s Method of Differences with great Facility.

COROLLARY I.

MF being divided into two equal Parts in Z; fince EN is equal to KL, if
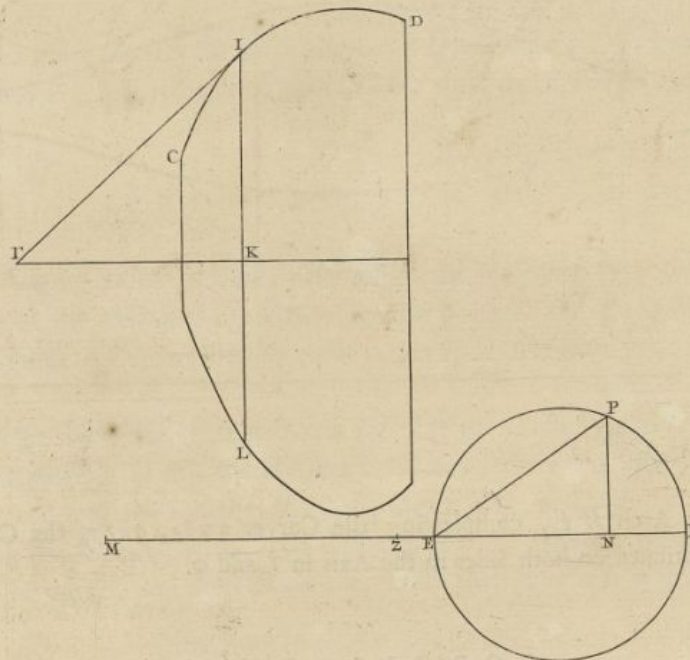
$I\Gamma$ be drawn to touch the Curve CD in I, $I\Gamma$ fhall be to ΓK as ZF to ZN.

INTRODUCTION.

COROLLARY II.

IF $\alpha\beta$ be produced both ways, that $\alpha\nu$ be equal to the Arch VE, and $\beta\xi$ e-

qual to the Arch WE, compleating the Curves $\pi\gamma\delta\varrho$, $\sigma\varkappa\lambda\tau$, the Curve CD may be continued on both Sides to the Axis in Υ and Φ.
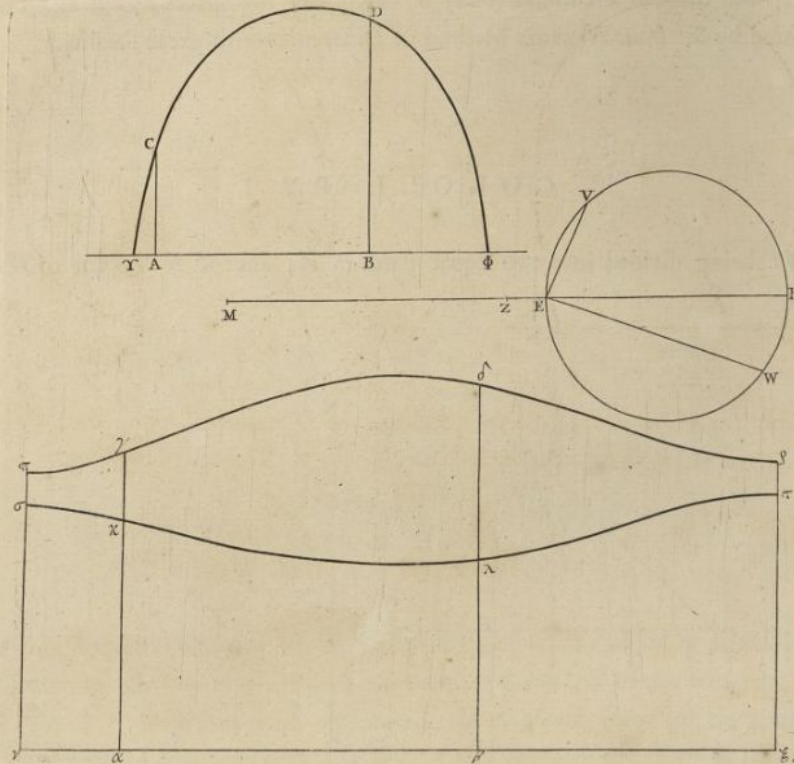
COROLLARY III.

IF ME be greater than EF, ſo that Z fall without the Circle, the right Lines that touch the Curve $\Upsilon CD\Phi$ in Υ and Φ ſhall make with the Axis an a-cute Angle towards the Curve; the Coſine of which Angle will be to the Radius as ZE to ZF. If ME be leſs than EF the ſame Angle ſhall be obtuſe; but the Coſine thereof to the Radius in the ſame Proportion as before. Laſtly, if ME be equal to EF the Tangents of the Curve in Υ and Φ ſhall be perpendicu-lar to the Axis.

COROLLARY

COROLLARY IV.

WHEN *ME* is lefs than *EF* an Ordinate may be drawn on each Side the Curve, that fhall touch it. Let *ABC* be a Curve defcribed with *ME* lefs than
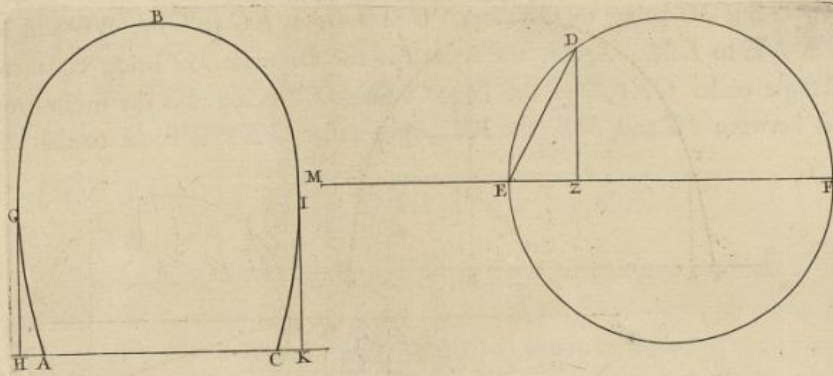
EF; from the Point *Z* erect the perpendicular *ZD* and draw *ED*; then each of the Ordinates *GH*, *IK*, that are equal to *ED*, fhall touch the Curve.

PROPOSITION VII.

TO draw a Tangent to the Curve defcribed in the preceding Propofition, that the Segment of the Axis intercepted between this Tangent and the Ordinate applied at the Point of Contact fhall be equal to any Line propofed.

LET *AB* be the Curve, *CD* its Axis, *EFGH* the Circle by which it is defcribed, the Diameter of this Circle being *EG*, and *I* the Point affumed in that Diameter in order to the Defcription of the Curve *AB*; and laftly let *K* be the Line equal to the Segment of the Axis *CD* that is to be intercepted between the Tangent to be drawn, and the Ordinate applied in the Curve *AB* at the Point of Contact.

IN the Circle *EFGH* draw the Diameter *FLH* at Right Angles to *EG*; take *GM* a third Proportional to *IG* and *GE*; and *IG* being divided into two equal Parts in *N*, take likewife *MO* a third Proportional to *NG* and *K*, joining *HO*; then take *OP* equal to *MO*; and draw *FQ*, *QP*, the firft of thefe Lines parallel to *EG*, but the latter parallel to *HO*. This being done to the Afymptotes *QF*, *QP* defcribe through the Point *H* the Hyperbola *HR* to meet the Circle *EFGH* in *R*, and draw *HSR*. Then in the Curve *AB* the Ordinate *TV* being applied, that fhall be a mean Proportional between *IG* and *MS*, and the Tangent *VW* being drawn, I fay *WT*, the Segment of the Axis *CD* intercepted

<div align="right">cepted</div>

cepted between this Tangent and the Ordinate VT, shall be equal to the Line K.

LET the correspondent Curve XY be drawn, and the Ordinate VT be produced to Z, and in the Line IG let $N\Upsilon$ be taken equal to TZ; then will the Square of VT be equal to the Rectangle under $GE\Upsilon$, and VW be to WT as NG to $N\Upsilon$. But IG being to GE, or NG to LG, as EG to GM, NG will be to LG as NE to LM. Again, the Square of the Ordinate VT being equal to the Rectangle under $GE\Upsilon$, and the same Ordinate VT being also the mean Proportional between IG and MS, the Rectangle under $GE\Upsilon$ is equal to that under
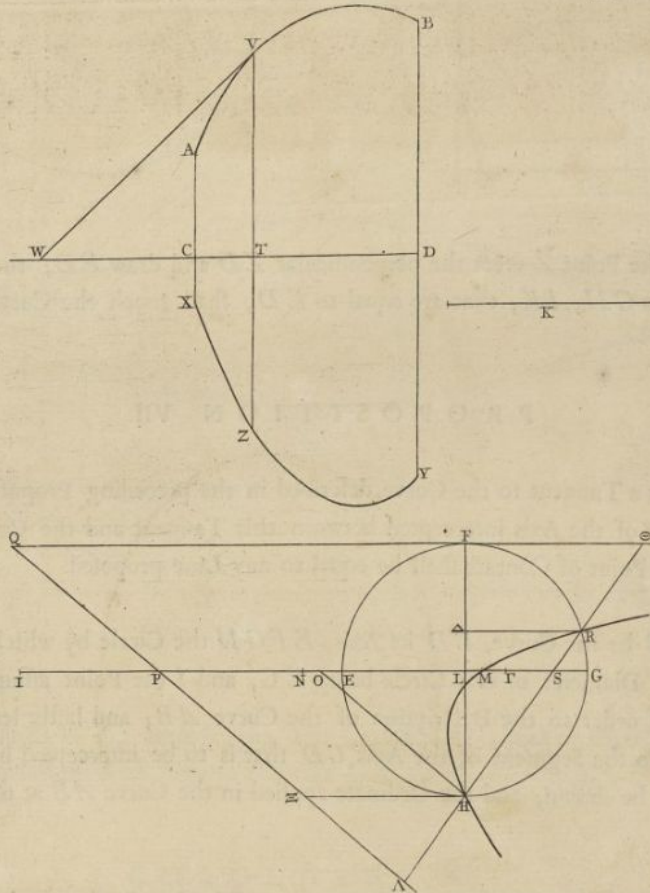
IG, MS, insomuch that IG will be to GE, or NG to LG, as $E\Upsilon$ to MS; and therefore NG being to LG as NE to LM, as NG to LG so will $N\Upsilon$ be to LS, and by Permutation NG will be to $N\Upsilon$, that is the Tangent VW to the Segment WT of the Axis, as LG or HL to LS; or, $R\Delta$ being drawn parallel to EG, as $H\Delta$ to ΔR. But now the *Ratio* of $H\Delta$ to ΔF is duplicate of the *Ratio* of $H\Delta$ to ΔR. Whence as the Square of VW to the Square of WT, so is $H\Delta$ to ΔF, and by Division as the Square of VT, that is the Rectangle under IG, MS, to the Square of WT, so is twice $L\Delta$ to ΔF, and taking half the Antecedents as the

Rectangle

Rectangle under NG, MS to the Square of WT so is $L\Delta$ to ΔF. Moreover, produce HR on both Sides to Θ and Λ, and draw $H\Xi$ parallel to EG, then ΘR by reason of the Hyperbola will be equal to $H\Lambda$. But as HS to $H\Lambda$ so is OS to $H\Xi$, $H\Xi$ being equal to OP or OM; and as HS to $R\Theta$ so is HL to $F\Delta$. Therefore as HL or LF to $F\Delta$ so is OS to OM, and by Division as $L\Delta$ to $F\Delta$ so is MS to OM, and so likewise is the Rectangle under NG, MS to that under NG, OM, which is equal to the Square of K. But it has been proved, that the Rectangle under NG, MS is to the Square of WT as $L\Delta$ to ΔF; so that the Rectangle under NG, MS will be to the Square of WT as the same Rectangle under NG, MS to the Square of K. Therefore WT is equal to K.

PROPOSITION VIII.

OF all the Curves described by the sixth Proposition, and continued to their Axes, that Curve, whose Tangents in the Points where it meets its Axis, are perpendicular to the said Axis, will by revolving about its Axis, generate a greater Solid than any other Curve whatever adapted to the same Axis, and of the same Length with this.

LET the Curve ABC be described to the Axis DE by the sixth Proposition, so that the Tangents in the Points A, C be perpendicular to DE; I say
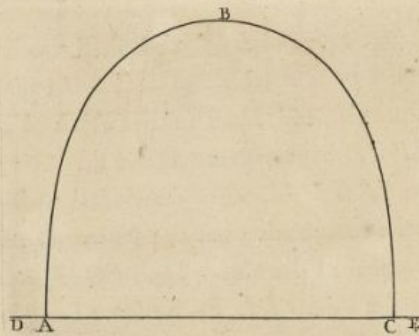
this Curve, by revolving round the Axis AC, shall generate a greater Solid than can be generated by any other Curve of the same Length with this, and described through any other two Points in the Axis DE.

IF this be not so, some other Curve adapted to the Axis DE, will produce the greatest Solid, that can be formed by Curves of the same Length with its self adapted to this Axis.

SUPPOSE therefore FGH to be such a Curve. It is evident that this Curve must be one of those, that would be described by the sixth Proposition through the

P

Points

Points *F, H*; for otherwise a Curve might be defcribed through thefe Points of the fame Length with this, which fhould produce a greater Solid. But it is farther manifeft, that the Tangents to this Curve in the Points *F, H* will make towards the Curve either obtufe or acute Angles with the Axis.
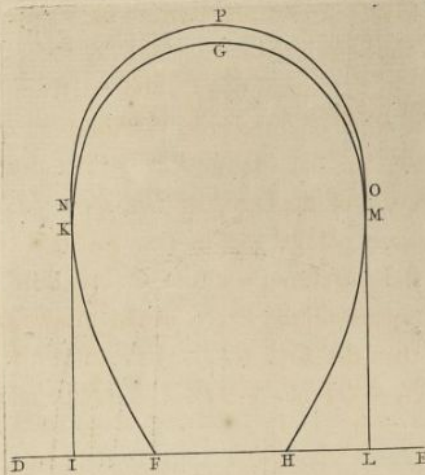
In the firft Place, let thofe Tangents make obtufe Angles: I fay another Curve of the fame Length with the Curve *FGH* may be fitted to this Axis, that fhall generate a greater Solid than this Curve will generate.

Draw the Ordinates *IK* and *LM*, that fhall touch the Curve *FGH* as in *K* and *M*; take *IN* equal to the Arch *KF* and *LO* equal to the Arch *MH*, drawing the Arch *NPO* fimilar and equal to the Arch *KGM*. Then it is evident that the Figure *INPOL* by revolving about the Axis *IL* will generate a greater Solid than the Figure *FKGMH*, wholly included within this other, can generate by revolving about the fame Axis; but the Perimeter of this Figure *INPOL* excepting the Bafe, is equal to the Curve Line *FGH*; and moreover, a Curve may be defcribed through the Points *I, L*, of the fame Length with the Line *INPOL*, or with *FGH*, that fhall generate a greater Solid than the Figure *INPOL* will generate. Confequently the Curve *FGH* will by no means generate the greateft Solid, that can be produced by Curves of the fame Length with its felf, and adapted to the fame Axis.

Again, let the Tangents of the Curve *FGH* in the Points *F, H* make with the Axis acute Angles towards the Curve. I fay neither will this Curve generate the greateft Solid, that can be generated by any Curve of the fame Length with this.

Let the Angle under *IKL* be equal to that, which the Tangents in *F* and *H* make with the Axis. Draw the perpendicular *IL*, divide *FH* into two equal

<div align="right">Parts</div>

Parts in M, and take the Line n, that the *Ratio* of n to FM may be lefs than the *Ratio* of three times the Square of the Excefs of IK above IL to the Sum of the Square of this Excefs and of the Square of IL; then draw the Tangent NO, that OP being let fall perpendicular to FH, NP fhall be equal to n. By this means the *Ratio* of NP to FM, and more effectually the *Ratio* of NP to NM, will be lefs than the *Ratio* of three times the Square of the Excefs of IK above IL to the Sum of the Square of this Excefs and of the Square of IL; alfo by Divifion the *Ratio* of NP to PM will be lefs than the *Ratio* of three times the Square of the Excefs of IK above IL to the Square of IL; and likewife the *Ratio* of one third of NP to PM lefs than the *Ratio* of the Square of the Excefs of IK above IL to the Square of IL. Moreover, if OQ be drawn parallel to the Tangent in F, the Triangles OPQ, ILK will be fimilar; and therefore the *Ratio* of one third of NP to PM lefs than the *Ratio* of the Square of the Excefs of OQ above OP to the Square of OP. But OQ is lefs than the Arch OF, and therefore the Excefs of OQ above OP is lefs than the Excefs of OF above OP. Let PR be taken equal to this latter

Excefs, and then the *Ratio* of one third of NP to PM being lefs than the *Ratio* of the Square of the Excefs of OQ above OP to the Square of OP; the fame *Ratio* of one third of NP to PM fhall be yet lefs than the *Ratio* of the Square of PR to the Square of OP; and laftly, one third Part of the Solid, whofe Bafe is the Square of OP and Altitude NP fhall be lefs than the Solid, whofe Bafe is the Square of PR and Altitude MP.

Now draw OS parallel to FH, the Tangent ST, the Perpendicular SV, and laftly RW likewife parallel to FH; then will the Triangles NOP, TSV be fimilar and equal, and MV equal to MP. Hence the two Cones generated by the Revolution of the Triangles NPO, TVS about the Axes NP, TV will be to the Cylinder generated by the Revolution of the Rectangle $PRWV$ about the Axis PV as one third Part of the Solid, whofe Bafe is the Square of OP and Altitude PN to the Solid, whofe Bafe is the Square of PR and Altitude MP. Wherefore the firft of thefe Solids being lefs than the latter, thefe two Cones are

lefs

lefs than the Cylinder; and confequently the two Solids generated by the Revolution of the Spaces FPO, HVS about the Axes FP, HV will be ftill lefs than the Cylinder produced by the Revolution of the Rectangle $PRWV$ about the Axis PV. But moreover, if PX and VY be taken equal to the Arches FO and SH, fo that RX and WY fhall be equal to PO and VS; and if the Curve XZY be defcribed fimilar and equal to the Arch OGS; the Space $RXZYW$ is fimilar and equal to the Space $POGSV$. Therefore fince the Cylinder generated by the Rectangle $PRWV$ is greater than the two Solids generated by the Spaces FPO, HVS, the Solid generated by the Revolution of the Space $PXZYV$ about the Axis PV fhall be greater than the Solid generated by the Revolution of the Space FGH about the fame Axis FH. But the Perimeter of the Space $PXZYV$, excepting the Bafe PV, is equal in Length to the Curve FGH, and through the Points P and V a Curve may be defcribed of the fame Length
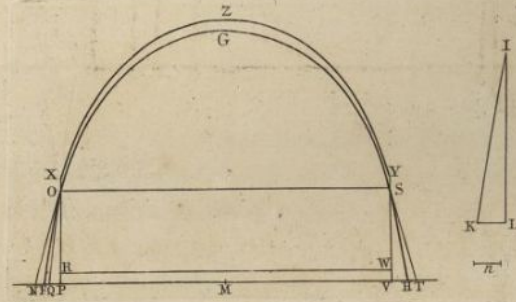
that fhall produce a Solid yet greater than the Solid produced by the Space $PXZYV$. Therefore the Solid generated by the Curve FGH is by no means the greateft that can be produced from Curves of the fame Length with its felf applied to the Axis FG.

But now fince the Curve, which generates the greateft Solid of all, muft of Neceffity be one of thofe defcribed by the fixth Propofition, and it is here fhewn not to be any of thofe Curves, whofe Tangents in the Points, where the Curve meets the Bafe, make oblique Angles with that Bafe, it follows that it muft be the Curve, wherein thofe Tangents are perpendicular to the Bafe.

PROPOSITION IX.

IF in the Curve, which generates the greateft Solid of any of the fame Length with its felf, any two Points be taken, and from them Perpendiculars be let fall

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upon the Bafe, the Space included by thefe Perpendiculars and the intermediate Part of the Curve fhall generate a greater Solid than can be produced by a Space included under two Perpendiculars of the fame Lengths with the former, and under any other Line of the fame Length with the intermediate Part of the forementioned Curve.

LET *ABC* be the Curve, which in revolving round the Axis *AC*, generates a greater Solid than can be produced in like manner by any other Curve of the
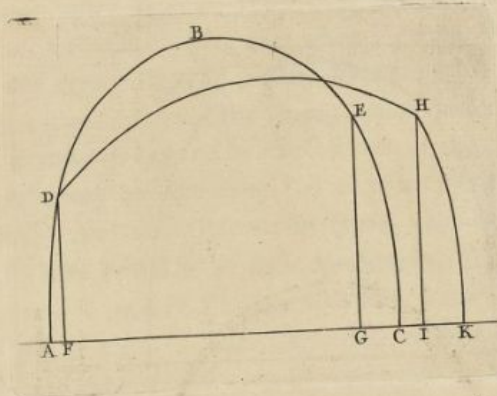
fame Length with this. If in this Curve any two Points *D*, *E* be taken, and the Perpendiculars *DF*, *EG* be drawn, I fay the Space *FDBEG* by revolving round the Axis *FG* fhall generate a greater Solid than any other Space included under two Perpendiculars of the fame Length with *DF*, *EG*, and under a Line of the fame Length with *DBE*.

IF not, let the Space *FDHI* generate a greater Solid than the Space *FDEG*, the perpendicular *IH* being equal to *GE*, and the Curve *DH* equal to *DE*. Draw the Arch *HK* fimilar and equal to the Arch *EC*. Then the Solid generated by the Space *FDHI* being greater than that generated by the Space *FDEG*, the Solid generated by the Space *ADHK* will be greater than that generated by the Space *ADEC*, which is abfurd; for the Curve Line *ADHK* is equal in Length to the Curve *ABC*, and the Curve *ABC* generates a greater Solid than any other Line of the fame Length. The Space therefore *FDEG* generates a greater Solid than any other Space included under Perpendiculars of the fame Length with *FD*, *GE*, and under any other Line of the fame Length with *DE*.

THESE Propofitions will afford us the neceffary Affiftance for making the firft Step of the Inquiry, we have propofed, concerning the Suppofition, that the mufcular Fibres are compofed of Veficles, by whofe Inflation thofe Fibres are contracted. For it will not be difficult now to affign in what proportion the Cavity of the Cells

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on this Hypothefis muft be enlarged, in any degree of Contraction the Fibre fhall be fuppofed to undergo. In the ufual way of reprefenting thefe Cells as fmall Bladders, whofe Sides will wholly collapfe together, and leave no Vacuity in the Cells, when the Fibre is entirely relaxed; the Fibre may be contracted by the Inflation of thefe Cells into lefs than half its greateft Length: For the firft Figure of the eighth Propofition reprefents the Form into which the Sides of fuch a Cell will be extended, when the Cell is moft inflated, as will be evident by comparing what is there demonftrated, with what has been delivered at the Beginning of this fecond Part *. And in that Figure the Curve *ABC* bears to its Axis *AC* a
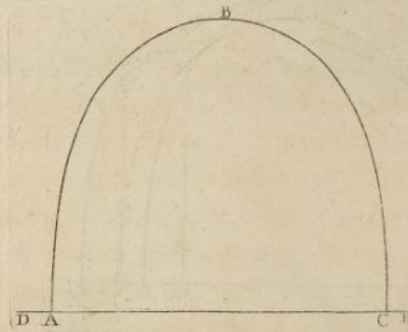
Proportion fomewhat greater than that of 35 to 16; this Curve *ABC* being equal to the Length of that Cell, when wholly relaxed, whofe Length becomes equal to the Axis *AC*, when the Cell is moft of all inflated. But let us now fuppofe the Cell, when uninflated, to be a Cylinder, whofe Section through the Axis fhall be the rectangular Parallelogram *ABCD*. The *Ratio* of *AB* the Diameter of the Cell to its Altitude *BD* or *AC* being given, it will be eafy to defcribe the Figure *EFGH*, which fhall be fimilar to the Section through the Axis of this Cell, when

* Pag. xxxv.

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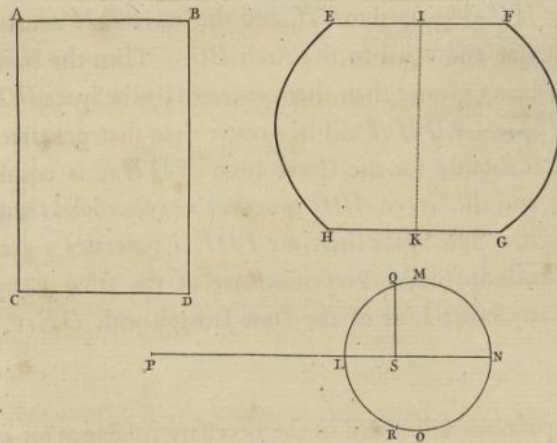
in any degree inflated. Let IK be the Axis of this Figure, or of the Cell, dividing EF and its Equal HG into two equal Parts in I and K. Any Circle $LMNO$ being assumed, and in its Diameter produced the Point P, it is only required to take in this Circle the equal Arches QN, RN of such a Magnitude, that IF and KG being made equal to the Chords of the Arches LQ and LR, and the Curve FG being described from the Circle $LMNO$ after the manner that has been before taught, IF and its Equal KG shall bear to FG the same *Ratio* as half AB or CD bears to BD or AC: For the Curve EH being described, similar and equal to FG, the Figure $EFGH$ will be similar to the Section through the Axis of the Cell, when in some degree inflated, whose Section when relaxed is the Rectangle $ABCD$. But here we must observe, that when the Point P is so taken, that PL is equal to LN, the Figure $EFGH$ is that, which the Cell will receive, when inflated the most that is possible, and the Proportion of the Side FG to the Axis IK, the greatest that it can ever become by the Inflation of the Cell, as is evident from the two last Propositions; and the more PL exceeds LN, the less will be the *Ratio* of FG to IK. And this Observation shews, that the Arches NQ, NR, and the Line LP, may be taken of such Magnitudes, that while in the Figure $EFGH$, the Curve FG or EH shall bear the same *Ratio* to EF or HG as BD or AC bears to AB or CD, the same Curve FG or EH shall likewise bear any assigned Proportion to the Axis IK. As likewise by taking LP equal to LN, the Arches NQ, NR may be taken of such a Magnitude, that the Figure $EFGH$ shall represent the Section through the Axis of a Cell in its greatest Inflation, while the Side FG or IH bears to the Axis IK any given Proportion less than that, which the Curve in the first Figure of the eighth Proposition bears to its Axis. And by this means the Proportion between the Diameter of a Cell and the Length of it may be found, that is required to render the Cell capable of any possible Degree of Contraction.

I need not be particular in explaining the way of doing all this, since it is obvious from Sir *Isaac Newton*'s Method of Differences.

But now, after the Figure of any Cell has been described, to find the Proportion between the Cavity of such a Cell, when in any degree inflated, to the Cavity of the same Cell when relaxed, which it is our principal design by these Propositions to discover, it is only required farther to know, that QS being let fall perpendicular upon LN, the Solid, made by the Revolution of the Space $IFGK$ about the Axis IK, is equal to a Cone whose Altitude is LN, the Semidiameter of its Base, when PL is equal to LN, containing in power the Rectangle under LN and the Curve FG, together with twice the Rectangle under QS and the mean Proportional between PS and LN; but if PL exceeds LN, this Semidiameter contains in power, besides the forementioned Rectangles, the Rectangle also contained under half the Excess of PL above LN, and under the difference between the Curve FG and the Axis IK.

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By Computation upon thefe Principles it will be found, that if *AB* or the Diameter of the Cell bears to *BD* or its Altitude, when uninflated, the Proportion of about 20 to 37, this Cell in its greateft Inflation will be contracted into about two thirds of its greateft Length; and when it is thus inflated, the greateft Diameter thereof will be to the Diameter of its Bafes, nearly as 100 to 46; and its Cavity will be enlarged in the Proportion of 24 to 10. If the Diameter of the Cell bear to its Altitude, when relaxed, the Proportion of 20 to 23, the Cell is capable by Contraction of lofing one fourth of its Length; and in its moft contracted ftate its greateft Diameter will be to the Diameter of its Bafes nearly as 5 to 3, and its Cavity will be enlarged in the proportion of about $16\frac{1}{7}$ to 10. Likewife if the Diameter of a Cell be to its Altitude, when uninflated, as 8 to 5, the Cell can be contracted by its Inflation into four fifths only of its greateft Length; the Proportion of its greateft Diameter in that contracted State to the Diameter of its Bafes becoming near the fame with the *Ratio* of 100 to 69, and its Cavity will be enlarged in the Proportion of 7 to 5.

Moreover it is to be noted, that the Force, with which the Bafes of a Cell are made to approach by its Inflation, very much decreafes in proportion to the Force wherewith the Cell is inflated, when the Cell approaches its utmoft Diftention. For this reafon it will not be improper to enquire into the Degrees of Enlargement of the Cell in other cafes, befides thefe now mentioned. Of this kind of Computations take the two following Examples. In the firft place, fuppofe the Cell to be fo framed, that it fhall be capable of contracting to half its greateft Length; for which purpofe the Diameter of the Cell muft bear to its Altitude, when relaxed about the Proportion of 1 to $10\frac{4}{7}$. In this cafe, when the Cell is fo far inflated as to be reduced into three fourths only of its greateft Length, the greateft Diameter of the Cell fhall be fomewhat more than feven times the Diameter of its Bafes, and its Cavity almoft twenty three times enlarged. Suppofe again that the Cell by its Inflation can be contracted no farther than into three fourths of its greateft Length: In this cafe, when it has loft one eighth of its Length only, the Proportion of its greateft Diameter to the Diameter of its Bafes will be very little lefs than the *Ratio* of 3 to 2; and the Cavity of the Cell will be enlarged nearly in the Proportion of $15\frac{1}{4}$ to 10.

By fuch Computations as thefe, when it has been difcovered in what degree the Cavity of the Fibres of any Mufcle is required on the veficular Hypothefis to be enlarged, in order to render thofe Fibres capable of the Contraction, that fhall be obferved to belong to them; the next thing is to confider how much the whole Mufcle may be required to increafe in Bulk by the Cavities of its Fibres being thus augmented. And this is the firft Step towards the Examination of the prefent Hypothefis; for if the Body of the Mufcle is not found to increafe in bulk, as much as the Refult of thefe Computations demands, the Hypothefis will appear to be abfurd;

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otherwife it will merit further confideration. But in order to make this enquiry into the degree of Intumefcence to be expected in the Mufcle, fome confiderations are neceffary. In the firft place it is very obvious, that the whole Mufcle muft not be expected to enlarge in its bulk, fo much as the Cavity of its Fibres are required to do; by reafon that the undiftended Part of the Mufcle, fuch as the folid Parts of thefe Fibres, and the Fat interfperfed between them, together with the Blood Vef- fels and Nerves appertaining to the Mufcle, bear without queftion no inconfiderable proportion to the bulk of the whole Mufcle. A caution is likewife neceffary in eftimating the Degree, in which the Fibres of a Mufcle in any Experiment contract; for this muft not be determined merely from the Contraction of the whole Mufcle, without taking into confideration the Structure of the Mufcle, and obferving in what manner the Fibres are fituated in it. In the third place it fhould be confidered, whether the Mufcle experimented upon is contracted to the utmoft it is capable of, or not; becaufe in this Hypothefis a greater Intumefcence is required to contract a Fibre in any given degree, if that Fibre be capable of a yet greater Contraction, than if the given Degree of Contraction be the utmoft Limit of the Fibre's Action. And we ought farther to add, that the Cells of the mufcular Fibres cannot receive exactly the Figure, which from the preceding Demonftrations has been attributed to them, unlefs they were difengaged from each other; whereas by the Refiftance, that the Mufcle acts againft, the Mufcular Fibres are compreffed together, fo that the Figure of their Cells will in a good degree be altered by that Compreffion, and the Action of each Fibre by that means fo much hindered, that a greater Inflation of its Cavity will be required to produce any defired Effect, than if the Fibre were at liberty to act to the greateft advantage. By which means though the Mufcle will not take up fo much room, as it would do, were its Fibres, when freely in- flated, to lie contiguous only to one another, and to leave thofe intermediate Va- cuities, that would be the confequence of their tumified Figure; yet the Bulk of the Mufcle muft be greater than the collective Magnitude of its Fibres exclufive of thofe Intervals.

By how much more the Fibres of the Mufcle, on which trial fhall be made in this Difquifition, are contracted in their Length, by fo much more vifible and con- vincing will the Succefs of the Experiment be. Of all the Mufcles in the Body, the Sphincters feem to contract in the moft eminent degree; but are out of reach from being experimented upon. In comparifon of thefe, the Mufcles of the Limbs, whofe Action lies better expofed to Examination, contract but little. Though as they preferve a good degree of Force, even when contracted to the utmoft, the Structure of the Joint, they operate upon, will permit; no doubt but they are ca- pable of contracting much more than they do. *Borelli* * indeed undertakes to prove the contrary, that the Mufcles by which the Joints are moved are hardly of themfelves capable of a greater Contraction than what the Form of the Joints do

* De Mot. Animal. part. I. prop. xi. pag. 25, 26.

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allow; and that when the Joints, over which Muscles lie, are fully bent, the Muscles lose all their Force. The latter Part of this Assertion he would prove from observing, that when the Fingers are clinched towards the Palm of the Hand, the Elbow and Wrist being bent, the Palm cannot be pressed with any Degree of Force by the Fingers. But this Observation will no wise confirm what he brings it to prove, seeing the Effect here mentioned may as well be attributed to the Muscles, that are employed in extending the Fingers; which appear to Sense to be over-strained, by the Pain that is felt on the Back of the Hand. And the contrary to this Opinion of his is manifest in the greatest number of the Joints. As to his Observations in dissecting living Animals, to which he appeals for proof, that the Muscles are not of themselves capable of contracting more than he affirms of them; if these Observations were accurately made, they are a considerable Objection against the vesicular Hypothesis, which of necessity requires, that the Muscles should lose almost all their Force, when they approach near the Limit of their Contraction.

To make an exact Judgment how much more the Muscles of the Limbs must in this Hypothesis be supposed capable of contracting, than they do in their ordinary Action, we ought to know the Method of determining, in what Degree the contractile Force of any Vesicle diminishes, in proportion as it is more and more contracted: And this may be determined by the help of the same two Curves, that we made use of in describing the Figures of those Cells. But this I shall not farther prosecute, because no such Augmentation of the Muscle, as is here required, has yet been discovered by any Experiment. On the contrary, the Writers upon this Subject have thought themselves obliged to suppose little or no Augmentation in the Bulk of the Muscle. *Steno* * indeed has argued, and with a greater pomp of Argument than so plain a matter required, that when the Muscle is abbreviated in its Length, it must increase in some other Dimension, in order to preserve its Magnitude; the same thing being also expresly remarked by *Borelli* †. But *Steno* does not incline to admit that the Muscles augment in any Dimension more than is required for this purpose; and so much, no doubt, he thought it necessary to allow of. Though *Borelli* grants that the Muscles of the Limbs, when they act, are rather contracted into a narrower space, than when they lie relaxed ‡. But at the same time, this last Author thinks he has discovered, beyond all question, that the Fibres of a Muscle do increase in bulk, when the Muscle acts. This he would collect from what he imagined he had observed of the Heart: But here he was deceived; for he has without sufficient ground asserted, that when the Fibres of that Muscle contract, and its Cavities are thereby closed up, its outer Surface is not diminished ‖. He would conclude the like Intumescence in the Fibres of other Muscles, though the whole Muscle does not increase in bulk, from the consideration only of their growing rigid upon their acting **. But this Argument is not very convincing, if we

* Myolog. Specim. p. 25.   † Borell. de Mot. Animal. part. II. prop. 14.   ‡ Ibid. ad fin. prop. 49.   ‖ Ibid. prop. 14, & 52.   ** Ibid. prop. 14.

except only what room may be made for the augmentation of the Fibres by the Compreſſion the Blood-veſſels may be ſuppoſed to undergo; which in many Muſcles muſt be very little, where the Magnitude of the Trunks and conſpicuous Branches of the Blood-veſſels lodged within the Muſcle, out of which only the Blood can be preſſed in quick Motions of the Muſcle, bears a very inconſiderable Proportion to the Bulk of the whole Muſcle. Certainly the Induration of the Muſcle, from whence he would deduce it, does on no other conſideration prove ſo much: For the Soft-neſs and Flaccidity of the Muſcle, when out of action, does not neceſſarily imply, as *Borelli* ſuppoſes, that the Fibres lie not then ſo cloſe together, as when they are in action; but it is ſufficient for producing this effect, that the Fibres while relaxed eaſily yield to any Force, and give place to any thing, that ſhall preſs upon them, with-out their making much reſiſtance; whereas when they are in action and tenſe, they muſt reſiſt every Force, that would diſcompoſe the Order, in which they lie by one another. But farther it muſt be conſidered, that the Bulk of the Muſcle ought to be greater, when it acts in a ſtate of great Contraction, than when the Muſcle is more extended, though it be in action. And I doubt no Experiment hi-therto made gives any ground to ſuppoſe this. Whence there is great reaſon to ſuſpect, that the ſeeming Intumeſcence of ſome Muſcles, when they act, does only ariſe from a Change made in their Figure.

If this be ſtrictly ſo, it is evident that the Veſicular Hypotheſis muſt be entirely rejected. And even if we ſhould ever, by any future Experiment, diſcover the Muſcles as they are contracted to augment ſomething in Bulk, I fear this Increaſe will be ſo very ſmall, that it will be exceeding difficult to reconcile it to this Veſi-cular Hypotheſis. Although this Difficulty will be ſomewhat leſſened by our firſt Caution, grounded on the Proportion the contracting Fibres may bear to other ac-ceſſory Parts of the Muſcle. And indeed we have great reaſon to conclude this Proportion to be but moderate, if we conſider how very much the Muſcles are di-miniſhed in emaciated Bodies, without the total conſumption of one muſcular Fibre; but only from the loſs of the Fat, which the Microſcope ſhews to be every where diſtributed through the whole Subſtance of the Muſcle.

LET us therefore ſuppoſe, that this Enquiry concerning the Augmentation of the Cavity of the contracting Fibres to remain ſo far doubtful, as to give room for a farther Examination into this Structure of the Fibre. All that *Borelli* * has ſo tediouſly and with ſuch Obſcurity advanced for the exiſtence of theſe Veſicles, is at laſt reduced to that Axiom in Philoſophy, that Nature takes the moſt eaſy courſe in all its Productions. For he has not attempted ſo much to prove his Notions by any Experiments, as to conclude it to be true, becauſe it was the ſimpleſt that he was able to frame in his Mind. But ſuch a Method of arguing is very unworthy a

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* De Mot. Animal. Part. I. prop. 113, 114. Part. II. prop. 14.

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Philosopher; for though we find indeed by manifold Inſtances, that the Operations of Nature are wonderfully ſimple and uncompounded; yet we are not to imagine, that the Author of the Univerſe, in the formation of things, had any ſuch regard to the Weakneſs of our Capacities, that he ſhould frame his Works in ſuch a manner, as we could moſt readily comprehend; but that he eſtabliſh'd ſuch Principles of Action, as might moſt compendiouſly produce the infinite number of Operations in Nature, though by what means any one of theſe Effects can moſt eaſily be brought about conſiſtent with the reſt, we can in no wiſe pretend to be proper Judges. In the Example before us, though this veſicular Structure of the Fibres may be the moſt obvious Method we are able to think of for their Contraction, yet we cannot be certain, but that the Principle that muſt neceſſarily be required to inflate and diſtend them, might poſſibly be inconſiſtent with every other Operation in the Animal Oeconomy.

THEY therefore have proceeded with greater Prudence, who have endeavoured to find out ſomething really appearing in the Muſcle, that might favour this Opinion. And the firſt thing that offer'd it ſelf for this purpoſe, are thoſe ſlender Filaments which, in rending the muſcular Fibres aſunder, were found to hold thoſe Fibres together. And certainly if theſe tranſverſe Filaments connected the Fibres together by being twiſted round them, as *Bernoulli* * ſuppoſes, they might be thought to divide the Fibres into Veſicles. But this Diſpoſition of theſe Filaments is not very reconcileable to the anatomical Enquiries that have been made about them. Mr. *Cowper* from particular Obſervations found them unfit for any ſuch purpoſe; for they appeared to him no other than ſmall Veſſels paſſing from one Fibre to another. And this Opinion is farther confirmed by the accurate *Morgagni* †, whoſe Authority is of great weight, as his Diſcoveries in Anatomy have been highly applauded by the Skilful.

OUR next Enquiry therefore muſt be, to examine whether this Structure may not be diſcovered in the ſtill more minute Diviſions of the Muſcles. For as the Muſcles are found to be divided by Membranes running through them into ſmall Parts, and thoſe Parts again ſubdivided for ſeveral Succeſſions; each of which diviſions on ſome accounts may not improperly be conſidered as a diſtinct Muſcle; ſo what firſt offers it ſelf to the naked Eye, under the form of a ſingle Fibre, by the Microſcope is found to be a Bundle of Fibres, and as it were a minute Muſcle included within a proper Membrane. Theſe leſſer Fibres are not too ſmall to be diſcerned even by the naked Eye, though not without difficulty. But the Microſcope ſhews us farther, that theſe Fibres are each inveſted with a Membrane, which includes within it not one ſimple Body, but a Bundle of ſtill finer Fibres‡. Whether theſe are likewiſe compounded of others, has not yet been diſ-

* Diſſert. Phyſico-Mech. de Mot. Muſc. Sect. II. pag. 3, 4. Edit. Venet. 1721. tom. II. Animadv. 7.　　‡ Leeuwenhoek. Anatom. & Contempl. pag. 46.　　† Adverſar. Ana-

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covered. On the contrary *Leeuwenhoek*, who has pushed his Observations on this Subject farther than any other Person besides, thinks these last mentioned Fibres to be simple hollow Tubes *. But his Observations cannot be wholly relied upon in so subtle a Case; for if those Pores, he sees in the transverse Sections of these Fibres, are really the Interstices between different Fibres, and are too small for his Microscopes to discern the Inequalities of them, they will appear of a round Figure, and consequently as the Hollow of a Tube. Just as the Ring of *Saturn*, before Telescopes were brought to a sufficient Perfection, to discover the less lucid Parts of it, seemed to be two round Bodies placed on each side of that Planet. In the same manner *Leeuwenhoek* himself, in this very Subject, was at first deceived by the Corrugations, as he afterwards found, into which the Membrane, that invests the small Bundles of Fibres before mentioned, forms it self; for seeing these Corrugations indistinctly through less perfect Glasses, he concluded the Fibres to be a String of globular Parts †. But his more exact Observations have not discovered the least Traces of such an Appearance.

THE only Circumstance in all *Leeuwenhoek*'s Observations, that any way favours the Hypothesis we are here considering, are those Corrugations he relates the Membrane, that invelopes the Fibres, to fall into; which, from the oblique Situation he finds them generally to take, he believes to surround the Fibres in a spiral manner ‡. And indeed were any Substance, firmer than the rest of the Membrane, observed in these Corrugations, it were all that could be wished for in favour of the Hypothesis. If it were so, these Bundles of Fibres might contract themselves by the Intumescence of the Parts between these Corrugations; and the Figure, into which the Sides of these Bundles of Fibres would swell, must be the same as if the Constrictions were directly transverse, as will easily be understood from what *Torricelli* ‖ has writ on the Measurement of the Screw. But no such firm Substance has yet been found in these Corrugations, nor is there any reason to suppose there lies hid in them any such; since the Corrugations in these Membranes have nothing in them peculiar; but the same, without any visible difference, are seen in the Fibres of the Tendons **.

SINCE therefore we cannot make any immediate Discovery of this Structure of the Fibres, we shall even be reduced to the Weakness of *Borelli*'s Argument for their Existence, unless we can corroborate his Reason by one of these two Methods; either that we could discover something existing in the Body, that we might know to be capable of inflating these Vesicles, were there any such; or in default of this, that at least we should be able to frame in our Minds a Notion of some Principle suited to produce the Effect required, which we could plainly see, would give no impedi-

* Philosoph. Transact. N°. 367. pag. 139, 140.   † Anatom. & Contempl. pag 43.   ‡ Epist. Physiol. Delph. Ann. 1719. epist. 16, 33.   ‖ Oper. Geom. de Cochleâ, pag. 136, &c. Tract. de Dimenf. Parab.   ** Epist. Physiol. epist. 16, 33.

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ment to the other Operations in the animal Oeconomy. For without one of these, in acquiescing in this Hypothesis, we shall do no better than that Person, who being only acquainted with the apparent Motion of the Sun, should immediately conclude the Earth to be in the Center of the World, because he could explain what he had observed without difficulty, by supposing the Sun to revolve round the Earth; and should not hold his Mind in suspence, till he had examined the Motions of the other Planets, and considered how well his Opinion could be reconciled to the whole System. As such a Person would act altogether rashly, in imagining the State of things must needs be agreeable to the first Notions of his Mind, and what would appear to him most reasonable, before he had fully inquired into the Constitution of the Universe; so neither ought we to take up an Opinion concerning the Frame of these Fibres, without being able either to see, that they are so framed, or yet to have sufficient reason to know, that muscular Motion could conveniently be produced by such a Structure. For what convinces us, that our first Thoughts of the Motion of the Sun is erroneous, and that the Earth it self really moves, is, that this latter Supposition we cannot only explain with ease the Appearances that belong to the Sun only, but account with the greatest exactness for every Appearance in the whole System. But the Writers on the present Subject have not examined the matter with this exactness; as will appear from the Enquiry we shall now proceed to make into some of the principal Opinions they have advanced.

But first it is proper to premise, that the Nerve is one chief Instrument, which puts the Muscle into action, as is evident from hence, that whenever the Nerve belonging to a Muscle is separated from it, it is no longer in the power of the Animal to put the Muscle into action. This Office of the Nerve is generally allowed to be performed by the means of some very fine and subtle Fluid, which is called by Authors the Animal Spirits; and that the Contraction of the Muscles concerned in voluntary Motion arises from this Spirit being some way operated upon at the Original of the Nerves. All which seems evident from this Observation, that a Ligature upon the Nerve deprives the Muscle of its Motion as effectually, as if the Nerve were divided.

Pyerus * indeed has observed of the Heart, a Muscle whose Motion is involuntary, that in some Creatures, as particularly in the Eel and Salmon, by being warmed it would long after the Death of the Animal renew its Pulsation; nay even when separated from the Body. And the same curious Person renewed the Pulsation of the Heart in other Animals also, after their Death, by inflating it through the Receptacle of the Chyle; especially if an external Warmth was likewise applied. But these Experiments are no Objection against the Office assigned to the Nerves in respect of the Muscles concerned in voluntary Motion; for they are consistent with the same Use of the Nerves in the Heart it self, seeing it may

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* Miracul. Anatom. pag. 107, &c. in Parergis.

very

very well be fuppofed, that the Nerves lodged within the Subftance of the Heart may retain a fufficient ftock of this fubtile Spirit, by which the Mufcles are actuated, to produce fome degree of Pulfation, when this Spirit fhall be put into action, by warming and agitating the Heart; fince thefe Experiments fucceeded beft in Animals that had died a violent Death, and had not their Spirits exhaufted by a long Difeafe, and a gradual Decay of Life. Nay, as thefe Experiments do not oppofe this Office of the animal Spirits, fo we may receive much light from them, not only in relation to the Heart in particular, but concerning the Mufcles in general. Of the Heart they feem to inform us, that its fucceffive Contractions and Relaxations do not arife fo much from any alternate Change wrought at the original of the Nerves, in the manner that the Mufcles, ferving for voluntary Motion, are put into action, or caufed to reft; but more from the very Structure of the Heart it felf, whereby in its contracted ftate the Paffage of the Spirits into its Fibres may be intercepted. For then, without any change wrought in the Spirits at a diftance from the Heart, its Fibres cannot remain long contracted; and on the other hand, will be no fooner relaxed, than a Paffage being opened for the Spirits into the Fibres, their Contraction will again be renewed. But thefe Experiments will much affift us likewife in making a right Judgment concerning the ufe of the Blood in mufcular Motion: For the Blood appears fome way neceffary thereto; fince it has been found, that by intercepting the Paffage of the Blood to any Mufcle, the Mufcle lofes its moving Power. But from thefe Experiments it may well be queftioned, whether this effect arifes from any other Caufe, than that by depriving the Mufcle of its Blood, the Fibres and Nerves muft foon grow cold and ftiff: For we fee in thefe Experiments, that the Fibres of the Heart, when warm, contracted themfelves, though the Blood was not circulating through them. And this Sufpicion, that the Blood affifts in mufcular Motion only by preferving the Parts in a proper ftate for the Spirits to pafs through the Extremities of the Nerves, and perform their Office on the mufcular Fibres, is farther confirmed from Experiments of Mr. *Cowper*, who by injecting warm Water only into the Artery of Mufcles concerned in voluntary Motion, after the Paffage of the Blood had been intercepted, caufed them to renew their Contraction.

But the Authors of the Hypothefis, we intend here to examine, afcribe a more particular Ufe to the Blood; for they fuppofe the Fluid in the Nerves to inflate the Cells of the mufcular Fibres by rarifying the Blood within them. Without queftion there are certain Juices intimately diftributed throughout thefe Fibres. Mr. *Cowper* relates, that he found them very plentifully charged with Mercury he had injected into the Artery. For the explaining of this fuppofed Operation, our Countryman Dr. *Croon* *, and *Borelli* †, proceed no farther than to afcribe it to a Fermentation arifing from the mixture of the Animal Spirits with thefe Juices. But as this general Expreffion gives us no real light into the Subject, fo the

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* De ratione Mot. Mufcul.　　† De Mot. Animal. Part. II. prop. 26, 27.

Effects of this supposed Fermentation shew it must be of a very singular kind, and very different from what generally goes under that Name. That on some occasions this imagined Fermentation should so suddenly be blown up into a great Effervescence, and again so immediately subside, as is required not only for the quickest Motions in larger Animals, but still more surprizingly in the small Insects, many of whose Motions are so prodigious swift, as often to escape the Sight: That on other occasions the same Fermentation should be conducted with such exceeding slowness and regularity, not only in the principal Muscles in action, but in those others, which in almost every Motion of the Body act in subserviency to the principal ones, by preserving themselves in a state of tension, relaxing or contracting by the minutest differences, with infinite variety ‡; that we see the Limbs not only capable of moving with great exactness in the slowest manner, that the naked Eye can discern, but even that Objects shall be carried over the Eye by our Hand with no small degree of slowness, when seen through large magnifying Glasses. No wonder then that, in order to account for these surprizing *Phænomena*, it has been much desired to find out some particular way, by which this so unusal a kind of Fermentation might be explained. For this two Hypotheses have been framed, one by the celebrated *John Bernoulli* ‖, the other by Dr. *James Keil* **; but both insufficient. They both assume the red Globules of the Blood to be small Bladders filled with Air, or some other elastick matter, in a state of greater compression, than the Air is in, which surrounds the Body. The tenacity of the Coats of these Globules is supposed to retain the elastick Substance within them so compressed; and the taking off that restraint in the Globules, as they pass through the Cells of the Muscles, and thereby permitting the elastic Substance to expand it self, and inflate the Cells, is assigned for the cause of the Contraction of the Muscles. Thus far the two Hypotheses agree; but they differ in the manner of setting the elastic Substance at liberty to expand it self. *Bernoulli* ascribes to the Animal Spirits a pungent and penetrating Quality, by which they might be enabled to perforate the Coats of the Globules, and thereby let out the imprisoned *Aura*. Dr. *Keil* supposes this effect may be produced by the Principle of Attraction, that has been discovered by innumerable Experiments to belong to the small parts of matter ††. Upon this Principle it is only required, that the Nerves be so disposed in the Muscles, as to open by numerous Orifices into each Cell, and on every side of it. And when the Spirits are moved toward the Muscle, and are entering into the Cells at those Orifices, as soon as the Particles of them come within a certain distance of the Globules, the Coats of the Globules, and those Particles must be supposed to attract each other. By this Attraction the Particles of the Spirits will have their Motion towards the Globules accelerated; and these Particles, like all corporeal Substances, having a *vis inertiæ* in proportion to the quantity of matter in them, they will resist in some degree to this augmentation of their Motion; and so much will the Particles,

‡ *See* Memoir. de l'Acad. Royale de Sciences, Ann. 1720. pag. 87, 88.   ‖ Dissert. de Mot. Muscul. §. 5.
** Tentam. Medico-Physic. pag. 135, 136.   †† Newton. Opt. Qu. 31.

which

which compofe the Coats of the Globules, be folicited towards the Particles of the Spirits, and thereby have the force of their Cohefion with each other diminifhed, giving liberty to the included elaftic Fluid to dilate and expand it felf. But in this Hypothefis the Globules will expand themfelves with no greater force than what could generate in any given fpace of time that Degree of Motion, which will be communicated by this Attraction to the Particles of the Spirits in the fame time; and therefore, confidering how very minute the Particles of thefe Spirits are, this Attraction, to produce any confiderable effects, ought to be exceeding ftrong, and the increafe of Velocity given to the Spirits muft be immenfly great. However, this Hypothefis is better reconcileable than the former to the Quicknefs, with which the Mufcles contract and relax: For the Particles of the Spirits unite with the Globules of Blood in fo very fhort a fpace of time after their acting upon them, that as foon as a frefh fupply of Spirits is difcontinued, the Dilatation of the Globules will almoft inftantaneoufly ceafe. But *Bernoulli*, in his Hypothefis, in order to account for this fudden Detumefcence of the Mufcle, is obliged to reprefent the elaftic matter contained in the Globules fo very fine and fubtle, and difpofed to pafs through the Pores of the mufcular Cells with fo much freedom, as makes it very difficult to conceive, how it fhould be confined by the tender Coats of the Globules.

But yet both thefe Hypothefes, as I have faid before, muft be looked upon as infufficient, becaufe the red Globules of Blood, in all probability, are not Veficles filled with any fuch elaftic Subftance, as is fuppofed in thefe Hypothefes; but, on the contrary, nothing more than a Fluid, or at leaft a Subftance preferved in a State of Fluidity by the Heat and Motion of it, which will not perfectly mix and unite with the *Serum*; and therefore fwims in it under the form of fmall Globules, for no other reafon than Oyl does in Water, when they are agitated together. Which fingle Obfervation is fufficient to fhew, that neither of thefe Opinions have that degree of probability, that is neceffary to entitle them to a reception. Nay, if the make of thefe Globules was more doubtful than it really is, yet as thefe Opinions are no other than mere Hypothefes, we could have no ftrong perfuafion of their truth: efpecially fince thefe are not the only Conjectures, that might be framed concerning this matter. For might it be allowed to build an Hypothefis on any of the Thoughts of that great Philofopher, whofe chief Glory confifts in having banifhed all Uncertainties from his Inquiries into Nature, and in raifing natural Knowledge upon a more folid and durable Foundation, we might fet the effects of the Animal Spirits upon the Juices, that may be contained in thefe fuppofed Cells, in a light yet more familiar, by what Sir *Ifaac Newton* * has hinted concerning mufcular Motion. For we need not have recourfe to any imaginary Elafticity in a Fluid, flowing in the Fibres, if we affume with him, that the Fluid contained in the Nerves is probably no other than part of that fubtle, rare, and elaftic Spirit, he concludes to be diffufed through the Univerfe, as the moft likely

* Newt. Opt. Qu. 24.

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Caufe of the Reflection, Refraction and Inflection of Light, and of that extraordinary and fuprizing *Phænomenon* of Light firft difcovered by him; of its being fubject to regular fits of Reflection and Tranfmiffion alternately fucceeding each other in its Paffage through Bodies *. The fame Spirit he fuppofes to communicate Heat to Bodies †, and to produce all thofe Appearances, in which the fmall Particles of Matter feem to attract and repel each other ‡. Allowing, I fay, the Fluid of the Nerves to be a Part of this Spirit, the Intumefcence of the Juices in the Cells of the mufcular Fibres may in fome degree be illuftrated by a very familiar Operation in Nature, the forementioned Expanfion of Bodies by Heat: For if we afcribe this Expanfion to the vibratory Motion of the fubtle Spirit within the Body, there will nothing more be required for the prefent purpofe, than to fay, that the Mind, when it wills a Part to be moved, acts upon this Spirit at the Extremity, to which it is prefent, of the Nerve, fo as to communicate a proper Pulfation and vibratory Motion of this Spirit through the whole Nerve, fuppofed of fo uniform a Subftance, that the excited Pulfes may be propagated through it without Interruption, till they arrive at the Cells of the mufcular Fibres, where they may caufe fuch an Agitation in this fame elaftic Spirit within the Juices, wherewith the Cells are filled, as may rarify and dilate thofe Juices. Certainly the moft fuddain Relaxation of the Mufcles is eafily accounted for by this way of explaining their Motion: For as foon as ever the Mind ceafes to act upon that Part of the elaftic Spirit, to which it is prefent, the Pulfes propagated from thence will immediately be difcontinued; and confequently the mufcular Fluid, whofe Expanfion is occafioned by thofe Pulfes, will forthwith fubfide; juft as the Pulfation of the Air, which is the Caufe of Sound, prefently ftops, and the Sound depending upon it perifhes, as foon as ever the fonorous Body ceafes to vibrate. Though, as in the Air the different Degrees of Quicknefs in its Pulfations, ·by which the feveral Species of mufical Notes are formed, are not the only Varieties in the Air's vibratory Motion, fo by the Licence fo neceffary to the Framers of Hypothefes, we muft here conceive fome difference between this vibratory Motion, whereby the Fluids in the Mufcles are to be expanded, and that which occafions Heat in Bodies; becaufe we do not find the Mufcles to grow confiderably hot in their Action.

But to leave fuch Gueffes, as the Experiments we have mentioned of *Pyerus* and Mr. *Cowper* fhew, that the Effects obferved from intercepting the Paffage of the Blood through the Artery to any Mufcle are no direct Proof, that the Blood confpires any farther to mufcular Motion, than by preferving the Parts of the Mufcle in a due Temper; fo by what has now been faid, it appears, that we have yet no other convincing Reafon to conclude, that the Blood, or other Juices lodged within the Fibres, have any more particular Ufe therein; as no real Difcovery has yet been made of any fuch Ufe of thefe Juices. Nay moreover, fince we can neither form any diftinct

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* Newton's Opt. Qu. 18.　　† Ibid.　　‡ Philofoph. Nat. Princ. pag. ult.

Notion of the way the Vesicles of the Fibres should be inflated, nor yet have any direct Proof of the Existence of such Cells; it will at length follow, that the Hypothesis it self can lay claim to no greater Degree of Certainty than any other of those Conjectures, with which *Des Cartes* and his Followers, in contemplating so great a Subject as Nature, have idly amused themselves.

BUT their Method of Philosophy ought entirely to be laid aside: For as the Event has abundantly shewn, that no Improvement in the Knowledge of Nature can thence be expected; so it was the highest Vanity to enter at first upon such a Scheme, seeing to hope any Success therefrom, was to imagine our weak Understandings by a slight Act of Fancy able to penetrate the Designs of the wise Author of all things, of whom it is declared, that his Ways and Thoughts are as far above our Conceptions, as the infinite Extent of the Heavens is remote from this Earth, to which we are confined. We ought not indeed to be easily discouraged from making Inquiries into the Causes of things: For as the Experience of all Ages proves nothing to be more agreeable to contemplative Minds, so nothing seems more worthy of our Thoughts, as the Consideration of the Frame of Nature eminently sets forth not only the Power, but the Wisdom likewise of its Author: And therefore nothing can be more suited to enlarge the human Understanding, and improve the noblest Faculty of our Minds, and at the same time to promote the Knowledge of our Creator, wherein consists our chief Happiness. But the more excellent the Knowledge of Nature is in it self, by so much the more are to be condemned the Proceedings of these mistaken Philosophers. For while the utmost Diligence and Modesty in searching into the Works of Nature by the slowest degrees are of necessity required to enable our limited Capacities to trace out any of the hidden Causes of things, we cannot sufficiently admire, that Men of warm Imaginations should build up at once vain Systems upon rash Determinations of what those Causes are, from ungrounded and precipitate Conjectures. Not as if our utmost Abilities were too small ever fully to discover the Wisdom necessary to compose this Order and Disposition of things, the Authors of this conjectural Philosophy proceed as if they imagined these Effects of infinite Wisdom a Contrivance almost within the reach of human Invention: For however absurd it would be in any one expresly to boast himself endued with Sagacity sufficient to contrive this stupendious Frame of Nature in all its Beauty and Perfections; yet *Des Cartes*, to gain an imaginary Empire in Philosophy, has boldly adventured upon a way, that can be allowed rational only in a Being who thought himself inferior to the supreme Author of all things chiefly in Power.

SURELY nothing but the seeming Impossibility of advancing any great length in natural Discoveries by a more regular Method, could prevail on any sober Inquirers into Truth to follow *Des Cartes* in so preposterous a Course. And indeed we could not much have wondered, if the exceeding small Advancement made in Philosophy

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by thofe very few, who through the Courfe of all the learned Ages, at great Inter-
vals of Time, have diftinguifhed themfelves by purfuing their Searches into Nature
upon true Principles, had occafioned Philofophers wholly to defpair of arriving at
any Certainty in the more recluse Parts of Phyfics. For now our great Philofopher
has at length in fo furprizing a manner enter'd into the Depths of Nature, we find
much lefs reafon to admire, that his Difcoveries had lain fo long concealed, than
that they fhould ever have been fearched out. Difcoveries that have given a proof
of the moft flowing and abounding Invention, of the profoundeft Penetration, and
of the fublimeft Force of Reafon: Not only where it was neceffary to apply the
fubtleft Parts of Geometry, and even to improve that Science much beyond its for-
mer Bounds; as where he has difclofed the Nature and Operations of Fluids, and
difcovered the great Principle, that keeps in motion the large Bodies of the Uni-
verfe; but if poffible, yet more in thofe Advancements he has made from the con-
fideration of Light into a more hidden part of Nature, by the moft refined and
powerful Reafonings upon the moft obvious Obfervations, even to the deducing
many wonderful Secrets of Nature from things, which appeared wholly barren not
only to common Capacities, but to the Philofophers of the greateft Penetration.

EVEN fully to perceive the Progrefs this excellent Perfon has made in the real
Knowledge of Nature, calls for the utmoft Application and Thought; infomuch
that many, who would have formerly paffed for no mean Philofophers, have inge-
nuoufly owned themfelves unable to comprehend fome of Sir *Ifaac Newton*'s moft
fublime Speculations. But however difficult the fearching into Nature may appear,
doubtlefs when this true Method of Philofophy comes to be generally underftood,
it will entirely put a ftop to the falfe way, that has prevailed in the World. When
we fee thofe Principles of natural Operations, that are now difcovered, are fo wide-
ly diftant from our moft refined Conjectures concerning them, it will be impoffible
for us for the future to receive any kind of Hypothefis with the leaft approbation.
If in one of the moft fimple Productions of Nature, the Motions of the heavenly
Bodies, the Principle by which they are preferved, is fo much above the reach of
our Conceptions, that we hardly find any one, that can reconcile it to his Thoughts,
who does not fee the full Force of the Demonftrations, by which it is proved; how
can we conceive the brifkeft Imagination ever able to difcover any of the more con-
cealed Springs of natural Effects? Thefe Confiderations furely will intirely free us
from that Miftake the Philofophers feem to have laboured under, who imagined it
was required of them to account for almoft all the Appearances of Nature; info-
much that we find the very manner how a World or an Animal might be formed, is
frequently attempted by the Framers of Hypothefes, who yet were fo far from being
qualified for fo daring an Enterprize, that on the contrary they have fhewn them-
felves not really able to difcover the obvious Laws of Motion. But we ought to be
more modeft in our Inquiries, and not go fo precipitantly to work. If we can truly
difcover any one ftep, Nature takes in her Productions, we ought to look upon it
as a confiderable Attainment, without repining at our not being able to trace her

through

through all her Caufes. The leaft acquaintance with the true Philofophy will ferve to fhew us, that the Queftions generally difputed in the common Syftems are fo far from being determined, that if we fhall ever be able to come at their knowledge, it muft be through a Courfe of many Ages employed in the true Method.

LET therefore the conjectural Philofophy, which has hitherto hindered the Progrefs, that might have been made in the Knowledge of Nature, be for ever banifhed. And now a true way is fully brought to light, let every Inquirer after Truth without delay enter upon it. The way indeed is rough, and befet with difficulties, but not unpaffable, nor yet unpleafant, if we free our Thoughts from the airy Conceits and exorbitant Expectations, which ufed to fwell the Minds of Philofophers, and make it painful for them to acquiefce in the fmall Meafure of Science within their power. A Mind thus inflated by grafping at the Knowledge of all things, can underftand nothing truly; but to one prepared with the juft Love of Truth, the Difcovery of our Ignorance in any particular will be more grateful than any tranfient Fame, that may attend a falfe Pretenfion to Knowledge. For this reafon I have chofe in this latter part of the prefent Difcourfe only to fet out, in the plaineft manner I was able, how infufficient all Conjectures have hitherto been at the Caufe of mufcular Motion, without hazarding to augment the Number of Errors by recommending any new Conceit of my own.

IF I am not miftaken, we muft have made a much greater Progrefs in the Knowledge of Nature, before any Light can be got in fo reclufe a Subject with the leaft degree of Certainty. While we are wholly Strangers to the Principle, that caufes the Parts of Matter to adhere together, and how it comes to pafs, that this Principle fhould operate with fo much Strength, while the Parts of the folid Body are yet kept from the moft intimate Contact they are capable of; how a Body fhould be increafed in all its Dimenfions by Heat, and yet retain in great meafure its Solidity; how can we know, but there is fome Power in Animals, that can operate upon this Principle, which keeps the Parts of their Fibres together, and can ftrengthen the Effects thereof upon proper Occafions, fo that the Particles of thofe Fibres fhall be made to approach each other with great force? And if the Caufe of mufcular Motion fhould lie fo remote as this Principle, which I fee no Abfurdity in fuppofing, it is impoffible for us in the prefent Infancy of natural Philofophy to difcover any thing concerning it.

ERRATA.

Pag. lxvii. l. 31. del. *that*. Ibid. l. antepenult. l. *Notion*. Paffim pro *Gafterocnemius* leg. *Gaftrocnemius*.

V

MYOTOMIA REFORMATA:

OR, A

New Adminiſtration and Deſcription

OF THE

MUSCLES

OF A

HUMAN BODY.
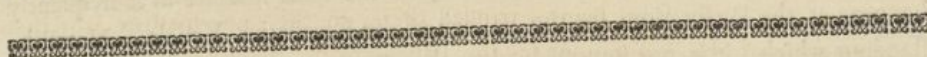
CHAP. I.

Of the MUSCLES *of the* ABDOMEN.

IT being uſual for the Contents of the lower Belly to putrefy and grow offenſive ſooner than any other Part of the Body, Anatomiſts for this Reaſon generally begin their Diſſections with the ABDOMEN. This is done by making a crucial Inciſion through the common Integuments, one Line of which is continued from the *Cartilago Enſiformis* directly to the *Os Pubis*; the other is drawn tranſverſly from the Navel to the Region of the Loins on each ſide; after which the Skin, Fat, and Membranes of each Portion being raiſed from their reſpective Angles, the Muſcles

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of the Abdomen prefent themfelves to View. In the particular Enumeration and Defcription of thefe, as well as of all the other Mufcles of the Body, we fhall conftantly obferve that Order, in which they will moft readily appear in Diffection.

I.

OBLIQUUS DESCENDENS,

ARISES partly tendinous, but chiefly flefhy from the lower Margins of the fifth, fixth, feventh, and eighth Ribs, where its feveral feparate Originations lie between the Indentations of the *Serratus Major Anticus*; thefe, for better Diftinction, we chufe to call its firft Origin. Befides which, it continues to derive more Heads in like manner from the ninth, tenth, eleventh, and fometimes from the Extremity of the laft Rib; which Heads we fhall call its fecond Origin. From the former Origin, its flefhy Part, defcending obliquely, expands itfelf into a broad membranous Tendon, before it marches over the *Rectus* to its Infertion into the *Linea Alba* and *Os Pubis*. From the latter Origin, defcending in the fame manner, it ends tendinous in the *Os Pubis*, and partly tendinous, but chiefly flefhy, on the upper and forepart of the circular Edge of the *Os Ilium*, without any Adhefion to the *Vertebræ* of the Loins, as *Spigelius**, *Veſlingius†*, and with them moft other Anatomifts, have imagin'd. As its laft, thickeft, largeft, and moft flefhy Digitation defcends obliquely forward from the loweft Baftard Rib, and recedes more and more from the *Vertebræ* of the Loins, it forms a triangular Interftice, comprehended by its own lower Side, the *Sacrolumbalis*, and part of the Spine of the *Os Ilium*, in which *Area* the Fibres of the fubjacent afcending Mufcle plainly appear, after raifing part of the *Latiſſimus Dorſi*, and clearing away the Fat.

THE lower tendinous Margin of this Mufcle, which lies between the Spine of the *Os Ilium* and the *Os Pubis*, is particularly contriv'd to fecure the Contents of the lower Belly from being extruded there, in the fame manner as it frequently happens at the Perforations for the Paffage of the fpermatick Veffels. Notwithftanding which, it is not impoffible, but that Ruptures may fometimes happen in this Part; and I am apt to imagine this to be the cafe when a Rupture is very large, and not to be retained by a Trufs.

BESIDES the Actions commonly afcribed to this Mufcle and its Partner, together with the other Mufcles of the *Abdomen*, of affifting in Exfpiration, of compreffing the Inteftines, Bladder, and *Uterus*, and thereby excluding the *Fæces* and Urine in both Sexes, and the *Fœtus* in Women; they feem to have a farther ufe in affifting to bend the Body forward: And that Part of them which lies between their latter Origin and the Spine of the *Os Ilium*, may ferve for the Circumrotation of the Trunk upon the *Axis* of the *Vertebræ*, when we turn the Body toward the contrary fide, the Feet remaining unmoved.

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* *Hum. Corp. Fabr. Lib.* iv. *Cap.* x.   † *Syntagm. Anatom. Cap.* 11.

FOR

FOR the better *Diffection* of the *Muscles* of the Abdomen, *it may be convenient* to observe *the following Method.* First of all raife *that Part of the* Latiffimus Dorfi, *which lies on the* OBLIQUUS DESCENDENS. *This being done, the Blood fpong'd up and the Fat clear'd, begin the Separation of the* Oblique defcending Muscle, *by thrufting your Finger between it and the* Obliquus Afcendens, *at the Extremity of the lowest Baftard Rib:* Then raife that Part of the DESCENDENS *which fprings from the lowest Rib, and terminates in the Spine of the Os* Ilium. *After which proceed to free the rest of its Digitations from the* Serratus Major Anticus, *being cautious not to wound its Tendon in dividing it from the fubjacent Muscle, especially where it marches over the* Rectus. *Nor may the Separation of the Tendons of the oblique defcending and afcending Muscles be attempted, unless in an Hydropical Subject, by reafon of their ftrict Adhefion to each other. Wherefore in preparing thefe Muscles, when they are to be fhewn after Diffection, you may proceed in the following manner.*

THE OBLIQUUS DESCENDENS *being raifed on either fide (as before) to the* Rectus, *cut through the Tendon of the* Afcendens, *and raife both Tendons together, taking fufficient Care in their Separation from the Interfections of the* Rectus, *to which they firmly adhere, and leave them at their Infertion in the* Linea Alba. *This done, on the contrary fide raife the flefhy Part only of the* DESCENDENS, *beginning in the* Linea Semilunaris, *by making an Aperture in its Tendon, towards the lower Part of the* Linea Semilunaris, *where it is feparable from the* Afcendens: *Then thrufting in a Probe between the two Tendons, divide that of the* DESCENDENS *the length of the* Abdomen; *after which raife the flefhy Part of the* DESCENDENS *on this fide, clear it to the Extremities of its Digitations, and leave it there. Having thus raifed the defcending Muscles, that on one fide being left at its tendinous Infertion in the* Linea Alba, *and the other being cleared to its Origination, proceed next to raife the fubjacent afcending Muscles, and on that fide, where you have before rais'd the* DESCENDENS *to its Infertion, raife the* Afcendens, *and leave it at its Origination: On the opposite fide raife the* Afcendens *from its Origination, and leave it at its Infertion in the* Linea Alba, *continued with part of the Tendon of the* DESCENDENS, *to which it is infeparably join'd in paffing over the* Rectus, *as above noted.*

N. B. *You must be cautious in raifing the* Obliquus Afcendens *towards its Origination, least the* Tranfverfalis *arife with it; which may be avoided if you begin its Separation in the* Ilium, *by thrufting your Fingers between the* Afcendens *and* Tranfverfalis.

II.

OBLIQUUS ASCENDENS.

THIS Muscle arifes tendinous from the hinder Part, and flefhy from the fore Part of the Spine of the *Os Ilium,* and the *Ligamentum Pubis,* and thence mounting with an Order of Fibres inclining forwards, is inferted flefhy into the eleventh and twelfth Ribs, and afterwards forms a broad thin membranous Tendon, implanted into the whole length of the *Linea Alba,* and the Cartilages of the eighth, ninth, tenth, eleventh, and twelfth Ribs.

BESIDES

BESIDES its ufe in compreffing the Contents of the *Abdomen*, that part of it which arifes towards the back part of the Edge of the *Os Ilium*, by the oblique Afcent of its Fibres to the Cartilaginous Endings of the Ribs, not only depreffes them and ftreightens the Cavity of the *Thorax* in Exfpiration, but in regard the Order of Fibres in this Mufcle interfects thofe of the *Defcendens*, thefe two Mufcles muft antagonize each other in the Rotation of the Trunk of the Body on the Axis of the *Vertebræ*. In the Structure and reciprocal Co-operation of thefe Mufcles, the afcending on the right fide, and the defcending on the left, turning the Body to the right; and *vice verfa*, the afcending on the left, and defcending on the right fide; in like manner turning it to the left, the Art of Nature is very admirable, which is particularly taken notice of, and accurately defcrib'd by * *Archangelus Piccolominus.*

III.

PYRAMIDALIS *vel* SUCCENTURIATUS.

THIS Mufcle lying on the *Rectus*, prefents it felf next in order of Diffection. It has its Name from its Figure, aptly reprefenting a Pyramid. It arifes from the fuperiour part of the *Os Pubis*, and in its Afcent leffens gradually, till it becomes a long Tendon inferted into the Navel. † *Maffa* is the firft that (I find) takes notice of thefe Mufcles, but thinks they belong to the *Penis*. ‡ *Riolan* has obferv'd the left pyramidal Mufcle to be commonly the leffer of the two; and if either be abfent, it is ufually that. ** *Fallopius* conjectures they comprefs the Bladder of Urine. *Fabritius ab Aquapendente* imagines they fupport the *Abdomen*, and hinder the upper Parts from preffing too violently on the inferiour; but this Opinion feems to take its Rife from obferving the anatomical Subject in a fupine Pofition. When the Diaphragm is in Action, and the *Vifcera* of the *Abdomen* are thereby prefs'd downwards, the pyramidal Mufcles acting at the fame time, make a more adequate Compreffion of the Bladder in the Expulfion of the Urine, than any other Mufcle of this Part; though it muft be confefs'd that all the Abdominal Mufcles affift in that Action. They are called SUCCENTURIATI, or auxiliary Mufcles, from a Suppofition that they are only fupplemental to the *Recti*, the Order of Fibres agreeing in both, and thefe being generally abfent when the *Recti* are continued flefhy to the *Offa Pubis*.

IV.

RECTUS,

SO called from the Rectitude of its Pofition. Anatomifts differ in affigning the Origination of this Mufcle, fome deriving it from the *Sternum*, others from the *Offa Pubis*; but this feems a matter more of Controverfy than Ufe, fince

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* *Prælect. Anatom.* p. 74.   † Chap. XXI.   ‡*Anthropolog. lib.* v. *cap.* XXXIV.   ** *Obferv. Anatom.*

either

either Part is indifferently mov'd by it, when the oppofite remains ftable. Little can be added to the common and well known Defcription of thefe Mufcles, they being continued according to the Length of the lower Belly from the *Cartilago Enfiformis*, two of the Cartilages of the true, and two of the baftard Ribs, down to the *Os Pubis*; and divided into four or five Portions, by three or four tranf-verfe tendinous Interfections. The Veffels, which pafs underneath the upper Part of this Mufcle, are the Mammary Artery defcending, and its Vein afcending. Thofe of its lower Part are the Epigaftrick Artery afcending, and its Vein defcend-ing. The Inclofure of this Mufcle in the double Tendon of the *Afcendens* we could never as yet difcern, rather fufpecting, that the Adhefion of the Tendon of the *Afcendens* to that of the following Mufcle, in the *Linea Semilunaris*, might occafion the Miftake.

V.

TRANSVERSALIS.

Tab. II. V.
XVI.

SO called, becaufe its Fibres run tranfverfly over the *Abdomen*. This Mufcle does not arife, according to the common Tradition, from any Ligament, whether fpringing from the *Os Sacrum*, or covering the *Sacrolumbus*; but, as *Realdus* * *Columbus* has it, from the tranfverfe Proceffes of the Lumbal *Vertebræ*, where it is a thin Tendon, and flefhy from the Spine of the *Os Ilium*, *Ligamentum Pubis*, and the cartilaginous Endings of the Ribs below the *Sternum*, whence its flefhy Part paffes over the convex Surface of the *Peritonæum*, and becomes a broad expanded Tendon, before it runs under the *Rectus* to its Implantation into the *Linea Alba*. Sometimes part of the Tendon of the TRANSVERSALIS paffes over the inferiour Part of the *Rectus*, as appear'd in a Subject I lately diffected, and the upper Part of its Tendon was plainly continued to the *Linea Alba* under the *Rec-tus*. Perhaps fuch like Sportings of Nature, may give occafion to thofe irregular Ruptures, which we fometimes find.

WHEN this Mufcle with its Partner act, they prefs the *Peritonæum* directly in-wards, and confpire with the reft of the Mufcles of the *Abdomen*, together with the Diaphragm, in compreffing the Contents of the Belly. The Tendons of the two oblique Mufcles, before they march over the *Rectus* on either Side, being join'd to the Tendon of this Mufcle in the *Linea Semilunaris*, do include the *Rec-tus* in a tendinous Cafe; which feems no inconfiderable Contrivance of Nature to corroborate the inclofed *Rectus* in its Action. *Cafpar* † *Bartholin* obferves in Bulls and other Animals of large Size, that Part of the TRANSVERSALIS is continuous with the Diaphragm at the cartilaginous Endings of the Ribs below the *Sternum*, whence he fuppofes the Diaphragm to be a trigaftrick Mufcle. In human Bodies we find, that the Diaphragm and this Mufcle are both fix'd to the cartilaginous Endings of the Ribs. The fpermatick Veffels pafs through this and the afcend-ing Mufcle near the *Inguina*, in the mid-way between the fore Part of the Spine of

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* *De Re Anatom. lib.* 5. *cap.* 22.   † *De Structura Diaphragm. cap.* 2.

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the *Os Ilium*, and the *Os Pubis*; whence defcending for fome Space between the flefhy Part of the *Obliquus Afcendens*, and the Tendon of the *Defcendens*, they run through a Fiffure in that Tendon near the *Os Pubis*. Nature has artificially difpofed thefe Perforations not exactly opening againft one another, in order to prevent a *Prolapfus* of the Inteftines through them. Which Contrivance is not much unlike the oblique Infertion of the *Ureters* and *Ductus Bilarius* paffing between the Membranes of the Bladder, and the Inteftines, whereby the Return of the Urine in one, and the Bile in the other, is prevented.

Besides thefe Mufcles of the *Abdomen*, the Diaphragm may not improperly be reckon'd among them; fince without its Co-operation, the abdominal Mufcles would not be able to comprefs the Contents of the lower Belly fufficiently for the Exclufion of the Excrements, *&c.* But the Diaphragm being a principal Inftrument in Refpiration, we choofe to treat of it among the Mufcles of the *Thorax*.

N. B. In the Diffection of the transverfe Mufcles, Care muft be taken not to wound the Cremafter *on either Side.*

We proceed now to the Mufcles of thofe Parts, which for Conveniency of Diffection offer themfelves next, namely, the Teftes, Penis, *Bladder of Urine, and* Anus: *In order to which, the Divifion of the Skin, Fat, and Membranes, muft be continued, by a femicircular Section on each Side of the* Pubes, *meeting in the Perinæum near the* Anus, *after which the Operator muft begin to raife the Skin of the upper Part of the* Penis, *freeing it from the fpermatick Veffels, and next raifing that Part, which lies in the* Perinæum. *This being done and the Fat remov'd, the following Mufcles offer themfelves to view.*

CHAP. II.

Of the MUSCLES of the TESTES.

EACH Testicle is attended with one proper Muscle call'd *Cremaster*, to which * *Riolan* adds another, and thinks it common to both, comprehending them in the manner of a Bag; but other Anatomists take it for a Membrane only, and call it *Dartos*.

VI.

CREMASTER, *or* SUSPENSOR TESTICULI.

IT arises fleshy from the fore Part of the Spine of the *Os Ilium*, its Fibres running parallel with those of the *Obliquus Ascendens*, (not with those of the *Transversalis*, as † *Bartholin* maintains against *Riolan*,) and almost encompassing the Process of the *Peritonæum*, descends to the lower Part of the Process, which incloses the Testicle. Its Name declares its Office.

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* *Anthropolog. lib.* 5. *cap.* 36.   † *Lib.* 1. *cap.* 22.

Chap. III.
Of the MUSCLES of the PENIS.

ANATOMISTS generally describe two Pair of Muscles belonging to the *Penis, viz. Acceleratores* and *Erectores*. Besides these, we sometimes meet with a third Pair mentioned and figured by *Stephen* * *Riverius*.

VII.
ACCELERATOR URINÆ.

Tab. XVII
XIX.

SO called from its Action, in promoting the Ejection of the Urine and Seed. Authors have been mistaken in assigning the Origination of this Muscle in Men, either to the *Sphincter Ani*, or the Tubercles of the *Ossa Ischii*; it arising fleshy from the superiour Part of the *Urethra*, as it passes under the *Ossa Pubis*, and incompassing the external Part of the Bulb of its cavernous Body, on which its two Sides meet and join each other in the *Perinæum*, the whole being one Muscle, and not two. But on that Part of the *Urethra*, from which the *Scrotum* is pendulous, its Sides part again from each other, with two fleshy Elongations, which become thin Tendons at their Insertions on each Side into the *Corpora Cavernosa Penis*, nor do they terminate on the Sides of the *Urethra*, as some Anatomists pretend. But the Variety we meet with of Nature's Sportings in these Muscles, more than in those of other Parts, may perhaps be the occasion, that Authors differ so much in their Accounts of them.

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* *Lib.* 2. *P.* 196.

BESIDES the Use of this Muscle in compreffing the *Urethra,* and thereby driving out the Remains of the Urine, and promoting the Ejaculation of the *Semen in Coitu,* (which Action is chiefly performed by the laft defcribed Part of it embracing the *Urethra,* as its two Sides, after parting from each other, pafs to their Infertions on each Side the cavernous Bodies of the *Penis*) it alfo affifts the following Mufcles in the Erection of the *Penis,* by driving the Blood contain'd in the Bulb of the cavernous Body of the *Urethra* towards the *Glans* in greater Quantity, whereby the *Glans* becomes diftended. The Veins, which carry back the refluent Blood from the *Corpus Cavernofum Urethræ,* are alfo at that time compreft by the Intumefcence of this Muscle.

VIII.

ERECTOR PENIS,

Tab. XVII.
XIX.

BY fome call'd *Director,* and by * *Spigelius, Collateralis Penis.* It arifes flefhy from the external Knob of the *Os Ifchium,* below the Beginning of the cavernous Body of the *Penis* on each Side, into the thick Membrane of which it is inferted.

WHEN this Pair of Mufcles act, they pull the *Penis* towards the *Offa Pubis,* whereby its great Vein is compreft, and the refluent Blood ftopp'd in its Paffage under thofe Bones, by which means the *Penis* is erected.

IX.

TRANSVERSALIS PENIS.

Tab. XVII.
XIX.

SO called from its Situation. Thefe Mufcles are mention'd by *Lindanus* after *Fabricius ab Aquapendente,* as *Thom. Bartholin* takes notice. They arife near the former, from whence they pafs tranfverfly to their Infertions, at the upper Part of the Bulb of the cavernous Body of the *Urethra.*

To thefe may be added the Mufcles of the *Clitoris,* and that of the *Pudendum,* in Women.

ANATOMISTS differ concerning the Number of the Mufcles belonging to the *Clitoris*; fome with *Falloppius* (who firft obferved them) reckon one Pair only; others two; but *de Graaf* inclines to the firft Opinion, which we alfo think moft agreeable to Truth. Authors have not beftow'd any proper Names upon them, but fince they agree fo exactly with the *Erectores Penis* (above treated of) except only in Magnitude; the fame Appellation may likewife ferve here.

* *Lib. 4. cap. 12.*

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Tab. XVIII.

Erector Clitoridis.

THIS arises fleshy from the external Margin of the *Os Ischium*, and is implanted into the Beginning of the cavernous Body of the *Clitoris.*

THE Action and Use of this and its Partner, is the same with that of the *Erectores Penis*. The other Pair of Muscles ascribed to this Part by some Anatomists, and figured by *de Graaf,* are only Portions of the following Muscle, adhering to it.

XI.

Tab. XVIII.

Sphincter Vaginæ.

THIS lies immediately under the *Clitoris,* incompassing the *Vagina* with circular Fibres, three Fingers in breadth. In some Subjects it scarcely appeareth fleshy.

THIS in its Action, not only straitens the *Vagina,* but thereby also stops the Blood in its Return from the *Plexus Retiformis* of the *Pudendum,* by compressing some of its Veins which lie underneath, by which means the *Labia* become distended, and the *Vagina* contracted.

CHAP. IV.

Of the MUSCLES *of the* BLADDER *of Urine.*

A L E N * and the ancient Anatomists take notice of but one Muscle belonging to this Part, *viz.* the *Sphincter*, but *Fabricius ab Aquapendente* mentions another, call'd by *Spigelius*, *Detrusor Urinæ*, from its Use.

XII.

DETRUSOR URINÆ.   *Tab.* XVIII.

THIS by some is reckon'd the first proper Membrane of the Bladder, lying under that which is continued from the *Peritonæum*. Its carneous Fibres embracing the whole Bladder, compress it in the Evacuation of the Urine.

XIII.

SPHINCTER VESICÆ.   *Tab.* XVIII.

FALLOPPIUS † observes, that the Anatomists of his time had not well described the Situation of this Muscle, they placing it below the *Prostatæ*; in which Case, (as he alledges) the *Semen* could not be emitted in Coition, without

* *Lib. de Muscul.*   † *Observ. Anat.*

the

the Urine. Yet it feems his Contemporary *Columbus* * was not unacquainted with its true Appearance. *Natura prudens*, fays he, *Mufculum tenuem pofuit, orbicularem, circularibus Fibris, qui Veficæ Collum conftringit.* This Mufcle is feated in that Part of the Neck of the Bladder, which lies immediately under the upper part of the *Glandulæ Proftatæ.* Where, as *Falloppius* fays, † " You muft not expect " to find an entire Mufcle and Subftance diftinct from the fubject Canal, like that " of the *Anus*, but the more flefhy part of the Neck of the Bladder compofed of " many tranfverfe Fibres, whofe Contraction hinders the involuntary Egrefs of the " Urine.

> *N. B.* To difcover thefe tranfverfe Fibres, our Author advifes to dip the Bladder in fcalding Water after Inflation, when the external right Fibres being removed, thefe will appear underneath. By blowing up the Bladder, and drying it, after the *Proftatæ* were remov'd, we have difcover'd the tranfverfe Fibres of the *Sphincter*, as reprefented in Tab. XVIII. 13.

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* *Lib.* 5. *cap.* 26.   † *Obf. Anatom.*

CHAP. V.
Of the MUSCLES *of the* ANUS.

ARIOUS Accounts are given us by Anatomiſts of the Muſcles of the *Anus*. *Galen* * divides its *Sphincter* into two, *viz.* *Carnoſus* and *Cutaneus*; which, with the two *Levatores*, make four Muſcles belonging to this Part. *Riolan* † multiplies them to the Number of nine, three *Sphincters*, *Carnoſus*, *Cutaneus*, and *Vaginalis*; and ſix Elevators, two internal, and four external, of which one Pair belongs to the *Os Coccygis*. But this Opinion ſeems rather grounded on Fancy, or ſome particular Subject, than the general Appearance of them in Diſſection.

XIV.
SPHINCTER ANI.

THIS is a large, thick, fleſhy Muſcle, incompaſſing the *Anus*. Its Figure and Series of Fibres externally, immediately under the Skin, incline to a longiſh Oval. It is connected forwards to the *Accelerator Urinæ*, backwards to the *Os Coccygis*. As it is continued farther upon the Body of the *Inteſtinum Rectum*, its Fibres are circular for near two Inches in Breadth. It is much larger in Man, than in other Animals, in whom, by reaſon of the erect Poſition of the

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* *De Muſculis.*   † *Anthropolog. lib.* 5. *cap.* 40.

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Body, there is greater Force required to retain the *Fæces*, which is the Office of this Muscle.

XV.

Tab. XIX.
XX.

LEVATOR ANI.

SEEMS to be one Muscle, springing fleshy from each Side the *Ossa Pubis*, internally within the *Pelvis*, as also from part of the *Ischium* and *Sacrum*. From these Places, like Lines drawn from a Circumference towards a Center, its Fibres descend over the *Musculi Marsupiales*, to their Implantation at the lower end of the *Intestinum Rectum* in the *Anus*. Besides the Action ascribed to this Muscle, which its Name imports, it has a farther and more remarkable Use, which will appear to any, who examine its Position. For in its Descent on each Side from the *Ossa Pubis*, you'll find it passing close over the *Glandulæ Prostatæ*; and its back Parts descending from the *Os Ischium* and *Sacrum* must necessarily compress the *Vesiculæ Seminales*, by drawing up the *Anus* with the lower Part of the *Rectum*, not unlike the Diaphragm in compressing the Contents of the lower Belly. This Muscle therefore, when it acts, will force out the Contents of the *Prostatæ* and *Vesiculæ Seminales* into the *Urethra*, the Diaphragm, with the rest of the Abdominal Muscles, making a counter Pressure at the same time, and thereby assisting it to drive out the *Semen in Coitu*.

CHAP. VI.

Of the MUSCLES of the HAIRY-SCALP and FOREHEAD.

TO demonstrate these Muscles, make Incision through the common Integuments of the Head, the first and direct Line of Division being continued from the middle and inferiour part of the Os Occipitis, to the same part of the Os Frontis. The other must be made transversly from two Incisions round each Ear, to the Sinciput. Begin to raise the Skin at its Angles, on the Sinciput, taking great care, in freeing the Skin of the Forehead, not to raise the Frontal Muscles.

XVI.

OCCIPITALIS.

THIS and its Partner were first discover'd by *Columbus*, and accurately described by *Falloppius**, who took himself to be the first Inventor of them. " In Occipitio, says he, Musculi reperiuntur à reliquis omnibus Anatomicis prætermissi." They are short, but broad, thin, fleshy Muscles, situate on the *Occiput*, from whence they derive their Names. Each of these arises fleshy from that Part of the *Os Occipitis*, where the *Mastoideus* and *Musculus Splenius* are inserted, and soon becoming Tendinous, joins with the *Pericranium*; which firmly ad-

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* Obs. Anatom.

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heres to the Hairy-Scalp on the *Sinciput*. When these act, they pull the Hairy-Scalp backwards; which Action *Columbus* tells us, he had often seen with pleasure in the Head of his Master *Johannes Antonius Plat*, who was wont to move the whole Skin of his Head very freely.

It is certain the Tendons of the Occipital Muscles are continued with the *Frontales*; and, though Anatomists have given them two different Names, the *Occipitalis* and *Frontalis* on each Side are really one Digastrick Muscle, which serves to draw the Hairy-Scalp backwards or forwards, as either fleshy End is contracted. But, because I would avoid Innovation as much as possible, I shall still retain the usual Distinction.

XVII.

FRONTALIS.

Tab. xx.
XXI. XXII.

ITs Rise is already mention'd in describing the Occipital Muscles, besides which it has other Originations, or fix'd Points, to which the Skin of the

Tab. xx. *a,*
b, and
Tab. xxv.
Fig. v. *a,*
b.

Forehead is drawn, when its fleshy Fibres are contracted. From these Points arise two several Productions of this Muscle on each Side, the external of which springs from the lower part of the Bone of the Nose near the *Ala*. The other internal, and more fleshy Production, which is broader than the external, lying partly under the *Orbicularis Palpebrarum*, springs from the Margin of the *Os Frontis*, that makes the upper part of the Orbite of the Eye, near the great *Canthus*. This in its oblique Ascent becomes thick and fleshy on the Eyebrow, and afterwards the two Productions uniting compose that fleshy Body under the Skin of the Forehead. Though these Parts of the Frontal Muscle act separately, whether in lifting up the Eyebrows, and wrinkling the Skin of the Forehead, or in drawing the Eyebrows down, and corrugating the Skin between them, which we call knitting the Brows; yet I see no reason to make them distinct Muscles. That part of it express'd Tab. xxv. Fig. v. at *b*, was first taken notice of by *Vocherus Coiter*, and has been since call'd *Corrugator*.

N. B. *To raise the Skin, and discover the Muscles of the Face, which in the Order of Dissection are next to be prosecuted, continue your former Division from the* Dorsum Nasi, *where you left it, to its* Apex; *and from two Semicircular Sections, one on each Side the* Alæ Nasi *to the* Septum Narium, *make a direct one to join with a Circular Incision round the Lips. Then from the middle of the lower Lip, draw your Knife directly over the Chin, Neck, and Sternum, till you meet that longitudinal one made in Dissection of the Muscles of the* Abdomen. *The Skin is best cleared from the Eyelids, after raising it from the circumjacent Parts. In this Operation special Attention must be had, lest you wound the* Orbicularis Palpebrarum, *and Muscles of the* Alæ Nasi. *Care also must be taken in raising the Skin of the Neck, and Face, not to raise the* Quadrati Genarum *along with it.*

CHAP.

CHAP. VII.

Of the MUSCLES of the CHEEKS and LIPS.

THE Defcriptions and Ufes of thefe Mufcles given by Anatomifts, are fo various, that to recite their feveral Accounts of them would be exceedingly tedious to the Reader, and at the fame time of very little Ufe. For which reafon I fhall only reprefent them, as they have appear'd to my felf in fome late Subjects.

THE Mufcles of the Lips are either *Common* to the Cheeks and Lips, or to both Lips, or *Proper* to the upper, or under Lip only.

THOSE *Common* to the Cheeks and Lips, are two Pair, on each Side two Mufcles, *viz.* the *Quadratus* and *Buccinator*.

XVIII.

QUADRATUS GENÆ, *or* QUADRATUS COLLI, Tab. I. XXI. *by fome call'd* Tetragonus, *and by* Galen, Platyfma Myoides.

HAs a thin Membranous Beginning, according to *Galen* [*], from the Spines of the *Vertebræ* of the Neck, and from the Skin on the *Cucullaris* and Pectoral Mufcle; whence afcending with an oblique Courfe of flefhy Fibres, on the Side

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* De Mufculis.

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of the Neck, it is faſtened to the *Proceſſus Maſtoides* and root of the Ear; after
which it paſſes over the lower Side of the inferiour Jaw-bone, the Parotide Gland,
and *Maſſeter* Muſcle, and is at length inſerted into the Cheek, the Angle of the
Mouth or Lips, and the middle of the lower Jaw-bone, where its Fibres in ſome
Subjects decuſſate thoſe of the other Side.

WHEN both theſe Muſcles act, they pull down each Angle of the Lips, toge-
ther with the Cheeks, and part of them may aſſiſt the Digaſtrick Muſcles in opening
the Mouth.

XIX.

BUCCINATOR.

THIS Muſcle does not ſpring from the Gums of the upper, and end in thoſe
of the lower Jaw; nor is it of that Figure, which ſome Anatomiſts would
perſuade us, or interwoven with various Orders of Fibres, as others pretend. It
ariſes broad and fleſhy from the fore-part of the *Proceſſus Corone* of the lower Jaw-
Bone, from whence it proceeds with direct Fibres to its Inſertion at the Angle of
the Lips.   Through the middle of this Muſcle paſſes the *Ductus Salivalis ſuperior*,
which was obſerv'd by *Placentinus*, and by him call'd *Vinculum Robuſtum*.

BESIDES the Uſe, which Trumpeters make of theſe Muſcles acting together,
either of them contracting alone pulls the Lips to one Side.

THE Muſcles common to both Lips are ſuch as are inſerted into their Angles,
as the *Zygomaticus, Elevator, Depreſſor,* and *Conſtrictor Labiorum.*

XX.

ZYGOMATICUS.

SO called, becauſe it ariſes from the *Os Jugale*, or *Zygoma.* Its Origination is
round and fleſhy from the external part of that Bone, whence deſcending
obliquely forwards, it is inſerted near the Angle of the Lips. In ſome Subjects
I have found it divided at its Termination.

WHEN this Muſcle and its Partner act together, they draw both Lips upward;
but if one of them acts alone, it diſtorts the Mouth, whence it is by ſome called
Diſtortor Oris.

XXI.

ELEVATOR LABIORUM.

THIS lies between the former Muſcle and the *Elevator Labii Superioris Pro-
prius.* It ariſes from the fourth Bone of the upper Jaw, and deſcends di-
rectly to its Inſertion under the Termination of the former Muſcle.

XXII.

XXII.

Depressor Labiorum.

THIS arises fleshy from the lower edge of the inferiour Jaw-Bone laterally, whence it ascends to its Insertion at the Angle of the Lips.

THIS draws down the Corner of the Lips.

XXIII.

Orbicularis Labiorum.

THIS environs the Lips with Circular Fibres, and is called *Constrictor*, or *Sphincter Labiorum*, as likewise *Osculatorius*, from its Use.

THE Muscles *Proper* to the upper, or under Lip, are three Pair, viz. *Elevatores Labii Superioris Proprii, Depressores*, and *Elevatores Labii Inferioris Proprii*.

XXIV.

Elevator Labii Superioris Proprius.

THIS arises fleshy from the fore part of the fourth Bone of the upper Jaw, immediately above the *Elevator* treated of before, and descends obliquely under the Skin of the upper Lip, joining with its Partner in a middle Line, from the *Septum Narium* to its Termination in the *Sphincter Labiorum*. It has a double Series of Fibres. The external descend obliquely from its Origine, and are very thin. The internal decussate the former at Acute Angles, and pass in an arched manner under the *Alæ Nasi*, seeming to be a continuation of the *Orbicularis Labiorum*. The external Series give Slips of fleshy Fibres to the two Cartilages of the *Alæ Nasi* at their meeting with the *Septum*. These make the Furrow in the middle of the upper Lip, under the *Septum Narium*.

XXV.

Depressor Labii Inferioris Proprius.

ITs difficult to determine, whether this be one, or two Muscles. It lies between the *Depressores Labiorum Communes*, described above, possessing that part of the lower Jaw called the Chin, and ascending with a twofold order of Fibres, one direct, and the other transverse, is inserted into the lower Lip; in depressing which, it turns it outwards.

XXVI.

XXVI.

Tab. XXXI.

ELEVATOR LABII INFERIORIS PROPRIUS.

THIS Muſcle with its Partner lies within the lower Lip, and was firſt obſerv-ed by us ſome time ſince. It ariſes fleſhy from the fore part of the lower Jaw-Bone, below the Gums of the *Dentes Inciſorii*, and deſcends directly to its In-ſertion into the inferiour part of the Skin of the Chin. When theſe Muſcles act, they make divers Indentations in the Skin of the Chin, as may be obſerv'd in living Subjects, when the lower Lip is drawn upwards.

CHAP. VIII.

Of the MUSCLES *of the* EYE-LIDS.

ALEN * and the ancient Anatomists, together with *Vesalius* † and some later Writers, are extremely deceived in their Notion of these Muscles, in dividing the *Orbicularis* into two, and supposing thereby all the Motions of the Eye-Lids to be perform'd. But this System was first alter'd by *Falloppius* **, partly from an Intimation of *Oribasius* in his Book *De Dissect. Muscul. ex Galeno*, Cap. VI. where he takes Notice, that in the Cure of an *Ægilops*, not only the described Beginnings of the Orbicular Muscles are cut and burnt away, but the Bone underneath exfoliated, and yet the Motions of the Eye-Lids remain; and partly from the Dissection of the Eye in a Sea-Calf, where he observed four Muscles latent in the Orbit, inserted above, underneath, and on both Sides the *Palpebræ*. Being induced upon this to make the like Inquiry in a human Body, he happily discover'd the *Aperiens Palpebram Rectus*, which shall be described hereafter. We mention this Passage, because some later Authors have favoured the erroneous Account of the former Anatomists, retaining their Description of the *Orbicularis Palpebrarum*, and dividing it into two Semicircular Muscles.

XXVII.

ORBICULARIS PALPEBRARUM.

Tab. XXI.
XXII. XXV.
Fig. I.

THis is a thin fleshy Muscle, whose Fibres do circularly environ the Eye-Lids, and are inserted into them, (like the *Sphincter Labiorum*) not adhering to any Bone, from whence we may derive their Origine, except the superiour part of the great Bone of the Nose; by some reckoned the fourth Bone of the upper Jaw.

THis Muscle, acting like the Sphincters of other Parts, constringes the Eye-Lids. To these *Riolan* ‡ adds another Muscle belonging to each Eye-Lid, which

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* *De Dissectione Muscul.*   † *Hum. Corp. Fabric. lib.* 2. *cap.* 10.   ** *Observ. Anatom.*
‡ *Anthropog. lib.* 5. *cap.* 10.

G   he

he calls *Ciliaris,* which we take to be a Portion of the former adjacent to the *Cilia.*

To difcover the following Mufcle, part of the former lying between the upper Eye-Lid and Eye-brow, muft be raifed: After which, the Glandula Lachrymalis, *with part of the Fat within the* Orbit *being removed, by extending the upper Eye-Lid, either with a Hook, or your Fingers only, its tendinous Infertion and flefhy Body will appear.*

XXVIII.

Aperiens Palpebram Rectus.

SO called from its ftreight Progrefs and Ufe. It arifes fharp and flefhy from the profoundeft part of the *Orbit,* near the place where the Optick Nerve is tranfmitted; and paffing directly over the *Mufculus Attollens,* it becomes tendinous, as it marches over the Bulb of the Eye; where growing ftill broader and thinner, it is inferted into the whole fuperiour part of the upper Eye-Lid.

THESE Mufcles of the Eye-Lids being removed, we proceed next to thofe of the Eye itfelf, in the Demonftration of which, Fabricius ab Aquapendente * *propofes two ways; the one fhewing the Eye with its Mufcles in fitu, the other the Eye taken out of its Cavity, and its Mufcles expanded on the Table: The firft exhibiting their Motions, the fecond their Figure or Shape. In the firft, though our Author advifes the Brain to be taken out, and the Bones of the* Orbit *to be divided; yet we chufe to perform this Operation in the following manner, without troubling our felves with either. Both Eye-Lids being removed, firft with your fore Finger feel gently for the* Trochlea, *fituated near the brink of the* Orbit, *towards the Nofe; then clear the Tendon which paffes through it. This done, in like manner clear the oppofite Mufcle, the* Obliquus Inferior, *firft obferving its Origination at the brink of the inferiour part of the* Orbit; *then with the Affiftance of a fmall Hook and Sciffars extract the Fat, Membranes, and Veffels, from between the ftreight Mufcles. The other manner of Demonftration may be practifed in the fame Eye, or the oppofite, taking care in freeing the* Trochlea *from the* Orbit, *to avoid wounding the Tendon, which paffes through it. The inferiour oblique Mufcle being cut off clofe from its Origine, as alfo the reft of the Mufcles, and the Optick Nerve at the profoundeft part of the* Orbit, *and the whole Eye being diflodg'd; difengage its Mufcles, and difplay them, whereby you may obferve, that the* Trochlearis *is the longeft Mufcle of the Eye; and that its Infertion is directly behind the* Attollens; *and on the contrary, that the* Obliquus Inferior *is the fhorteft, whofe Termination is directly behind the* Abducens, *by which means you may diftinguifh the right Eye from the left.*

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* *De Vifione. Cap.* 11.

Chap.

CHAP. IX.
Of the MUSCLES *of the* EYE.

O LUMBUS * reprehends *Galen, Vefalius,* and the Anatomifts of this Time, for afcribing the *Aperiens Palpebram Rectus* and *Obliquus Superior* to the Eye, and at the fame time commits no lefs an Error himfelf, not only in fuppofing, that the laft named Mufcle belongs to the Eye-Lid, but likewife in imagining, that the *Obliquus Inferior* begins and ends in the *Cornea* of the Eye. But the accurate *Falloppius* †, who firft obferved the *Trochlea*, has given us the moft exact Defcription of thefe Mufcles of the Eye, as well as thofe of the *Palpebræ*.

XXIX.
OBLIQUUS SUPERIOR *or* TROCHLEARIS.

Tab. xxv.
Fig. I. II.
III. IV.

IT receives its firft Denomination from its oblique Pofition and Courfe, in regard of the reft of its Fellows. The fecond it derives from that Cartilaginous Ring, placed near the Brink of the upper Part of the *Orbit* towards the Nofe, through which its Tendon paffes, being reflected on it, as a Rope on a Pully. Befides which, it is called *Longiſſimus Oculi*, as exceeding the others in length. It arifes fharp and flefhy from the profoundeft Part of the *Orbit*, near the Origination of the *Adducens*, and becoming a flefhy Belly, as it paffes obliquely clofe under the fuperiour Part of the Bone of the *Orbit*, it makes a round Tendon running through the *Trochlea* (as above mentioned;) from whence reverting back, it's inferted into the *Tunica Sclerotis*, in the mid way between the Termination of the *Attollens* and Optick Nerve, towards the back Part of the Bulb of the Eye.

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* *De re Anatom. lib.* 5. *cap.* 8.   † *Obf. Anatom.*

XXX.

XXX.

OBLIQUUS INFERIOR.

Tab. XXV.
Fig. I. II.
III. IV.

ALso called *Breviſſimus Oculi,* it being the ſhorteſt Muſcle of the Eye. This ſprings ſharp and fleſhy from immediately within the lower, and almoſt outward Part of the *Orbit,* at the Juncture of the firſt Bone of the upper Jaw with the fourth, and becoming thicker, aſcends obliquely over the *Deprimens,* grow-ing tendinous at its Inſertion into the *Tunica Sclerotis,* near the Implantation of the former, directly betwixt the *Abducens* and Optick Nerve.

THE two oblique Muſcles are by ſome called *Circumagentes,* and *Amatorii,* from their Actions in winding and rolling the Eye about, which Motions we call Ogling. Anatomiſts differ in aſſigning the proper Offices of theſe Muſcles, ſome aſſerting when the Superiour acts, the Eye is rolled from the Noſe; when the Inferiour, to it. Others, on the contrary, ſuppoſe that the former draws it to the Noſe, and the latter directs it towards the leſſer *Canthus* of the Eye. But if we rightly con-ſider the Poſition of the *Trochlea,* which determines the Motion made by the Supe-riour Oblique Muſcle, and the Origination of the Inferiour; and that the Tendon of the former, and the whole *Ductus* of the latter, paſs obliquely from the exter-nal edge of the *Orbit* to their Inſertions at the back part of the Bulb of the Eye; we muſt neceſſarily conceive, that the vulgar Doctrines of their Motions are erro-neous. For when the *Obliquus Superior* acts, the poſteriour part of the Bulb of the Eye muſt approach towards the *Trochlea,* whereby its Globe is not only drawn ſomewhat forwards, but its *Pupil* is directed downwards; ſo on the contrary, when the *Obliquus Inferior* acts, the poſteriour part of the Bulb of the Eye approaches to-wards the external edge of the inferiour part of the *Orbit;* its *Pupil* is directed upwards, and its whole Globe is pulled ſomewhat outwards. Hence it is that the Bulb of the Eye is more protuberant in thoſe Actions; which Contrivance in Na-ture ſeems very neceſſary, ſince otherwiſe the Projections of the Eye-brows and Cheeks would be liable to hinder our Proſpect, whether directly upwards or down-wards. Beſides the Uſes of theſe oblique Muſcles now mentioned, they have ſtill a more notable one, not only in pulling the whole Eye directly forwards, but in holding it from being retracted, when any of the four ſtreight Muſcles act, which otherwiſe would rather draw it inwards, then turn it either ſideways, or upwards, or downwards. But theſe Muſcles, one of them deſcending inwardly from the up-permoſt, and the other aſcending from the lowermoſt edge of the *Orbit* to their Inſertions, prevent its being drawn back into the *Orbit,* and ſerve as an Axis for the Motions of the other Muſcles. Hence it is, when they ceaſe to act, the whole Globe of the Eye ſinks, which may give occaſion for that vulgar Tradition, that the Eye-ſtrings break in dying Perſons.

THE reſt of the Muſcles of the Eye are called *Recti,* from their ſtreight Pro-greſs and Uſe.

XXXI.

XXXI.

ELEVATOR OCULI.

IS also called *Superbus* from its moral Signification, it being one of the common Marks of a haughty Disposition to tofs up the Eye; wherefore its opposite Muscle is called *Humilis*; but *Placentinus* * thinks the Motions of the upper Eye-lids denote those Dispositions more significantly; for says he, *Qui enim hanc elatam habent*, (speaking of the upper Eye-lid) *Superbi & Feroces funt*; *qui vero depref-fam ac dimidium fere Oculum Claudentem, ita ut Terram adspicere videantur, Humiles ac Mites funt.* This Muscle arises sharp, and fleshy, near the place where the *Optick Nerve* enters the *Orbit*, and becoming a fleshy Belly, makes a thin Tendon inserted into the *Tunica Sclerotis*, on the Superiour and Fore-part of the Bulb of the Eye under the *Adnata*.

XXXII.

DEPRESSOR OCULI.

THIS, like the former, arises from the profoundest Part of the *Orbit*, and like it passes directly to its Insertion into the opposite part of the Globe of the Eye.

XXXIII.

ADDUCTOR OCULI.

SO called because it draws the *Pupil* towards the Nose, and *Bibitorius*, from directing the Eye towards the Cup. The Origine and Progress of this is agreeable to the two former, but it is inserted into that part of the *Tunica Sclerotis*, which borders on the Nose.

XXXIV.

ABDUCTOR OCULI.

SO called from its Action in drawing the Eye from the Nose; it is also called *Indignabundus*, because it is made use of to express Scorn and Resentment. This, like the three former, arises near the Entrance of the Optick Nerve into the *Orbit*, and is inserted like them into that part of the *Tunica Sclerotis*, that respects the lesser *Canthus* of the Eye, opposite to the Implantation of the former. When these four right Muscles act together, they pull the whole Globe of the Eye into the *Orbit*, from whence it's pull'd forwards again by the two *Obliqui* as before.

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* *Cafferius, lib. 5. cap. 18.*

To these *Mullinete* adds * another, which he calls the Fifth Right Muscle; the Office of which he confines to the Motion of the *Trochlea*, (supposing it moveable;) but what he has said concerning it, either as to its Existence, or Use, is so obscure, if not impossible, that there is no Reason to give it any Place or Description amongst the other Muscles of the Eye. Neither could we ever discover by Dissection any such Muscle, but suspect that part of the *Orbicularis Palpebrarum*, which adheres to the *Trochlea*, might occasion the Mistake. Which I rather remark, because I find others upon *Mullinete*'s Authority, without strict Enquiry into the Matter, have fallen into the same Error.

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* *Dissertat. Anatom. cap. 6.*

CHAP. X.

Of the MUSCLES *of the* NOSE.

HE Nose is altogether immoveable, except in its lower griftly Part, the Sides of which are not improperly called *Alæ* or *Pinnæ*, by whose Approach, or Recefs, the Noftrils are ftraitned, or dilated. *Galen* * affigns but one Pair of Mufcles to the *Alæ*, to which *Jacobus Berengarius Carpenfis* in his Commentary on *Mindinus* adds another, arifing from the Extremities of the Bones of the Nofe, and inferted into the infide of the *Alæ*; wherein he is followed by *Vefalius* †. *Columbus* ‡ fays, thofe defcribed by *Galen* belong to the upper Lip, and that thofe placed in the infide of the Nofe (above-mention'd) are entirely fictitious; defcribing ftill another Pair, arifing from the upper part of the Bones of the Nofe, and inferted into their *Alæ*. *Falloppius* ** is not pofitive, whether he has feen thofe internal Mufcles mention'd by *Berengarius* and *Vefalius* or no; but he defcribes another Mufcle, which later Anatomifts call *Conftrictor Alæ Nafi*; the Invention of which is claim'd by *Cafferius Placentinus* ††. I find in general, that Nature is more inconftant in thefe Mufcles, than in thofe of any other Part; but the following Account is taken from their moft common and ufual Appearance.

XXXV.

ELEVATOR ALÆ NASI.

THIS feems to be an Elongation of the Frontal Mufcle, continued from the upper part of the Bone of the Nofe, and defcending obliquely to the *Ala Nafi*, where it partly joins with the following, and partly paffes over, or fometimes under it, to its Infertion in the *Ala* and upper Lip.

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* *De Diffect. Mufc.*   † *Lib.* 2. *Cap.* 13.   ‡ *De re Anatom. lib.* 5. *cap.* 4.
** *Obf. Anatom.*   †† *Lib.* 3. *Cap.* 9.

XXXVI.

XXXVI.

DILATATOR ALÆ NASI, & ELEVATOR LABII SUPERIORIS.

THIS Muscle was mention'd by *Galen.* It arises thin, broad, and fleshy, from the fourth Bone of the upper Jaw; whence descending with a two-fold Order of Fibres, it is inserted into the upper Lip and *Ala Nasi.*

XXXVII.

CONSTRICTOR ALÆ NASI.

THIS arises fleshy from the fore part of the fourth Bone of the upper Jaw, immediately above the Gums of the *Dentes Incisorii*; and ascending, is soon inserted into the Root of the *Ala Nasi.*

WHEN these Muscles act, they draw the *Alæ* downwards and nearer each other.

CHAP. XI.
Of the MUSCLES of the AURICULA or OUTWARD EAR.

ALLOPPIUS *, the firſt Writer of theſe Muſcles, informs us there are ſometimes found three belonging to each Auricle; the Firſt or *Attollens*, the Second or *Deprimens*, and the Third, which is part of the *Platyſma Myoides*. Theſe, he ſays, are ſometimes wanting, though he has frequently ſeen them. *Placentinus* † multiplies them to the number of Five; but M. *Du Verney*, in his accurate Treatiſe of the Ear, deſcribes two only, whoſe Account we have found to be moſt agreeable to our own Enquiries.

XXXVIII.
ATTOLLENS AURICULAM.

THis conſiſts of divers fleſhy Fibres, and is annex'd to that part of the *Pericranium* that covers the temporal Muſcle, whence it deſcends directly to its Implantation at the ſuperiour part of the ſecond Wrinkle of the Cartilage of the Ear.

Its Name declares its Uſe.

XXXIX.
RETRAHENS AURICULAM.

BY ſome called *Triceps Auris*, becauſe it has ſometimes three Beginnings. M. *Du Verney* ſays ‡ it is compoſed of five or ſix *Faſciculi* of fleſhy Fibres, which have their Origination from the ſuperiour and fore part of the *Apophyſis Maſtoides*, and deſcend obliquely to their Inſertion in the middle of the *Concha Auriculæ*.

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* *Obſervat. Anatom.*   † *Caſſerius, lib. 4. cap. 4.*   ‡ *De l'Org. De l'Ouie.*

I   N. B.

N. B. *The Muscles of the internal Ear cannot be demonstrated, till after those of the Head are dispatch'd, and the Brain removed; but we shall follow the Example of others, and insert their Descriptions in this Place; it being also customary, in the Myological Lectures at Chirurgeons Hall, to shew them in a dried Preparation from the precedent Subject.*

CHAP. XII.

Of the MUSCLES *of the* INTERNAL EAR.

THESE Muscles were altogether unknown to the ancient Anatomists; but the most internal of those belonging to the *Malleus* is accurately described by *Bartholomæus Eustachius* *, and is called *Internus Auris*. *Volckerus Coiter* mentions † two Muscles latent in the second *Meatus* or *Concha*, commonly called *Tympanum*, but does not describe them. His Observations being made from Brutes, we suspect one of them was the internal Muscle of *Eustachius*, and the other the *Musculus Stapedis*. *Fabritius ab Aquapendente* ‡, and *Casserius Placentinus* **, contend for the Invention of another lying in the *Meatus Auditorius*, called *Externus*; in the Description of which they are followed by most Anatomists, except M. *Du Verny*, who (not taking notice of the Accounts of others, but writing from Dissection only) describes two Muscles belonging to the *Malleus*, but omits the external one of *Aquapendens* and *Placentinus*; and instead of it adds another, which he also calls *Externus*, because it lies on the external Bony *Paries* of the *Ductus*, leading from the Palate to the Ear, which from its Position we call *Obliquus Auris*. Hence it appears that three Muscles belong to the *Malleus*, of which the first, that appears in Dissection, is the *Externus* of *Aquapendens*; the second is the *Externus* of *Du Verny*, which we call *Obliquus Auris*; and the third is the *Internus* of *Eustachius*, to which may be added the fourth, belonging to the *Stapes*, called *Musculus Stapedis*, described by *Placentinus* in Brutes, and in Man by *Du Verny*.

FOR the better Demonstration of these Muscles, (after the Dissection of the Brain, and all the Muscles, which arise from, or are inserted into, the Basis of the Cranium) divide the Os Temporale, with part of the Os Sphenoides on one Side, and the Os Occipitis on the other, from the rest of the Bones, (it being well cleared of the Muscles, Membranes and Vessels, that remain on it;) then with a small semicircular Chisel cut away

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* *Opuscula Anatomica.*   † *Anatom. Observat.*   ‡ *De Aure pars prim. lib.* 4. *cap.* 12.
** *De Aure, lib.* 4. *cap.* 13.

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the inferiour Part of the Meatus Auditorius, *taking care not to wound the* Membrana Tympani. *This performed, you muſt be very cautious in raiſing the* Glandulous *Membrane that inveſts the* Meatus, *to which the external Muſcle adheres. The other two Muſcles of the* Malleus *lying incloſed within the* Os Petroſum, *require our next Inſpection. Firſt obſerve the laſt named Bone's Conjunction to the* Os Sphenoides, *where with the Chiſel lightly cut off their external* Laminæ, *and the oblique external Muſcle of* Du Verny *will appear, together with the Internal one of* Euſtachius. *But if you ſtill proceed to break off more of the* Os Petroſum, *you will not only have a Proſpect of the Bony Part of the* Aquæduct, *but of the Articulation of the* Malleus *with the* Incus, *and the whole Cavity of the* Tympanum. *Wherein may be obſerved the longer proceſs of the laſt named Bone, articulated with the* Stapes, *by the mediation of the* Os Orbiculare, *and the Tendon of the* Muſculus Stapedis, *running out of a Perforation in the* Os Petroſum, *down to its Inſertion in the Head of the* Stapes, *together with the internal Surface of the* Membrana Tympani, *and the long Proceſs of the* Malleus *lying on it.*

XL.

EXTERNUS AURIS *vel* LAXATOR EXTERNUS.

THIS lies in the upper Part of the *Meatus Auditorius,* having a ſhort fleſhy Body with a long ſlender Tendon. It ariſes from the external and ſuperiour Margin of the *Meatus Auditorius,* and ſoon becoming a ſlender Tendon, paſſes directly to the upper Part of the *Membrana Tympani,* on which it deſcends for ſome ſpace to its Inſertion in the long Proceſs of the *Malleus,* where it is contiguous to the ſaid Membrane. This draws the *Manubrium* of the *Malleus,* together with the *Membrana Tympani* forwards.

XLI.

OBLIQUUS AURIS.

THIS may be alſo called *Semicircularis* from its Poſition, it lying in the external Part of the Bony Chanel of the *Aquæduct,* whence marching ſomewhat upwards and backwards, it enters the *Tympanum* in a very oblique Sinuoſity excavated immediately above the Bone, where the *Tympanum* is inchaſed, and is inſerted into the ſlender Proceſs of the *Malleus.* The Sinuoſity, in which this Muſcle paſſes, is that, which may be taken notice of in the upper Part of the Bony Circle of the *Fœtus.* This we don't find deſcrib'd any where before *Du Verny.*

XLII.

XLII.

INTERNUS AURIS.

Tab. XXVI.
Fig. II. III.
IV. VIII.

THIS lies in a Bony Chanel in the *Os Petrofum*, which makes one of the *Parietes Tympani*. One part of this Chanel is without the *Tympanum*, and lies in the upper part of the Bony Paffage, which goes from the Ear to the Palate; the other Part, which is within the *Tympanum*, advancing as far as the *Feneftra Ovalis*, makes in that Place a Rifing, upon which, as on a Pully, the Tendon of this Mufcle paffes to the other fide of the *Tympanum*, and is inferted at the pofteriour Part of the Handle of the *Malleus*, a little below the Infertion of the external Mufcle; by which means it draws it towards the *Os Petrofum*. The Origine of this Mufcle is precifely in that Place, where the Bony Part of the *Aquæ-duct* terminates. It is covered with a nervous Coat, which forms a Sheath, accompanying it in its whole Progrefs, and binding it faft to the Chanel. When this Mufcle acts, it pulls the *Manubrium* of the *Malleus* towards the *Os Petrofum*, whereby the external Surface of the *Membrana Tympani* becomes fomewhat concave.

IN the Tendon of this Mufcle, in fome Animals, *Schelhamer* * informs us he has fometimes obferved a fmall Bone: But we fufpect he miftook the *Mufculus Stapedis* for this Mufcle, for in the Tendon of that my very good Friend, Dr. *Adair*, an accurate Anatomift, lately communicated his Obfervation of fuch an one to me, as it appear'd in a Calf's Head, which at firft fight may deceive the Enquirer, it being annex'd to the *Stapes*, and in Figure like the *Officulum Quartum* of *Sylvius*; but if you be careful in your Examination, you may find both in the fame Organ; the latter commonly remaining on the long Procefs of the *Incus* when feparated: But if you leave the *Stapes* in *Situ*, you may fee in that Animal the Origine, Progrefs, and Infertion of its Mufcle, together with the Bone in its Tendon, as it paffes over a Projection of the *Os Petrofum*, which compofes the *Foramen Rotundum*, on which we fufpect the Tendon of this Mufcle acts, as on a *Trochlea*, to which end that fmall Bone is placed, not unlike the *Patella* of the Knee and *Offa Sefamoidea* of the Feet; which is an elegant Mechanifm in Nature.

XLIII.

MUSCULUS STAPEDIS.

THIS lies hid in a Bony Pipe, excavated in the *Os Petrofum*, almoft at the Bottom of the *Tympanum*, whence it takes its Origine. Its Belly is big and flefhy, and fuddenly forms a very thin Tendon, which defcends to its Infertion at the Head of the *Stapes*. The Pipe, which contains the Belly of

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* *Chap.* III. *Sect.* IV.

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this

this Muscle, is about the sixth part of an Inch long, and is much larger than the *Foramen*, through which its Tendon passes.

WHEN this acts, it draws the *Stapes* upwards to the *Foramen Ovale*.

THE Order of Diſſection obliges us to examine the Muſcles of the Os Hyoides *next, to which end the* Maſtoidei *muſt be raiſed on both ſides of the Neck; the one being freed from its Origination, and left at its Inſertion; the other on the contrary may be raiſed from its Inſertion, and left at its Origine. This done, the Biventral Muſcles of the Lower Jaw may be obſerved in their whole Progreſs, wherein may be noted, that they deſcend from their Originations, through the* Stylohyoidei, *to the* Os Hyoides, *where an* Annulus *is made on each ſide for the Tranſmiſſion of their middle Tendons; after which they re-aſcend to their Implantations. Theſe being alſo raiſed contrariwiſe, like the above-mentioned* Maſtoidei, *and the Perforations of the* Stylohyoidei *being enlarged, through which each contrary end of the* Digaſtrici *muſt be drawn, the one may be left at its Origination, and the other at its Inſertion, till we come to deſcribe the reſt of the Muſcles, which move the Lower Jaw.*

CHAP. XIII.

Of the MUSCLES *of the* OS HYOIDES, *or* BONE *of the* TONGUE.

INCE the *Os Hyoides* is faftned to the Tongue and *Larynx*, the Mufcles which move it ought to be efteemed common to both. Authors difagree concerning their Number, * *Vefalius*, † *Columbus*, ‡ *Spigelius*, &c.* defcribe four Pair, (*viz.*) *Par Sternohyoideum, Coracohyoideum, Stylohyoideum,* and *Geniohyoideum.* To thefe the accurate ** *Falloppius* adds another Pair, which latter Anatomifts call *Mylohyoideum*, the Invention of which is claimed by *Riolan*, in his Animadverfions on *Cafpar Bauhin's Theatrum Anatomicum*.

ALL thefe Mufcles of the *Os Hyoides* receive their Denominations from their Originations and Infertions.

XLIV.

STERNOHYOIDEUS.

Tab. XXII.
XXIII.
XXVII.

THIS does not arife from the upper part of the *Sternum*, as Anatomifts generally write, but from the internal Part of the *Clavicula* next it, where its Origination is broad and flefhy, and afcends directly over the *Sternothyroideus* and *Larynx*, of an equal Breadth and Thicknefs, to its Infertion at the *Bafis* of the fore Bone of the *Os Hyoides*.

THIS with its Partner acting, pull the *Os Hyoides*, together with the Tongue and *Larynx*, directly downwards.

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* *Lib.* 2. *Cap.* 17.   † *Lib.* 5. *Cap.* 12.   ‡ *Lib.* 4. *Cap.* 6.   ** *Obferv. Anatom.*

XLV.

XLV.

CORACOHYOIDEUS.

THIS does not arife from the *Proceffus Coracoides Scapulæ*, as fome Anato-mifts pretend, its Origination being round and flefhy from the fuperiour *Cofta* of the *Scapula*, at the root of the faid Procefs; whence marching obliquely under the *Maftoideus*, it becomes tendinous; but growing flefhy again, its inferted into the fore Bone of the *Os Hyoides*, near the Implantation of the former Mufcle.

THIS running under the *Maftoideus*, as on a *Trochlea*, it there becomes tendi-nous, not unlike the *Digaftricus* of the Lower Jaw; wherefore this by fome is alfo called *Biventer*. When it acts together with its Partner, they do not only affift the former in drawing the *Os Hyoides*, Tongue and *Larynx*, downwards; but they alfo pull them fomewhat inwards, towards the *Vertebræ* of the Neck.

XLVI.

STYLOHYOIDEUS.

ARISES fharp and tendinous from the Root of the *Proceffus Styloides*, and foon growing flefhy, defcends obliquely forwards to the *Os Hyoides*. In half its Progrefs, it's flefhy Body is commonly divided, for the Tranfmiffion of the middle Tendon of the *Digaftricus* of the Lower Jaw. After which it becomes ten-dinous near its Implantation into the fore and Side Bone of the *Os Hyoides*.

BESIDES this, I have frequently found another Mufcle*, that arifes round and flefhy from the *Proceffus Styloides*; and accompanying the Ligament† between that Procefs and the *Os Hyoides*, is inferted tendinous with it into the *Appendiculum* of that Bone. But this not being found in all Bodies, ought not to be efteem'd a re-gular Mufcle.

THESE Mufcles with their Companions, the *Stylogloffi* and *Stylopharyngæi*, act-ing on each fide, do draw up the *Os Hyoides*, Tongue and *Larynx*, together with the *Fauces* in Deglutition; whereby the mafticated Aliment is not only comprefs'd into the latter, (they being then dilated) but the *Epiglottis* is deprefs'd, and ade-quately covers the *Rimula* of the *Larynx* by its Approximation to it, by which means the Defcent of any part of the Aliment into the *Afpera Arteria* is hindered; which Mechanifm in Nature is indeed very admirable.

XLVII.

MYLOHYOIDEUS.

THOUGH *Falloppius* makes this a pair of Mufcles, it feems not to be divifible without apparent Violence. It poffeffes all that Space which is between the Lower Jaw and *Os Hyoides*; arifing flefhy from both fides the Mandible inter-nally,

nally, near the *Dentes Molares*, whence it marches with a double Order of fleshy Fibres, the outward and lowermost of which pass directly to their Implantation in the *Os Hyoides*; and those in the middle run transversly over the following pair of Muscles, being inseparably joined to each other with a middle Line.

BESIDES the Uses commonly ascribed to this Muscle in moving the *Os Hyoides* Tongue, and *Larynx*, upwards and forwards, and to either Side, its last described transverse Order of Fibres have still a farther Use in compressing the *Glandulæ Sublinguales* which lie immediately under them on each side; whereby they hasten the Egress of the Spittle from the inferiour Salival Ducts into the Mouth. Hence it is we employ these Muscles, when *Saliva* is wanting to moisten the Mouth and to join with the Aliment, when Mastication is not required; which Artifice of Nature deserves our Admiration.

XLVIII.

GENIOHYOIDEUS.

THIS with its Partner are short, thick, and fleshy Muscles. They arise from the internal Parts of the Lower Jaw-Bone called the Chin, and dilating themselves, are soon lessened again, and inserted into the superiour part of the fore Bone of the *Os Hyoides*.

THESE acting, pull the *Os Hyoides*, &c. both upwards and forwards, and assist the *Geniogloffi* in thrusting the Tongue out of the Mouth; of which in the following Chapter.

ALL these Muscles of the Os Hyoides *being raised from their Originations, and left at their Insertions, the whole Bone together with them may be taken out, by dividing its two Extremes from the two Processes of the Scutiformal Cartilage, and cutting off the Originations of the* Ceratogloffi *and* Hyothyroidei, *(of which hereafter.) This done, they may be expanded on a Plain, as they are represented in* Tab. XXVII.

L   CHAP.

CHAP. XIV.
Of the MUSCLES *of the* TONGUE.

FOR the Motion of this Part, Authors affign various Numbers of Mufcles; fome reckoning eight, others nine, fome ten, and others eleven, amongft which they count the Tongue it felf.

N. B. The Mufcles of the Tongue, like thofe of the *Os Hyoides*, are named from their Originations and Infertions.

XLIX.

Tab. XXVIII.
Fig. I.

GENIOGLOSSUS.

THIS with its Partner lie immediately under the *Geniohyoidei.* They arife flefhy from the fore part of the Lower Jaw internally, and enlarging themfelves, are inferted into the middle part of the whole Body of the Tongue, according to its Length; and part of them fometimes paffes to the *Os Hyoides.*

By the Action of the different Series of Fibres of thefe Mufcles the Tongue is either drawn in, or thruft out of the Mouth.

L.

Tab. XXIV.
XXVIII.
Fig. I.

CERATOGLOSSUS.

THIS, in the Order of Diffection. above-mention'd, we cut from its broad flefhy Origination at the upper part of the *Os Hyoides* laterally, whence it afcends to its broad and flefhy Infertion at the Root of the Tongue.

THESE Mufcles acting together draw the Tongue into the Mouth directly; if one of them acts alone, it draws it to one Side.

LI.

LI.

STYLOGLOSSUS.

HAS a small fleshy Origination from the *Apex* of the *Processus Styloides*, whence descending obliquely forwards, it is inserted into the Root and Side of the Tongue, partly under the Insertion of the former.

THIS pulls the Tongue upwards and inwards in the Action of Deglutition, as before noted.

IN my former Edition I question'd the Existence of a Pair of Muscles call'd *Basioglossi*, on the Authority of *Falloppius* and *Julius Casserius*; but having since carefully examin'd all the Muscles of this Part in divers Subjects, I have found them agreeable to the following Description.

LII.

BASIOGLOSSUS.

THE Fibres of this Muscle, at their Origine from the *Basis* of the *Os Hyoides*, are intersected by the hinder Parts of the *Genioglossus*, but afterwards they pass distinctly according to the Length of the Tongue to its Tip.

CHAP. XV.
Of the MUSCLES *of the* UVULA.

ALLOPPIUS mentions the second and third of these Muscles among those of the *Fauces*; but *Riolan* first ascribed them to this Part, and call'd them *Pterygostaphylinus Internus* and *Externus*. The Discovery of the *Glossostaphylini* is owing to *Valsalva*.

LIII.

GLOSSOSTAPHYLINUS.

*Tab.*xxviii.
Fig. ii.
*Tab.*xxix.
Fig. i. ii.

IS a very small Muscle, consisting but of two or three *Fasciculi* of fleshy Fibres, which lie immediately under the Glandulous Membrane of the *Fauces*, and make those two Risings, which we see on this Side the *Amygdalæ*, when we inspect these Parts in living Subjects. They arise on each Side the Tongue, near its Root, and after a bending Progress are expanded on the fore part of the *Uvula*.

THEIR Use is to bring the *Uvula* downwards.

LIV.

SPHENOSTAPHYLINUS.

*Tab.*xxviii.
Fig. ii. iv.
Tab. xxix.
Fig. i. ii.

THIS descends from its Origination at a Process of the *Os Sphenoides*, which is in a direct Line between the *Ala Vespertilionis* and *Processus Styloides*, and becoming a round fleshy Belly, in half its Progress grows less again, near its lateral Insertion into the posteriour Part of the *Uvula*.

THIS with its Partner acting draw the *Uvula* upwards and backwards, which hinders the masticated Aliment from regurgitating through the *Foramina Narium* in *Deglutition*.

LV.

LV.

PTERYGOSTAPHYLINUS.

THIS arifes from the fame Procefs of the *Os Sphenoides* as the preceding Mufcle, and like it defcends according to the length of the Interftice made by the internal *Ala* of the *Os Sphenoides* and *Mufculus Pterygoideus Internus* of the Jaw; and becoming tendinous, marches over the *Proceffus Pterygoides*, and is inferted into the fore part of the *Uvula*.

THE Tendon of this paffes over the Pterygoidal Procefs, which like a Pully gives it a different Direction from that of the former Mufcle, though they have both their Origine from the fame Place. Wherefore, contrary to the preceding, this draws the *Uvula* forwards and downwards; which contrivance in Nature is no lefs remarkable than any of thofe, where the like Artifice of a *Trochlea* is made Ufe of.

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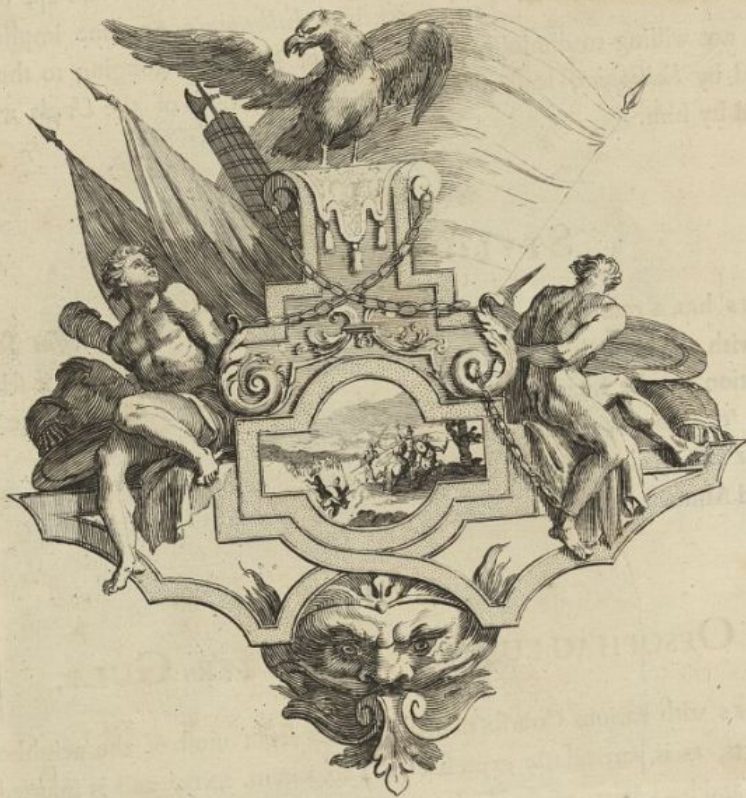
CHAP.

CHAP. XVI.

Of the MUSCLES *of the* FAUCES.

THE Difcovery of thefe Mufcles is affumed by * *Riolan,* tho' they were defcribed before him by † *Falloppius.* Neither *Vefalius,* nor *Columbus,* mentions thefe Mufcles of the *Fauces,* or thofe of the *Uvula,* though the Mufcles of the *Fauces* are partly defcribed by *Galen, Oribafius,* and *Avicenna,* as ‡ *Laurentius* obferves. Later Writers have followed the erroneous Syftem of *Riolan,* who, as I am apt to think, either received *Falloppius*'s Account implicitly, or elfe was not willing to diminifh the Number of Mufcles belonging to the *Fauces,* defcribed by *Falloppius,* leaft it fhould appear that thofe of the *Uvula* were alfo defcribed by him.

LVI.

STYLOPHARYNGÆUS.

THIS has a round flefhy Origination at the Root of the *Proceffus Styloides,* (with the *Stylogloffus*) whence defcending obliquely, it expands it felf at its Termination on the Internal Glandulous Membrane of the *Fauces,* in the middle of which 'tis joined with its Partner.

THESE acting draw the *Fauces* upwards, and dilate them in order to receive the mafticated Aliment in *Deglutition.*

LVII.

OESOPHAGÆUS, *feu* SPHINCTER GULÆ.

ARISES with various Courfes of flefhy Fibres from moft of the neighbouring Parts, as is particularly exprefs'd in Tab. xxviii. xxix. and is inferted into the lateral and back Parts of the *Gula.*

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* *Animadv. in Spigel. & Vefling.*   † *Obferv. Anatom.*   ‡ *Hiftor. Anatom. lib.* 5. *cap.* 9.

ITS

ITS Ufe is to thruft the mafticated Aliment, by its Compreffion, through the *Gula* towards the Stomach.

LVIII.

VAGINALIS GULÆ.

STE NO fuppofes this to confift of a double Order of fpiral Fibres mutually intercuffating each other. Dr. *Willis* * fays the whole *Oefophagus* feems to confift of two Mufcles, which make four Parallelograms with their oppofite Fibres decuffating each other. But in Man we find it far otherwife, in whom the Fibres of this Mufcle are longitudinal, and oblique; the former feem to take their Original at the Arytænoidal Cartilages, and paffing fomewhat obliquely to the back part of the *Oefophagus*, defcend to the Stomach. The latter feem to be a Continuation of the *laft treated of Mufcles*, defcending obliquely in a fpiral manner not unlike thofe of the Inteftines.

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* *Pharma. Rational. cap.* 2. *Sect.* 2.
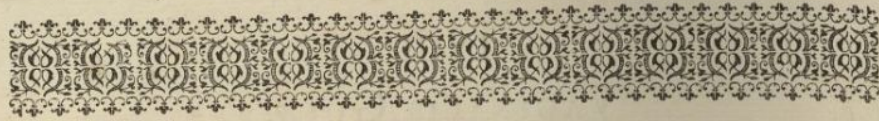
CHAP. XVII.
Of the MUSCLES *of the* LARYNX.
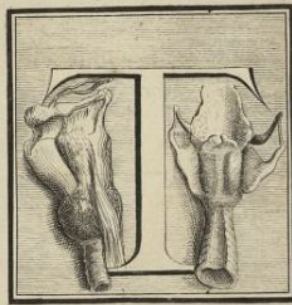
THESE Muscles of the *Larynx* are generally divided into *Common* and *Proper*.

THE *Common* arise from other Parts, and are inserted into the *Larynx*, concerning which *Galen* and the ancient Anatomists erred in their Accounts, reckoning three Pair, of which the *Oesophagæus* is esteemed as one pair of Muscles. But this Mistake is corrected by * *Fabritius ab Aquapendente*, the *Oesophagæus* being but one single Muscle, and belonging to the *Gula*, wherefore the common Muscles of the *Larynx* are reckon'd to be two Pair only; *(viz.) Par Sternothyroideum* and *Hyothyroideum*.

THE *Proper* Muscles of this Part are such whose Rise and Termination are confined to the Cartilages themselves. † *Falloppius* and *Placentinus* have both employ'd themselves in their Description. These are four Pair, besides one single Muscle, *(viz.) Par Cricothyroideum*, *Cricoarytænoideum posticum*, *Cricoarytænoideum laterale*, *Thyroarytænoideum*, and the *Arytænoideus*.

N. B. That all these Muscles of the *Larynx* have their Denominations from their Originations and Insertions.

LIX.
STERNOTHYROIDEUS.

THIS arises broad and fleshy from the upper and internal Part of the *Sternum*, whence ascending on the Sides of the Wind-pipe over the *Glandula Thyroidea*, it's inserted into the whole length of the Thyroidal or Scutiformal Cartilage from its Basis to its upper Process. This with its Partner pulls the *Larynx* downwards, and lengthens the *Canalis* or Distance between the *Rimula*, and Tip of the Tongue, (which latter we take to be the true *Plectrum Vocis*) whereby the Tone of the Voice is render'd grave.

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* *De Lar. cap.* 8.   † *Observat. Anatom.*

LX.

LX.

HYOTHYROIDEUS.

THIS arises fleshy from the inferiour Part of the *Os Hyoides* laterally, oppo-
site to the Origination of the *Ceratoglossus*, and descends directly to the
Side of the Scutiformal Cartilage, near the Implantation of the former.

THIS with its Fellow draw the *Larynx* upwards in an acute Tone of the Voice;
the Canal of the *Aspera Arteria* being also straitned thereby.

WE proceed next to the *Proper* Muscles of the *Larynx*.

In order to the Administration of these, the Musculus Œsophagæus *must be freed
from both sides the Scutiformal Cartilage; the Arytænoidal Cartilages clear'd from
the* Glottis, *and the* Aspera Arteria *separated from the* Gula.

LXI.

CRICOTHYROIDEUS.

THIS is seated on the fore part of the *Larynx*, and is a short thin fleshy Mus-
cle, with a double order of Fibres decussating each other, arising from the
fore part of the *Cricoides*, whence marching obliquely, it is soon inserted into the
Scutiformis internally and laterally.

THIS by * *Galen* and † *Vesalius* is made two Muscles; but in separating the in-
feriour Processes of the Scutiformal Cartilage from the *Annularis*, you will find but
one on each Side, says ‡ *Fabritius ab Aquapendente*: The Origination and Inserti-
on of which is supposed by some to be *e contrario*, and that its Use is rather to pull
up the *Annularis*, than to bring down the *Scutiformis* nearer it; but this Contro-
versy (we think) is of no moment, since all Muscles move the Parts less stable to
those more fix'd.

LXII.

CRICOARYTÆNOIDEUS POSTICUS.

ARISES from the posteriour part of the Annular Cartilage, filling a shallow
Depression of it, with Fibres ascending obliquely outwards, to their Insertion
at the lowermost part of the Arytænoidal Cartilage.

THIS with its Partner serve for the opening of the *Rimula*; which will plainly
appear, if with your Knife you repress this Muscle, the Arytænoidal Cartilage be-
ing opened thereby.

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* *De Musc.*   † *Lib.* 2. *Cap.* 21.   ‡ *Fabrit. de Laryn. c.* 8.

N   LXIII.

LXIII.

CRICOARYTÆNOIDEUS LATERALIS.

THIS is the smallest Muscle of the *Larynx.* It arises from the *Cartilago Cricoides* laterally, and ascending obliquely, is inserted into the Arytænoidal Cartilage near the Implantation of the former.

THIS pulls the *Arytænoides* sideways, and thereby opens the *Rimula.*

LXIV.

THYROARYTÆNOIDEUS.

THIS is the largest of all the proper Muscles of the *Larynx.* It has a broad, disgregated, fleshy Original from the internal and concave Part of the Scutiformal Cartilage, whence it passes with a double Order of Fibres, which decussate each other near their Insertion, to the Arytænoidal Cartilage.

ITS Use is to draw the Arytænoidal Cartilages nearer to each other, and shut the *Rimula.*

LXV.

ARYTÆNOIDEUS.

THIS Muscle has no Partner. It arises from the external part of one of the Arytænoidal Cartilages, and running transversly is inserted into the other.

THIS pulls the Arytænoidal Cartilages close together, and entirely shuts the *Rimula.*

N. B. *Now all the Muscles of the Lower Jaw may be dissected; its Depressors being left at their respective Originations and Insertions, as before.*

CHAP. XVIII.

Of the MUSCLES *of the* LOWER JAW.

IVE Pair of Muscles are employ'd in the Motion of the Lower Jaw: Four of which were described by * *Vesalius* and the preceding Anatomists; but for the Discovery of the fifth we are oblig'd to *Falloppius*. To these *Riolan* adds a sixth Pair, namely, the *Quadrati Genarum*, which we have already described among the Muscles of the Cheeks and Lips.

LXVI.

TEMPORALIS, *seu* CROTAPHITES.

Tab. XXIII. XXIV. XXXI.

THIS has a large, semicircular, fleshy Beginning, from part of the *Os Frontis*, *Sincipitis*, *Sphenoides*, and *Temporale*. From these Places its Fibres pass (like Lines drawn from a Circumference to a Center) under the *Os Jugale*, from which also arise some fleshy Fibres joining with the former at their united, partly tendinous and partly fleshy Insertion, into the upper part of the *Processus Corone* of the Lower Jaw.

THIS with its Partner draws the Lower Jaw upwards. We could never observe those dreadful Symptoms Authors tells us of in Wounds of this Muscle, though part of it has been taken away to apply the *Trepan* in Fractures of the *Cranium*.

A VERY remarkable Instance of which we have in an old Woman now living in *Little Chelsea*; who had not less than two thirds of this Muscle above the *Os Jugale* cut away, in order to remove the pieces of broken Scull underneath it, by which the *Dura Mater* was laid bare two Inches one way, and not less than an Inch and half the other. This Woman recover'd under the Care of Mr. *Tooly*, an experienc'd Surgeon in *Chelsea*, and my self.

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* *Lib.* 2. *Cap.* 15.

LXVII.

LXVII.

MASSETER.

IS a fhort, thick Mufcle, partly flefhy, and partly tendinous. It arifes forwards from the firft Bone of the upper Jaw, backwards from the *Os Jugale*, and fome of its Fibres are continued from the *Temporalis* under the laft named Bone. Thence defcending with Fibres interfecting each other in acute Angles, it is inferted into the lower and external part of the under Jaw-Bone.

THIS affifts the former in its Office. The paffing of the *Ductus Salivalis Superior* over this Mufcle is a provident contrivance of Nature, to prefs out the *Saliva* in Maftication. The next Mufcle which prefents it felf is the *Digaftricus*, by fome call'd *Graphoideus*, becaufe they imagine it to arife from the Styloidal Procefs.

LXVIII.

DIGASTRICUS, *feu* BIVENTER.

SO called from its Figure, it being compofed of two Bellies. It arifes flefhy from a *Sulcus* near the internal and back part of the *Proceffus Maftoides*, under part of the *Complexus*; whence defcending, it becomes tendinous, paffing through the *Stylohyoideus*, and an annular Ligament, or fometimes a membranous Inclofure, laterally faftned to the *Os Hyoides*; to which Bone it is likewife faftned by fome tendinous Fibres detached from its middle Tendon. Thence it afcends to its Infertion at the middle of the inferiour part of the Lower Jaw. The paffage of the middle Tendon of this Mufcle through the Annular Ligament fix'd to the *Os Hyoides*, like a Rope through a Pully, is a wonderful contrivance of the Author of Nature to render it capable of pulling down the Lower Jaw, which, had its Progrefs been direct from its Origination, could not have been perform'd. Nor are there any Proceffes, whether of the *Vertebræ* of the Neck, or the neighbouring Parts, that could give an Origination to thefe Mufcles, below their Infertions, as in fome *Quadrupeds:* Wherefore the Divine Architect of human Bodies has placed thefe Pullies below the Terminations of thefe Mufcles, whereby they are enabled to pull down the Lower Jaw and open the Mouth. The Pullies being fix'd to the *Os Hyoides*, the Action of thefe Mufcles is neceffarily interrupted in Deglutition, becaufe the Tongue, *Larynx*, and the *Os Hyoides*, are all rais'd upwards in fwallowing, and confequently, at that time, the Digaftrick Mufcles cannot act. Hence it is, that, when we fwallow our Aliment, the under Jaw is drawn towards the upper, and the Mouth is fhut. But in Dogs, and perhaps in other voracious Animals, where thefe Mufcles pafs directly from their Origines to their Infertions, thefe two Actions of depreffing the Lower Jaw, and raifing the *Os Hyoides*, do not interfere with each other, which may be one reafon why thefe Creatures devour their Food fo fpeedily.

<div align="right">LXIX.</div>

LXIX.

PTERYGOIDEUS INTERNUS.

SO called from its Origine and Situation. It arifes partly tendinous, and partly fleſhy, from the *Proceſſus Pterygoides*, or *Aliformis*, of the *Os Sphenoides*, whence it defcends to its Implantation at the internal and inferiour part of the Lower Jaw, oppoſite to the Termination of the *Maſſeter*,

EITHER of theſe acting, draws the Jaw to the contrary Side; if both act, they aſſiſt the *Temporales* and *Maſſeteres*.

IN a Subject I lately diſſected I obſerved an elegant diſtinct Muſcle, tho' very ſmall. This aroſe fleſhy from the extremity of the *Proceſſus Styloides*, but ſoon became tendinous, and was ſo inſerted immediately above the external lower Angle of the under Jaw, between the Terminations of the *Maſſeter* and *Pterygoideus Internus.*

N. B. *To diſcover the following Muſcle the* Temporalis *and* Maſſeter *on either ſide muſt be removed. But if you ſtill deſire a fairer Proſpect of it, with a Chiſſel cut off part of the* Proceſſus Corone, *together with the* Os Jugale.

LXX.

PTERYGOIDEUS EXTERNUS.

THIS, like the former, receives its Name from its Situation and Origine: it ariſing from the external Part of the ſaid *Proceſſus Pterygoides*, and ſuperiour Part of the *Os Sphenoides* ſeated in the cavity of the Temples, oppoſite to the *Os Jugale*, whence it runs backwards to its Inſertion at the Neck of the *Proceſſus Condyloides* of the Lower Jaw.

WHEN this and its Partner act, they draw the Lower Jaw forwards, and force the Teeth of the Lower Jaw beyond thoſe of the Upper, as *Falloppius* * their firſt Defcriber obſerves.

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* *Obſervat. Anatom.*

O

CHAP.

CHAP. XIX.
Of the MUSCLES of the THORAX.

HE Muſcles of the *Thorax* may be divided into *Proper* and *Common*.

THE *Proper* Muſcles have their Riſe and Termination within the Limits of the *Thorax*, as the *Intercoſtales*, the *Triangularis*, and the *Serrati Poſtici*.

THE *Common* are ſuch Muſcles uſed in moving the *Thorax*, as take either their Origine, or Inſertion, from other Parts. Of theſe ſome are Principal, having their Inſertions in the *Thorax*, and immediately contributing to its Motion, as the three *Scaleni*, the two *Serrati Antici*, the *Subclavius*, Diaphragm, and *Sacrolumbalis*, which laſt we reckon among the Muſcles of the *Thorax*, in compliance with other Anatomiſts, though it might perhaps be more properly placed among thoſe of the Back. Other of the common Muſcles may be called auxiliary, as moving only the neighbouring Parts, whoſe Actions are in ſome degree ſerviceable to the Motion of the *Thorax*, of which ſort are the Muſcles of the *Scapula*. For in extraordinary Inſpirations the Elevation of the *Scapulæ* is neceſſary, ſince the *Serrati Antici* cannot act in raiſing the Ribs without it. Whence an Account may be given, why Reſpiration is leſs free, when the Arms are employ'd in any laborious Action. Thus likewiſe in Aſthma's, Peripneumonies, Pleuriſies, and other Caſes, wherein the Organs of Reſpiration are inflamed, or otherwiſe obſtructed in the due execution of their Office, the Extenſion of the Neck becomes neceſſary, in order to give liberty to the *Scaleni* to aſſiſt in raiſing up the Ribs.

BUT

BUT though this Division of the Muscles of the *Thorax* be commodious enough for learning and retaining in memory their several Uses, yet it will be more agreeable to our present Design, to treat of them in such order, as they are most easily rais'd in the course of Dissection. For which reason we shall take leave to divide them into, *such Muscles of the* Thorax *as appear on its fore part, The Muscles of the* Scapula, *and Those Muscles of the* Thorax, *that appear on its back part.*

FIRST then of *those Muscles which appear on the fore part of the* Thorax.

LXXI.

SERRATUS MINOR ANTICUS.

ANATOMISTS generally reckon this Muscle amongst those of the *Scapula*; but we are persuaded from its Position, that it may be equally serviceable to the *Thorax*, in elevating those Ribs it is inserted into. Wherefore we offer it indifferently, whether belonging to one, or the other; but choose to insert it in this place, because it now appears in *Situ.* If due Care be not taken in raising the *Pectoralis*, you will be in danger of wounding this. It arises fleshy from the *Processus Coracoides Scapulæ*, and descends obliquely forwards, becoming broader and thinner, and is inserted fleshy into the Bony Part of the second, third, and fourth Ribs. If the *Scapulæ* are elevated by their proper Muscles, this with its Partner are then capable of dilating the Breast in large Inspirations: But if those are depress'd, it may be easily conceived with what difficulty that Action must then be perform'd.

LXXII.

SERRATUS MAJOR ANTICUS.

THIS arises fleshy from the whole *Basis Scapulæ*, and passing under the *Subscapularis*, it becomes broader and thicker, still running somewhat forwards, till its inserted into the eight superiour Ribs laterally, by so many distinct fleshy Portions, or *Digituli*, representing the Teeth of a Saw; the two and sometimes three inferiour of which are indented with the *Obliquus Descendens* of the *Abdomen*, as was before noted. This like the former dilates the *Thorax*, or moves the *Scapula* forwards and downwards, when its Muscles are relaxed.

THE next Muscle of the *Thorax*, that appears as the Body lies supine, is the *Diaphragm*, which is a singular Muscle, elegantly framed for those Uses, for which the Author of Nature has design'd it.

LXXIII.

LXXIII.

SUBCLAVIUS.

Tab. II. V.
VI. XXXIII.

ARISES flefhy from the inferiour part of half the *Clavicula*, next its connecti- on with the *Spina Scapulæ*; hence its Fibres defcend obliquely forwards, and it becomes a round Tendon at its Infertion into the fuperiour part of the firft Rib near the *Sternum*. Its Ufe is intimated above; but * *Spigelius*, who has writ- ten a Chapter exprefly about this Mufcle, pretends it depreffes the *Clavicula*; for which Opinion he argues ftrenuoufly, and to this purpofe relates an Obfervation from *Hippocrates*, that when the *Clavicula* is fractured near the *Sternum*, that next part vifibly afcends, and that part next the *Scapula*, together with the *Humerus*, falls down; but if its fractur'd near the *Scapula*, then neither part rifes; which, as our Author conjectures, feems to depend on the Termination of this Mufcle. In the firft cafe, it draws part of the *Clavicula*, together with the *Humerus* downwards, the Fracture being betwixt its Infertion and the contrary end of the Bone, that is fix'd to the *Sternum*. In the latter, the Fracture being made in that part, where this Mufcle is inferted, it muft keep the ends of the Bone in the fame pofture, as before the Accident.

LXXIV.

SCALENUS PRIMUS.

Tab. III. VI.
XXXIII.

THIS arifes flefhy from the fore part of the fourth and fifth, and fometimes likewife from the fixth, tranfverfe Proceffes of the *Vertebræ* of the Neck, and defcending obliquely forwards, becomes tendinous at its infertion into the firft Rib. The Axillary Nerves pafs between this and the following Mufcle.

ITS Ufe is to draw the fuperiour Rib, together with the reft, upwards in Infpi- ration.

LXXV.

SCALENUS SECUNDUS.

Tab. III. V.
XXXIII.

THIS fprings flefhy from the third, fourth and fifth tranfverfe Proceffes of the *Vertebræ* of the Neck laterally; in its Defcent it becomes thin and ten- dinous, marching, over the firft Rib, to its Infertion into the fecond, and fome- times the third.

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* *Lib.* 4. *Cap.* 9.

LXXVI.

LXXVI.

SCALENUS TERTIUS.

THIS has its Beginning near the former from the tranſverſe Proceſs of the ſixth *Vertebra* of the Neck, and is ſoon inſerted into the firſt Rib.

THESE three laſt Muſcles are called *Scaleni* from their Figure, having three unequal Sides. Though they are moſt commonly reckon'd among thoſe of the Neck, to whoſe Motion they are ſubſervient, yet the judicious * *Falloppius,* duly conſidering the *Subclavius* and *Serratus Superior Poſticus* to be inſufficient for the Elevation of the Cheſt, aſſigns theſe part of that Office.

THE Sternum *being raiſed, by dividing the Cartilages on each ſide from the Bony Endings of the Ribs, the following Muſcle will appear underneath.*

LXXVII.

TRIANGULARIS.

THIS with its Partner lies on each ſide the *Cartilago Enſiformis,* within the Cavity of the *Thorax* under the *Sternum;* ſometimes it appears to be three, at other times four diſtinct Muſcles on each ſide. It ariſes from the inferiour Part of the *Os Pectoris,* whence its upper part aſcends, and the lower deſcends to its Implantations at the Bony Endings of the fourth, fifth, ſixth, and ſometimes ſeventh and eighth Ribs, near their Conjunctions with their Cartilages.

ITS Uſe is to contract the Breaſt.

THE next Muſcle of the *Thorax,* that appears as the Body lies ſupine, is the *Diaphragm,* which is a ſingular Muſcle, elegantly framed for thoſe Uſes, for which the Author of Nature has deſign'd it.

LXXVIII.

DIAPHRAGMA.

† STENO ſuppoſes this to be a Digaſtric Muſcle. ‡ *Caſpar Bartholin* conceiving it double, calls the lower Part, ſpringing from the *Vertebræ* of the Back and Loins, the *Muſculus Inferior,* and the oppoſite ariſing from the Cartilaginous Endings of the Ribs, the *Superior;* or imagines it Trigaſtrical, as above noted, *Chap.* I. Which latter Opinion of his ſeems to quadrate to this Part in Birds. But whether we may ſuppoſe it one or two Muſcles in Man, is a Matter more of Controverſy than uſe. Its inferiour part ariſes partly tendinous and partly fleſhy on the the Right Side, from the firſt, ſecond, and third *Vertebræ* of the Loins; on the Left from the laſt, and laſt but one of the Back: Hence it aſcends with fleſhy Fibres, which run ſtreight on each ſide, but in the middle paſs ſomewhat curvedly,

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* *Obſerv. Anatom.* † *Specim. Myologiæ.* ‡ *Diaphr. Structur. cap.* 2.

P

and

and interfecting each other, do as it were embrace the *Oefophagus*; after which they become tendinous, and join with its upper part, which arifes thin and Membranous, but foon growing flefhy, from the whole inferiour Margin of the cartilaginous endings of the Ribs, and lower part of the *Os Pectoris*; whence, its flefhy Fibres, like Lines drawn from a Circumference towards a Center, pafs to its middle part, where its tendinous Fibres intercuffate each other, and exhibit a *Rete*. It has two large Perforations, the one in its tendinous part, to tranfmit the *Vena Cava* towards the right Auricle of the Heart; the other in its flefhy part, which, like an *Annulus*, embraces the *Oefophagus*, (as above noted). Its double Origine at the *Vertebræ* gives way to the defcending Trunk of the *Arteria Magna*, and two afcending of the *Ductus Chyliferus* and *Vena Azygos*.

ITS Ufe in the Animal Œconomy is too large to be inferted in this place. *Pecquet* obferves, that when all the Mufcles of Refpiration are feparated and removed, the *Diaphragma* and *Intercoftales* excepted, the Animal ftill perfifts to breathe. When we infpire, its fuperiour Surface comes towards a Plain. In Expiration it's convex towards the *Thorax*, and concave towards the *Abdomen*. In the former the *Vifcera* of the lower Belly are comprefs'd, and the Cavity of the *Thorax* enlarged. In the latter the Air is exprefs'd out of the *Veficulæ* of the Lungs.

THE Thorax *being now laid open, the Heart and Lungs may be taken out. After which you may raife the* Pleura, *beginning at the Divifion of the Ribs from their cartilaginous Endings, which were left at the* Sternum; *where thrufting in your Fingers between that Membrane and the internal Intercoftal Mufcles, you may clear it away to the* Vertebræ *of the Back. By which means you will have a clear View of the Series of Fibres of thofe Mufcles.*

LXXIX.

INTERCOSTALES INTERNI.

ARE in number eleven on each fide, arifing from the upper edge of each inferiour Rib, and inferted into the lower edge of that immediately above it, the Courfe of their Fibres afcending obliquely forwards. But we have obferv'd, that fome Parts of thefe Mufcles lying next the *Vertebræ*, pafs over the Rib immediately above their Origine, and are inferted into the next, as reprefented in Tab. XXXIII. Fig. II. *AB, AB*.

THESE feem to deprefs the Ribs.

LXXX.

LXXX.
COR.

Tab. XXXVI.
XXXVII.
XXXVIII.
XXXIX.
XL.

WE have been fo large in the Reprefentation of the feveral Parts of this Muf- cle in five Copper Plates, and in the Defcription of them in the Refe- rences thereto belonging, that we think it fuperfluous to fay any more of it in this Place.

N. B. *To profecute our Work, we muft now lay the Subject in a prone Pofition the Back uppermoft, continuing our Section from the* Occiput *down to the* Os Sacrum, *and interfecting it with a tranfverfe Line over the* Regio Lumbalis. *Which done, and the common Integuments removed, the fubjacent Mufcles may be beft diffected in the following Order.*

Chap. XX.

Of the MUSCLES *of the* Scapula, *or* Shoulder-Blade.

Tab. VII.
XLII.

HESE Muscles make the second Division of those relating to the Motion of the *Thorax*, as above-said.

LXXXI.

Cucullaris, *seu* Trapezius.

SO named, because this with its Fellow covering the Back represents a Cowl. It arises fleshy from the *Os Occipitis*, tendinous from the *Ligamentum Colli*, and *Apex* of the Spine of the last *Vertebra* of the Neck, and eight superiour of the *Thorax*; from which broad Origination becoming thick and fleshy, it's so inserted into the *Clavicula*, but is mostly tendinous at its Insertion into the *Spina Scapulæ*. Each Muscle is triangular, and both jointly compose a Lozenge or *Trapezium*, whose large Diameter extends from the *Occiput* to the fifteenth *Vertebra*; the shorter from near the Extremity of the *Spina Scapulæ* on one side to that of the other. They contain a triple Series of Fibres; the middle passing directly transverse from the first *Vertebra* of the *Thorax*; those above descend, and those beneath ascend to their Insertion; whereby the *Scapula* is variously moved according to their Directions, either obliquely upward, directly back, or obliquely downwards.

N. B. *You must proceed with Caution in the separation of this Muscle, lest you raise the following with it, which adheres very strictly to its tendinous Part, where it springs from the superiour Spines of the* Vertebræ Thoracis.

LXXXII.

Rhomboides.

SO called from its Figure. This lies immediately under the former: In some Subjects we have found it divided into two distinct Muscles on each side. It arises tendinous from the *Ligamentum Colli*, the Spines of the lowest *Vertebra* of

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the Neck, and four uppermoſt of the *Thorax*; whence deſcending obliquely, it becomes thick and fleſhy, and is ſo inſerted into that part of the *Baſis Scapulæ* that lies below its Spine.

WHEN this acts, it draws the *Scapula* upwards and backwards.

N. B. *THIS adheres ſtrictly to its ſubjacent Muſcle the* Serratus Superior Poſticus; *wherefore you muſt be cautious in raiſing it.*

LXXXIII.
LEVATOR SCAPULÆ.

Ibid.

BY ſome called *Levator Patientiæ*. This lies immediately under the *Cucullaris*, ariſing by ſo many ſeparate Originations from the firſt, ſecond, third, and fourth tranſverſe Proceſſes of the *Vertebræ* of the Neck. Theſe unite into one large fleſhy Body, which deſcends obliquely to its Inſertion into the ſuperiour Angle and the next part of the *Baſis* of the *Scapula*.

WE have found in ſome Subjects a few Slips of fleſhy Fibres ſent off from this Muſcle at its lower Part, and ending tendinous on the ſecond, or third Rib, with the upper Part of the *Serratus Major Anticus*.

ITS Name declares its Office.

N. B. *WE proceed next to the Muſcles of the* Thorax *which appear on the Back-ſide, the Body lying prone; to diſcover which, the* Latiſſimus Dorſi *muſt be removed, part of it being raiſed in the* Ilia *in diſſecting the Muſcles of the* Abdomen, *where you muſt purſue its Separation, firſt cutting it from the poſteriour Part of the Spine of the* Ilium, *ſeparating it (if poſſible) from the* Serratus Inferior Poſticus; *freeing it from the Spines of the Loins, and inferiour of the* Thorax, *and leaving it at its Inſertion into the Os Humeri. This done on both ſides, the reſt of the Muſcles of Reſpiration offer themſelves.*

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CHAP.

CHAP. XXI.

Of the MUSCLES *of the* THORAX, *which appear on the backside of the Body.*

THESE conſtitute the third Order of Muſcles belonging to the *Thorax.*

LXXXIV.

SERRATUS SUPERIOR POSTICUS.

Tab. XLI.
XLII.

THIS lies immediately under the *Rhomboides,* as above noted. It ariſes with a thin Tendon from the *Ligamentum Colli* the Spine of the loweſt *Vertebra* of the Neck, and three ſuperiour of the *Thorax;* from thence deſcending obliquely over the *Splenius Capitis,* and upper Parts of the *Sacrolumbalis,* and *Dorſi Longiſſimus,* it becomes fleſhy, marching under the *Scapula* to its Inſertion at the Curvature of the ſecond, third, fourth, fifth, and ſometimes ſixth Ribs, by ſo many diſtinct fleſhy Endings.

THIS aſſiſts in elevating the Ribs.

LXXXV.

Ibid.

SERRATUS INFERIOR POSTICUS.

THE Origination of this Muſcle is much larger than Authors generally aſſign it. In a robuſt Subject we obſerved its Continuation not only from the Spines of the *Vertebræ* of the Loins, but from all thoſe of the *Thorax,* as well underneath as below the former Muſcle; its ſuperiour and inferiour Parts being entirely tendinous, its middle growing fleſhy near its ſerrated Terminations at the Curvature of the tenth, eleventh, and Extremity of the twelfth Ribs. The *Ductus* of Fibres of this paſſing tranſverſe, and thoſe of the precedent deſcending obliquely, do decuſſate each other in acute Angles; which * *Riolan* has well obſerved, and

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* *Anthrop. Lib.* 5.

contrary to the Opinion of other Authors, affigns this Mufcle with its Partner a different Ufe, in deprefling the *Thorax*; both performing the Office of a Bandage in binding together and conftringing the pofteriour Mufcles of the Spine, not unlike thofe conftrictive Inclofures of the Thigh and Cubit hereafter mentioned.

LXXXVI.

SACROLUMBALIS.

<div style="text-align: right">Tab. VIII.
IX. XLV.</div>

THIS rifes in common with the *Longiffimus Dorfi*, externally tendinous, and internally flefhy, from the hinder part of the Spine of the *Os Ilium*, the upper Part of the *Sacrum*, and all the Spines of the *Vertebræ* of the Loins. Whence afcending with a direct Order of Fibres, they are inferted, by feveral common Terminations, into the tranfverfe Proceffes of the *Vertebræ* of the Loins, before their Divifion into two feparate flefhy Bodies, at their Paffage over the lowermoft Rib; the outermoft of which is called *Sacrolumbalis*. This is inferted into the twelve Ribs, near the beginning of their Curvature, by fo many thin, long Tendons. It receives a *Fafciculus* of tendinous and flefhy Fibres from each of the nine, or ten, lower Ribs; which after their uniting with the Body of the Mufcle, are continued to the Tendons above-mention'd, that are inferted into the upper Ribs. Thefe *Fafciculi* are call'd by *Steno* *, *Mufculi ad Sacrolumbum acceſſorii*. The upper Part of this Mufcle, after it has paft the *Thorax*, is inferted by four Tendons into the third, fourth, fifth, and fixth *Vertebræ* of the Neck; which Part is by *Diemerbroek* † made a diftinct Mufcle, and called *Cervicalis Defcendens*.

LXXXVII.

INTERCOSTALES EXTERNI.

<div style="text-align: right">Tab. XLIV.
XLVI.</div>

ARE equal in number to the Internal. They arife from the lower Edges of the upper Ribs, and defcending obliquely forwards are inferted into the upper Edge of the Rib next below, their Fibres decuffating thofe of the internal Intercoftals. The *Levatores Coftarum*, arifing from the tranfverfe Proceffes of the *Vertebræ* of the Back, and inferted into the upper Edge of each Rib, except the firft, we efteem as parts of thefe external Intercoftals.

Now all the Mufcles of the Head may be examined.

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* *Specim. Myolog.*   † *Lib.* 5. *Cap.* 6.

<div style="text-align: right">CHAP.</div>

Chap. XXII.
Of the MUSCLES of the HEAD.
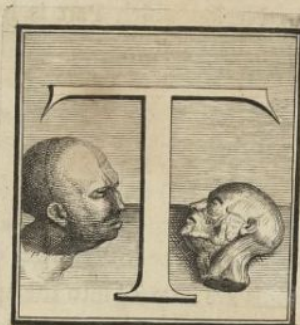
THE Head is moved by Muscles that are either *Common* or *Proper*.

THE *Common* are those, which move the Head together with the *Vertebræ* of the Neck, which shall be described in the following Chapter, under the Title *of the Muscles of the Neck*.

THE *Proper* are those, which move the Head together with the first *Vertebra* of the Neck only, the rest remaining unmoved; of which latter Anatomists, as * *Spigelius*, † *Veslingius*, and others reckon eight pair, *viz. Mastoidei, Splenii, Complexi, Par tertium Falloppii, Recti Majores, Recti Minores, Obliqui Superiores & Obliqui Inferiores*: But ‡ *Oribasius* adds two pair more, who is followed by ** *Falloppius*, which shall be described here, as they arise in Dissection, together with another pair of Muscles, not mentioned by any Author, (for what I know,) but first observed by me some time since.

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* *Lib.* 4:   † *Cap.* 12.   ‡ *Lib. De Dissect. Muscul. ex Galeno, Cap.* 10.   ** *Observ. Anatom.*

LXXXVIII.

LXXXVIII.

SPLENIUS.

ARISETH partly tendinous and partly fleshy, from the four superiour Spines of the *Vertebræ* of the *Thorax*; and this lower Part seems to be distinct from the upper, which ariseth from the Spines of the two inferiour *Vertebræ* of the Neck only. The lower Part ascending obliquely grows fleshy, and becomes tendinous again at its Insertion into the first, second, and some times third, transverse Processes of the *Vertebræ* of the Neck: The upper part of the Muscle in like manner ascending obliquely outward, grows fleshy, and is so inserted into the *Occiput*, partly under the Implantation of the *Maſtoideus*. Although this Muscle by Anatomists be reckoned amongst the proper Muscles of the Head, yet when it acteth it must necessarily move the first, and second *Vertebræ* of the Neck (into which it is inserted) obliquely backwards; but acting with its Partner, it pulleth those *Vertebræ* together with the Head directly backwards.

LXXXIX.

COMPLEXUS.

RISES fleshy from the transverse Processes of the six upper *Vertebræ* of the *Thorax*, partly tendinous and partly fleshy from those of the six lower *Vertebræ* of the Neck; after which becoming fleshy, and partly tendinous on the outside, it is inserted broad and fleshy into the *Os Occipitis*. That part of this Muscle, that springs from the tranverse Processes of the *Thorax*, joins with the *Longiſſimus Dorſi*. The Fibres of this Muscle are rightly observed to decussate those of the former. *Falloppius* makes a part of the *Longiſſimus Dorſi*, that passes over the *Complexus*, a distinct Muscle, which he calls the third Muscle of the Head. This is more distinct in some Bodies, than in others.

EITHER of the *Complexi* acting moves the Head backwards to one side: If both act together, they assist the two former. This with its Partner being raised, the four following Muscles appear underneath.

R XC.

XC.

RECTUS MAJOR.

THIS ariseth partly tendinous, but chiefly fleshy from the superiour part of the double Spine of the second *Vertebra* of the Neck, and in its ascent becomes broader and fleshy, and is so inserted into the hinder part of the *Os Occipitis,* partly under the Termination of the *Obliquus Superior.*

THIS Muscle with its Partner acting, pull the Head directly back on the first *Vertebra.* These being both raised, the following Muscle will appear underneath.

XCI.

RECTUS MINOR.

THESE are two small Muscles, appearing in some Subjects before the former are dissected. They arise fleshy from the posteriour part of the first *Vertebra* of the Neck, and are so inserted into the middle part of the *Os Occipitis,* in two shallow Depressions of the said Bone.

THESE from their Use may be called *Renuentes,* or Nodders backwards, and are Antagonists to those we shall hereafter describe, and call *Annuentes.*

XCII.

OBLIQUUS SUPERIOR.

THIS arising fleshy from the back part of the transverse Process of the first *Vertebra* of the Neck, in its somewhat oblique Ascent becometh a fleshy Belly, and lessening it self again, is inserted into the *Os Occipitis* laterally.

BY this, together with its Partner, (they never acting separately) the Head is moved backwards on the first *Vertebra.*

XCIII.

OBLIQUUS INFERIOR.

THIS ariseth fleshy from the external part of the Spinal Process of the second *Vertebra* of the Neck, close by the Origination of the *Rectus Major,* and being dilated into a fleshy Belly, passes obliquely to its Insertion at the transverse Process of the first *Vertebra,* where the former Muscle begins. When this acts on either side the transverse Process of the first *Vertebra* of the Neck is moved towards the Spine of the second; wherefore some Authors have reckoned it amongst the Muscles of the Neck. But since the Head is also moved thereby, and the Face turned to that side on which it acteth, it is not improperly reckoned amongst the Muscles that move the Head. It is assisted by the *Mastoideus;* of which in its Order.

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THE four Muscles laft treated of are named from their Progreſs, Poſition, and Magnitude.

THE Body muſt now be turned on the Back again, to examine the reſt of the Muſcles of the Head that appear on the fore part, together with thoſe of the Neck, of which the firſt is the Maſtoideus, *which is beſt raiſed, by freeing it at its Origination on one ſide, and its Inſertion on the other, as in* Chap. XII. *in order to diſſect the Muſcles of the* Os Hyoides *and the Tongue.*

XCIV.

MASTOIDEUS.

SO called, becauſe it is inſerted into the Mamillary Proceſs of the Temple-Bone. It ariſeth partly tendinous, and partly fleſhy, from the upper part of the *Os Pectoris*, and near half the Clavicle, with two (as it were) diſtinct Originations; the firſt of which aſcending ſomewhat obliquely outwards joins with the ſecond, and afterwards marches up more directly, compoſing a round, thick, fleſhy Body, which, as it paſſeth over the upper part of the *Muſculus Levator Scapulæ*, becomes broader and tendinous, and is ſo inſerted into the back part of the *Proceſſus Mamillaris*, and the adjoining part of the *Os Occipitis*, where the *Splenius* (above treated of) is implanted.

THESE Muſcles contracting together bend the Head forwards; but either of them acting alone draws it down to one Side.

THE next Muſcle that preſents it ſelf to the Knife, is partly deſcribed by * *Galen*, and mentioned by † *Veſalius* as belonging to the Back: ‡ *Falloppius* makes it his ninth Pair of the Head. It is alſo mentioned by *Riolan, Caſp. Bauhin, Bartholomæus Euſtachius*, and others. Tho' it be a large fleſhy Muſcle, and appear immediately under the *Gula* or *Pharynx*, yet *Spigelius* and ſome others take no notice of it. It is likewiſe expreſs'd by *Bidloo*, and called *Rectus Internus*. But we having obſerved an other ſmall pair of Muſcles underneath this pair, of a right Poſition likewiſe, we ſhall call them, for diſtinction, *Recti Interni Minores*, and theſe, *Recti Interni Majores*.

XCV.

RECTUS INTERNUS MAJOR.

THIS has commonly four Beginnings, partly tendinous, but chiefly fleſhy, from the fore part of the four lowermoſt tranſverſe Proceſſes of the *Vertebræ* of the Neck; (but in ſome Subjects we have found its Origination to extend much lower down, even as far as the fourth *Vertebra* of the *Thorax*,) and in its

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* *Lib. de Muſculis.* † *Lib. 2. cap. 28.* ‡ *Obſerv. Anatom.*

aſcent

afcent becoming flefhy, paffes over the three fuperiour *Vertebræ*, and is inferted into the anteriour *Appendix* of the *Os Occipitis*, near the great *Foramen*, that tranfmits the *Medulla Oblongata*.

THIS manifefty bends the Head forewards, and therefore may be called *Flexor Capitis* from its Ufe.

THIS with its Partner being removed, the following pair of Mufcles appear underneath them.

XCVI.

RECTUS INTERNUS MINOR.

THIS and its Partner appear on the fore part of the firft *Vertebra*, like the *Recti Minores* on the back part, arifing near its tranfverfe Proceffes, whence they afcend directly, and are inferted into the anteriour *Appendix* of the *Os Occipitis*, immediately under the former.

THESE nod the Head forward, and are Antagonifts to the *Recti Minores*, as is above noted, wherefore they may be called *Annuentes*.

THE laft pair of Mufcles which we fhall treat of belonging to the Head, are mentioned by *Galen*, and defcribed by * *Falloppius* in thefe Words; *Ultimo loco notandi funt Mufculi duo admodum parvi, qui à Proceffu tranfverfo Primæ Vertebræ orti, valde graciles afcendunt ad Caput, & in illud inferuntur prope Mamillarem proceffum.* Thefe we fhall call *Recti Laterales*, from their Progrefs and Pofition; they may be alfo called *Renuentes Laterales* from their Ufe.

XCVII.

RECTUS LATERALIS.

THIS is a fhort, thick, flefhy Mufcle; arifing from the fuperiour part of the Extremity of the tranfverfe Procefs of the firft *Vertebra* of the Neck, between the former and *Obliquus Superior*, whence it afcends directly to its Infertion into the *Os Occipitis*, in the Interftice made by the *Proceffus Mamillaris* and *Styloides*. This nods the Head to one Side.

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* *Obfervat. Anatom.*

CHAP. XXIII.
Of the MUSCLES *of the* NECK.

HE Muscles of the Neck move the Head secon-
darily, whence they are esteemed as *Common* to
both. Of these Authors reckon four pair, name-
ly the *Longi Colli,* the *Scaleni,* (which according to
Falloppius are described amongst the Muscles of the
Thorax) the *Transversales,* and *Spinati Colli.*

XCVIII.

LONGUS COLLI. *Tab.* III. XLIV.

THIS arises partly tendinous, but chiefly fleshy from the fore part of the three
superiour *Vertebræ* of the *Thorax,* and three lowermost of the Neck; and
being dilated in its middle to a fleshy Belly, is inserted into the fore part of all the
rest of the *Vertebræ* of the Neck.

THIS with its Partner acting bends the Neck right forwards. Between this and
the *Scaleni,* (describ'd *Chap.* XIX.) lies the *Rectus Internus Major,* describ'd in the
precedent Chapter, which * *Vestingius* calls *Musculus Brevior.*

XCIX.

SPINALIS COLLI. *Tab.* XLIV.

SO called, because it accompanies the Spines of the Neck. It arises tendinous
and fleshy from the transverse Processes of the five upper *Vertebræ* of the
Thorax, and the lowermost of the Neck. In its Ascent it becomes more fleshy, and
has a large fleshy Insertion into the inferiour part of the second *Vertebra* of the
Neck laterally, near its Spinal Procefs. Internally it sends off three Tendons,
which terminate in the Sides of the double Spines of the third, fourth, and fifth
Vertebræ of the Neck.

THESE draw the Neck backwards; or a little to one Side, when they act sepa-
rately.

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* *Cap.* II.

S   C.

C.

Tab. XLIV.
XLVI.

INTERSPINALES COLLI.

THESE are small fleshy Muscles, arising from the superiour Part of each double Spinal Process of the Neck, except that of the second *Vertebra*, and are inserted into the inferiour part of the double Spines immediately above them.

WHEN these Muscles act, they draw the Spines of the *Vertebræ* of the Neck nearer each other. These we first discover'd in the Year 1690.

CI.

Tab. XLV.
XLVI.

TRANSVERSALIS COLLI.

THIS ariseth fleshy from all the transverse Processes of the *Vertebræ* of the Neck, except the first and second, and is inserted, after an oblique ascending Progress, into their superiour Spines: It being a Continuation of the same Series of Muscular *Fibres* that compose the *Sacer* and *Semi-Spinatus*; of which hereafter.

THIS Muscle detaches off two several Productions, the shorter of which is inserted into the *Os Occipitale*, near the Mastoide Process; the longer and slenderer

Tab. XXIII. is likewise implanted in the *Os Occipitis*, beside the Production of the *Longissimus Dorsi*, called, *Par tertium Falloppii*.

THIS pair of Muscles acting together, help to keep the Neck erect; but either of them acting alone, draws the *Vertebræ* of the Neck obliquely backward, by which Motion the Head is turned towards the contrary Shoulder.

Tab. XXIII.
XLIV.

THE *Intertransversales* are small Muscles, arising from each transverse Process of the *Vertebræ* of the Neck, except the first, and inserted into the transverse Process immediately above.

CHAP.

CHAP. XXIV.
Of the MUSCLES *of the* BACK *and* LOINS.

T would be very tedious and of little Use to insert all the different Accounts Anatomists have given us of these Muscles; and the variety we have found in several Subjects, inclines us to think, that scarcely three in ten are exactly alike in this respect. Which Irregularity might perhaps induce *Falloppius* to that ingenuous Confession, that these Muscles seemed to him to be an indigested Heap and confused *Chaos.* However, we shall endeavour to give as distinct an Account of them as possible; and in order thereunto, we shall consider them as *Common* to the Back and Loins, or *Proper* to either of them.

The *Common* are such as arise from the one, and are inserted into the other, as the *Dorsi Longissimi.*

The *Proper* are either such, as arise from the *Os Sacrum* or *Ilium,* and are inserted into the *Vertebræ* of the Loins only, as the *Quadrati Lumborum*; or arise from the transverse Processes either of the *Vertebræ* of the Loins or *Thorax,* and are inserted into their superiour Spines; as the *Transversales Vertebrarum Dorsi &* *Lumborum,* which by Authors are commonly called *Sacer* and *Semispinatus.*

CII.

LONGISSIMUS DORSI.

THis Muscle takes its Origine in common with the *Sacrolumbalis,* from the back part of the Spine of the *Os Ilium,* the upper part of the *Sacrum,* and the Spines of the *Vertebræ* of the Loins; and in its ascent is inserted with it into the transverse Processes of the *Vertebræ* of the Loins, as before noted, *Chap.* XXI. After their Division upon the last Rib, the inner Muscle next the Spine takes the Name of *Longissimus Dorsi,* ascending with a partly fleshy, and partly tendinous outside, and Fibres passing somewhat obliquely outward. Part of these tendinous Fibres arise distinct from the lower Spines of the *Vertebræ* of the *Thorax,* and the uppermost of the Loins; from which Tendons do likewise arise some fleshy Fibres, which ascending obliquely inwards, are afterwards inserted into the fifth, sixth, and
seventh

feventh Spine of the *Thorax*. This Part is by fome improperly call'd *Semifpinalis*. The other larger Part of this Mufcle, afcending on the *Thorax*, divides it felf into many diftinct Portions, not much unlike a Palm Branch, which are inferted into the tranfverfe Procefs of each *Vertebra* of the *Thorax*, into each Rib near its Tubercle, and into the three lower tranfverfe Procefses of the *Vertebræ* of the Neck;

Tab. XLV. F.
Tab. XXIII. 102.
whilft a long flefhy Production of it afcends over the reft of the tranfverfe Procefses of the Neck, to its Infertion into the *Os Occipitis*, behind the *Proceffus Maftoides*.

WHEN this and its Partner act in conjunction with the *Sacrolumbalis*, they are not only ferviceable in keeping the Trunk of the Body erect and bending it backwards, but likewife in Progreffion. For it may be obferved, that when either Leg is moved forwards, thefe Mufcles on the fame Side are in action; which to us feemeth to be advantagious for the more commodious Elevation of the Thigh, by rendring the *Os Ilium* and the *Vertebræ* of the Loins at that time ftable; from which Bones the Benders of the Thigh take their Origine.

N. B. *To examine this Mufcle, it is beft to ufe the Fingers, or the pointed Handle of a diffecting Knife, to divide it from its Companion, the* Sacrolumbalis, *and difcover its* Anfulæ, *as Spigelius calls thofe Parts of it, which are inferted into the tranfverfe Procefses of the* Vertebræ *of the Back and Loins.*

CIII.
QUADRATUS LUMBORUM.

Tab. XLIV. XLVI.

ARISES flefhy from the pofteriour part of the Spine of the *Os Ilium*, whence it afcends obliquely with various Orders of flefhy Fibres, and is inferted into all the tranfverfe Procefses of the *Vertebræ* of the Loins internally, under the *Pfoas* Mufcle, as likewife into the lower Edges of the two laft Ribs. This, like the *Mufculus Rectus Abdominis*, either draws the *Vertebræ* of the Loins nearer the *Os Ilium* laterally, when we are ftanding on both Legs, or elfe brings the *Os Ilium* nearer the faid *Vertebræ*, when we ftand upon the oppofite Leg only.

CIV.
SEMISPINATUS.

Tab. XLV. XLVI.

THIS might not improperly be call'd the *Tranfverfalis Dorfi*. It arifeth flefhy from all the tranfverfe Procefses of the *Vertebræ* of the *Thorax*, and marching obliquely upwards is inferted into the fuperiour Spines of the faid *Vertebræ*. This with the following Mufcle and *Tranfverfalis Colli* acting together on one fide, move the whole Spine, or *Vertebræ* of the Neck, Back, and Loins, obliquely backwards, as when we endeavour to look behind us: If they all act together on both Sides, they affift in erecting the Trunk of the Body.

WE

CV.

SACER.

THIS may be also called *Transversalis Lumborum.* It lies under the tendinous part of the *Longissimus* above-mentioned, arising fleshy from the *Os Sacrum,* and the transverse Processes of all the *Vertebræ* of the Loins, and is inserted into their superior Spines. We have sometimes observed a *Spinalis Lumborum,* like the *Spinalis Colli* above described, which arising from the Superior Spines of the *Os Sacrum,* and marching with direct fleshy Fibres, is so inserted into the Spines of the upper *Vertebræ* of the Loins; the *Transversalis Lumborum,* now described, lying under it.

CVI.

MUSCULUS COCCYGIS.

ARISES narrow, partly fleshy and partly tendinous, from the acute Process of the *Os Iscium,* and dilating it self into a broad thin Belly, is inserted laterally along the whole *Os Coccygis.*

WE need not wonder at the many *Multiform* Muscles inservient to the Extention or Erection of the Head, Neck, Back and Loins, if we consider how great a force is required to sustain the Head and *Thorax,* on account of their projecting so much forwards from the *Vertebræ.* For if we take a view of the Skeleton, *Tab.* VI. we should think the Body constantly liable to fall on its Face, were it not supported by these many strong Muscles. In which we have a plain demonstration of the immense Wisdom of the most wise Architect, in framing a Structure projecting from its *Fulcimen,* which for several Ends (too numerous to specify here) is to be moved forwards, backwards, and sideways, and could by no other means be supported so, as to render it upon occasion flexible, but by Muscles; they being capable of a much greater Contraction and Relaxation, than any other springy Bodies, composed of Ligaments, *&c.*

THUS having breifly treated of all those Muscles, as yet known, that appear on the Trunk of the Body, we come next to those belonging to the Limbs, and first to those that move the Arm; two of which, namely, the Pectoralis *and* Latissimus, *we were obliged to dissect before, to discover the subjacent Muscles; but we shall now describe them among the rest, as the order of Dissection requires. For the more convenient Administration of these Muscles, we are wont to take off the whole Arm, together with the* Scapula *and* Clavicula, *by dividing the latter from the* Os Pectoris, *by which means the trouble in examining them is lessen'd, those moving the* Scapula *being cut from it.*

CHAP. XXV.
Of the MUSCLES of the ARM, or Os HUMERI.

ALEN*, *Jacobus Sylvius* †, and *Vesalius* ‡, describe seven Muscles belonging to each Arm, *viz. Pectoralis, Deltoides, Teres Major, Latissimus Dorsi, Supraspinatus, Infraspinatus,* and *Subscapularis. Arantius,* in his Anatomical Observations, counts another by ** *Rioland* called *Coracobrachieus,* to which †† *Julius Casserius Placentinus* adds the *Teres Minor,* by some reckoned as the eighth Muscle of this part, which is therefore called *Octavus Humeri Placentini.* Of these in their Order.

CVII.

PECTORALIS.

SO called from its Situation. This hath a broad, semicircular, fleshy Beginning, above, from near half the inferiour part of the *Clavicula,* below, from the *Os Pectoris,* and all the cartilaginous Endings of the six superiour Ribs; and from the Bony Part of the seventh it hath a distinct *Fasciculus* of fleshy Fibres, which

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* *Cap.* 18.   † *Isagog. Anatom.*   ‡ *Lib.* 2. *Cap.* 24.   ** *Lib.* 5. *Cap.* 24.
†† *Tab.* 17. *Lib.* 4. *Spigelii.*

sometimes

sometimes we have seen confounded with the *Obliquus Descendens Abdominis.* From this large Origin it marcheth transversly, and becoming narrower but thicker, lessens it self as it passeth over the upper part of the *Biceps Cubiti,* and is inserted by a short, but broad strong Tendon, into the superiour part of the *Os Humeri,* from immediately above the Termination of the following Muscle, to the smooth Head of the Bone, where it joins with part of the *Ligamentum Latum* of the *Humerus,* which Ligament is connected with the *Ligamentum Fasciale* of the *Musculus Infraspinatus, Teres Minor,* and *Major.*

The Fibres of this Muscle decussate each other, near their Implantation into the *Os Humeri;* those of the superiour part running downwards, and those of the inferiour marching up, and intersecting the former in acute Angles.

WHEN this Muscle acts, it moves the Arm obliquely upwards, directly forwards, or obliquely downwards; according to the various Direction of its *Series of Fibres.*

CVIII

DELTOIDES.

SO called from its Figure, being like the *Greek* Δ. It hath a broad Origination, forwards from above one third of the inferiour and external part of the *Clavicula,* where it is entirely fleshy; backwards it springeth partly fleshy, but chiefly tendinous, from the whole inferiour Margin of the *Spina Scapulæ.* In its descent from this Origine, it soon becomes thick and fleshy, growing narrower, till it is inserted by its partly fleshy, and partly tendinous *Apex,* into the middle of the *Os Humeri.* This draws the Arm either directly upwards, or somewhat forwards, or backwards, according to the Direction of its differing *Series of Fibres.*

CIX.

SUPRASPINATUS.

SO called, because it is placed above the Spine of the Shoulder-Blade. It ariseth fleshy from that part of the *Basis Scapulæ,* that is above its Spine, as also from the said Spine, and *Costa Superior* of the *Scapula;* from whence passing between the *Processus Coracoides,* and *Anchoriformis,* it grows less, and becoming tendinous, marches over the Articulation of the *Humerus,* joining its Tendons with the following, and is inserted into the Head of the *Os Humeri.* The proper Use of this Muscle is to lift the Arm upwards towards the *Occiput.*

CX.

CX.

INFRASPINATUS.

SO called becaufe it lies below the Spine. This arifes flefhy from the inferiour part of the *Bafis Scapulæ*, as alfo from its Spine, its inferiour *Cofta* and *Dorfum*; from hence paffing in a triangular Form according to the Figure of the Part, and leffening itfelf as it marches over the juncture, it becomes tendinous, and is inferted like the former into the Head of the *Os Humeri*. This moves the Arm directly backwards.

CXI.

TERES MINOR.

SO called from its Figure and Magnitude, to diftinguifh it from the following.

THIS Mufcle in fome Bodies cannot be diftinguifhed from the former, but in others we have found it diftinct enough.

IT arifes flefhy from the lower part of the inferiour *Cofta* of the *Scapula*, and defcends obliquely over the fuperiour Head of the *Gemellus*, where becoming tendinous, it is inferted into the Head of the *Os Humeri*.

WHEN this acteth, the Arm is moved backwards.

CXII.

TERES MAJOR.

THIS arifes from the inferiour Angle of the *Scapula*, and becoming a round flefhy Body, afcends obliquely below the former, and paffes under the fuperiour Head of the *Gemellus*, where it becomes a fhort, flat Tendon, inferted below the Neck of the *Os Humeri*, clofe to that of the following.

THIS draws the Arm backwards, and fomewhat downwards.

CXIII.

LATISSIMUS DORSI, *five* ANISCALPTOR.

THE firft Appellation it receives from its large Dimenfions, the whole Back being cover'd with it and its Partner; the latter from the ufe, that is fometimes made of it. Its thin, broad, tendinous Origination, is continued from the feven inferiour Spines of the *Vertebræ* of the *Thorax*, all thofe of the Loins, the upper ones of the *Os Sacrum*, and the back part of the Spine of the *Os Ilium*; it begins to grow flefhy, as it paffes over the *Longiffimus Dorfi* and *Sacrolumbus*; and in its Progrefs over the curvated part of the Ribs it receives feveral *Fafciculi* of flefhy Fibres arifing from them in feveral Fiffures of the *Obliquus Defcendens*, which

by

by their Conjunction compose a thick Body, still lessening it self in its Dimensions, as it marcheth towards the *Axilla*, and running over the inferiour Angle of the *Scapula*, from which sometimes does arise a fleshy part of it, which I have observed in those Bodies in which the *Teres Minor* was absent, being at last inserted by a short, but flat, strong Tendon, into the *Os Humeri* near the former.

THE next Muscle that presents it self, is the *Coracobrachialis*, by some called *Perforatus*, which is described by *Galen* and *Vesalius*, as part of the internal Head of the *Biceps Cubiti*.

CXIV.

CORACOBRACHIALIS.

*Tab.*XLVIII.
XLIX.

SO called from its Origination and Insertion. It arises partly fleshy, and partly tendinous, from the Extremity of the *Processus Coracoides Scapulæ*, and in its descent it becomes larger, strictly adhering to the internal tendinous Beginning of the *Biceps*, and parts from it near its partly tendinous and partly fleshy Insertion at the middle of the internal part of the *Os Humeri*. Through this Muscle passeth a large Nerve; wherefore by some it is called *Perforatus*.

WHEN it acts, the Arm is moved upwards, and turned somewhat obliquely outward.

CXV.

SUBSCAPULARIS.

Ibid.

SO named from its Situation, by some called *Immersus*. It is a large fleshy Muscle, filling the internal Concave part of the *Scapula*, arising fleshy from its whole *Basis* and *Superior* and *Inferior Costa* internally; as it marches forward, it lessens it self according to the Dimensions of the Bone, and passing over the Juncture, is inserted in a semicircular Manner into the Neck of the *Os Humeri*.

THIS Muscle draws the *Os Humeri* down close to the Ribs. Its Tendon together with those of the *Supraspinatus*, *Infraspinatus*, and *Teres Minor*, unite near their Insertions, and join with the broad Ligament of the Articulation of the *Os Humeri* with the *Scapula*.

IN moving the Arm circularly, these last named Muscles act successively.

U

CHAP.

CHAP. XXVI.
Of the MUSCLES *of the* CUBIT.

THE lower part of the Arm from the Elbow to the Wrift is called the *Cubit*, which is bended and extended by five Mufcles, namely, *Biceps, Brachiæus Internus, Gemellus, Brachiæus Externus,* and *Anconæus.*

Tab. XLIX.
L.

CXVI.
BICEPS.

HATH two Heads or Beginnings; the firft or outermoft of which arifes with a long round Tendon from the upper part of the Brink of the *Acetabulum Scapulæ*, and runs under the Ligament of the Articulation, in a *Sulcus* or Chanel on the Head of the Shoulder-Bone, wherein it is inclofed by a proper Ligament. In its Defcent it begins to grow flefhy, as it marcheth under the Termination of the Pectoral Mufcle, where dilating it felf into a large flefhy Body, it joins with the internal Head or Beginning. This arifeth with a fomewhat broad, flat, and long Tendon at the Extremity of the *Proceffus Caracoides Scapulæ*; in its defcent it ftrictly adheres to the *Coracobrachialis*; on which account fome Authors, not rightly defcribing that Mufcle amongft thofe of the Arm, have miftaken it for a flefhy Beginning of this. But then parting from it, both thefe Heads compofe a large flefhy Belly, which becoming tendinous near the *Cubit*, is commonly faid to be inferted by a ftrong, round Tendon, into the Tubercle near the upper Head of the *Radius*. But we have obferved this Tendon to be double, the External Part of which being thin, paffeth obliquely over the *Mufculus Pronator Radii Teres*, and Membrane-like expanding it felf, joins with the *Membrana Communis Mufculorum*, which embraceth all the external Mufcles of the *Carpus* and Fingers.

WHEN this Mufcle acts, the *Cubit* is bended.

THE double tendinous Termination of this Mufcle, (tho' not taken notice of by any Author, that we know) is very evident, and was obferv'd firft by us fome Years fince, in diffecting thefe Mufcles, in Company with our very good Friend, that moft indefatigable and curious Botanift Mr. *Samuel Doody*. It appeareth immediately under the Skin and *Membrana Adipofa* of the *Cubit*.

THIS

THIS external Tendon, which we call *Fascia Tendinosa*, seems not to be designed only for the more advantagious elevation, or bending of the *Cubit*, which it more easily moves, by how much the more it recedes from the centre of its Motion or *Fulcimen* at the lower part of the Arm-Bone. For as it strictly includes all the external Muscles, whether belonging to the *Radius, Carpus*, or Fingers, it thereby corroborates them in performing those strenuous Actions they are necessarily employ'd in. This latter Use was first suggested to us, by observing those artificial Bandages made of Leather, which some laborious Mechanicks make use of, adapting them to the belly'd part of the Muscles of the *Cubit*; amongst which Turners, and especially those that use the Rasp, in making the Frames for Cane-Chairs, (as they are commonly called) like a double Screw, are frequently obliged to this Artifice.

IN *Phlebotomy* the *Ductus* of these external tendinous Fibres ought to be respected, by directing the Launcet according to their Length, to avoid too great a division of them, which is frequently the occasion of those ill Symptoms, that remain after that so commonly practised Operation by bold Blood-Letters.

AN extraordinary Case, relating to this Muscle, has more than once happened in our Practice. Particularly a Woman, three days before she consulted us, had, (as she suspected) dislocated her Shoulder-Bone, by wringing of Linen Clothes after washing, (which is commonly done to express the Water) adding, that in straining her Arm, in that Action, she sensibly felt something (as she thought) slip out of its place on her Shoulder. After examining the Part, we were well satisfy'd that there was no Dislocation: But observing a Depressure on the external part of the Deltoide Muscle, and finding the two inferiour Tendons of this Bicipital Muscle rigid, and the *Cubit* thereby denied its due Extension, we suspected that the external tendinous Beginning, (before taken notice of) was slipt out of its Chanel on the Head of the *Os Humeri*; but finding the part at that time somewhat inflamed, we advised her to an emollient Application, and to give her Arm rest till the next Day, at which time we found our Conjecture true; for by turning the whole Arm to and fro, the Tendon readily slipt into its place, she recovering the Use of the Part immediately.

CXVII.

BRACHIÆUS INTERNUS. *Ibid.*

THIS derives its Name from its Situation, lying partly under the former. It ariseth fleshy from the internal part of the *Os Humeri*, at the Insertion of the *Deltoides* and *Coracobrachialis* Muscles, and descending over the Juncture of the *Cubit* with the Arm-Bone, it's inserted partly fleshy and partly tendinous into the superiour and fore part of the *Ulna*. This is also a Bender of the *Cubit*.

CXVIII.

CXVIII.

GEMELLUS.

SO called from its double Origine. It arifeth firft tendinous from the upper part of the inferiour *Cofta* of the *Scapula* internally, and as it paffeth between the two round Mufcles it grows flefhy, and in its Defcent joineth with its other Beginning; which arifeth broad and flefhy from the upper and back part of the *Os Humeri*, under the Deltoid Mufcle; and being tendinous on the outfide and flefhy within, is fo inferted into the fuperiour and external part of the *Ulna*, called *Olecranum*, and *Ancon*, or the Elbow.

ITS Ufe is to extend the *Cubit*. If we examine the two Beginnings of this Mufcle, we fhall find them interwoven with various Orders of Fibres, whereby it is render'd capable of performing the Extenfion of the *Cubit* with a greater Strength, as appears in Tumblers when they are walking on their Hands, who by a fudden Extenfion of their *Cubits* can return to their Feet.

CXIX.

BRACHIÆUS EXTERNUS.

THIS feems to be the third Beginning of the former Mufcle. Its Origination is continued from above the middle of the inferiour and back part of the *Os Humeri* to its Cavity, which receives the *Olecranum* in the Extenfion of the *Cubit*, where, joining with the tendinous outfide of the former, it is inferted with it, as abovefaid.

CXX.

ANCONÆUS.

SO called by * *Riolan* from its Situation. It arifeth flefhy from the inferiour and back part of the *Os Humeri*, growing larger as it marcheth between the fuperiour Ends of the *Ulna* and *Radius*, and is inferted flefhy into the lateral part of the former about two Inches below the *Olecranum*.

THIS is alfo an Extender of the *Cubit*.

THE Mufcles of the Palm of the Hand offer themfelves next to be diffeĉted, before we can examine thofe of the Carpus, Fingers, *and* Radius.

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* *Lib.* 5. *Cap.* 24.

CHAP.

Chap. XXVII.

Of the MUSCLES *of the* Palm *of the* Hand.

LL the Anatomists before *Falloppius* mention but one Muscle belonging to the Palm of the Hand, except *Valverda*, who, from the Observation of *Johannes Baptista Cannanus*, adds the *Palmaris Brevis.*

CXXI.

Palmaris Longus.

THIS has a narrow Beginning from the internal Extuberance of the *Os Humeri*, and soon becoming a fleshy Belly, contracts it self again to a long, flat, slender Tendon, marching obliquely with the Tendon of the *Flexor Carpi Superior*, and passing over the *Ligamentum Annulare*, where it expands it self, and cleaves firmly to the Skin of the Palm, and is afterwards inserted into the Roots of the Fingers laterally; it being there divided to transmit the Tendons that bend them.

Columbus * observes the long beginning of this Muscle from the Extuberance of the *Os Humeri* is sometimes wanting, which Observation is also confirmed by our own Experience. It assists in grasping, and defends the subjacent Tendons from external Injuries.

CXXII.

Palmaris Brevis.

BY *Spigelius* † called *Caro Musculosa Quadrata.* Anatomists have been extremely deceived in their Ideas of this Muscle; it not arising from the *Membrana Carnosa*, as *Columbus* pretends, or from the eighth Bone of the *Carpus*, as *Falloppius* ‡ writes; but it springs with a broad Membrane-like Tendon from the exter-

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* *Lib.* 5. *Cap.* 33.   † *Lib.* 5. *Cap.* 35.   ‡ *Observat. Anatom.*

X   nal

nal Part of the *Os Metacarpi Minimi Digiti*, and one of the Bones of the *Carpus*; whence afcending over the *Abductor Minimi Digiti*, it becomes a thin difgregated flefhy Mufcle, marching under the tendinous Expanfion of the former in the Palm, and is inferted by a fhort, ftrong Tendon, into the eighth Bone of the *Carpus*.

THIS draws the *Mons Lunæ* towards the *Os Metacarpi Minimi Digiti*, whereby the Palm becomes hollow; contrary to the Opinion of *Spigelius*, who thinks it ex-tends the Hand, when we open it; which is not done by any proper Mufcle, but by the common Extenders of the Fingers.

Chap. XXVIII.
Of the MUSCLES of the FOUR FINGERS.

THESE we shall divide into *Common* and *Proper*. The *Common* Muscles of the Fingers are such, as arise from the external or internal Protuberances of the *Os Humeri*, and subdividing themselves, are inserted into most, if not all the Fingers; namely the *Perforatus*, *Perforans*, *Lumbricales*, and *Extensor Communis Digitorum*. The *Proper* Muscles of the Fingers are such as have their Beginnings distinct, and are inserted without any Subdivision into each respective Finger; as the *Interossei*, the *Extensor* and *Abductor Indicis*, the *Extensor* and *Abductor Minimi Digiti*. First of the *Common* Muscles of the Fingers.

CXXIII.

PERFORATUS.

Tab. II.
XLIX. LI.

SO called, because its Tendons are perforated, to admit those of the following Muscles to pass through them to their Insertions: It is also call'd *Sublimis* from its Situation, being above the following; and *Flexor secundi Internodii Digitorum* from its Use. It ariseth tendinous from the internal Extuberance of the *Os Humeri* between the *Flexores Carpi*; it also has a disgregated fleshy Origination from the fore

fore part of the *Radius*, between the *Pronator Radii Teres* and *Flexor Pollicis Longus*; afterwards composing a fleshy Belly, it lessens it self in less than half its Progress, where it's divided into four fleshy Portions, each of which soon becomes a roundish Tendon, included in its proper mucilaginous Membrane, as it passes under the *Ligamentum Transversale Carpi* through the Palm. Near the first Internode of the Fingers each Tendon is divided, to admit those of the following Muscle to pass through them, then joining, and subdividing again, immediately before they are inserted into the superiour part of the second Bone of each Finger.

CXXIV.

PERFORANS.

SO named, because its Tendons run through those of the former; it's also called *Profundus* from its Situation, and *Tertii Internodii Digitorum Flexor* from its Use. It ariseth fleshy from near two Thirds of the superiour and fore part of the *Ulna*, as also from the Ligament between the last named Bone and the *Radius*, and becoming a large thick belly'd Muscle, grows outwardly tendinous, before it passes over the *Pronator Radii Quadratus*, and is divided into four round Tendons, which march under those of the former Muscle, beneath the *Ligamentum Transversale* above-mentioned, (from each of which Tendons the *Musculi Lumbricales* are said to arise) after which they pass through the *Fissures* of those of the former Muscle, and proceeding over their Extremities, terminate in the superiour and fore part of the third Bone of each Finger.

THE running of the Tendons of the last described Muscle through those of the precedent, is a no less useful than stupendous Artifice in Nature.

THE better to accommodate the Fingers to their various Employments, and to enable them to act with greater Strength, it was necessary, that a particular Muscle should be appointed for every Internode, and that the strongest Muscle should be inserted nearest to their Extremities. Now as the *Perforatus* takes its Origine from the internal Extuberance of the *Os Humeri*, and the upper part of the *Radius*, it is plain, that this cannot be an Instrument of sufficient Strength for moving the third Internode of the Fingers, not only in regard to its Magnitude, but on the account of the approach of its two Extremes, when the Cubit is bended, which must needs be of no small Impediment to it in divers Actions. This therefore is with great Wisdom set aside for the Motion of the second Internode; and the *Perforans*, which is not only the larger Muscle, but likewise takes its Origination below the *Os Humeri*, whereby it is freed from the above-mention'd Inconvenience in the bending of the Cubit, is allotted for the Motion of the third Internode, which, as we said before, ought to be attended with the Muscle of the greatest Strength. Besides that by this Disposition a Provision is made for bending the Fingers, even when the outermost Muscle happens by any accident to be totally divided.

CXXV.

CXXV.

LUMBRICALES.

Tab. LI. LII.

SO called from their Figure, being not much unlike the common Earth-worms; they are also called *Flexores Primi Internodii Digitorum*, from their Use. Anatomists generally derive the Originations of these Muscles from the Tendons of the last treated of; but in a Subject lately dissected, I observed part of the Lumbrical Muscle belonging to the fore Finger had a distinct fleshy Original, and a long slender Tendon lying between the two preceding; which suggested to me, that the other three, and those of other Subjects, have their Beginnings in common with the *Perforans*, and uniting with its Tendons, are afterwards disunited again, and growing fleshy, pass to their tendinous Implantations with the *Interossei*, at the first Internode of each Finger externally and laterally, next the Thumb.

THESE, we suppose, perform those minute Motions of the Fingers, when the second and third Internodes are curvated by the two last treated of Muscles; and are therefore used in playing on Musical Instruments, whence they may be named *Musculi Fidicinales*.

CXXVI.

EXTENSOR DIGITORUM COMMUNIS, *seu* DIGITORUM TENSOR.

Tab. v. VII. XLIX. LII.

THIS has an acute tendinous Origination from the outward Extuberance of the *Os Humeri*, between the *Extensores Carpi*; and becoming fleshy, in less than half its Progress is divided into three Portions, which become so many Tendons, (of which the middlemost is the longest) passing under their annular Ligaments between the lower Parts of the *Ulna* and *Radius*; then marching separately over the *Dorsum Manus*, and remitting tendinous Filaments to each other, before they pass the first Internodes of each Finger, they are afterwards inserted into the superiour Parts of the first, second, and third Bones of the fore, middle, and third Fingers.

THERE being little Force required in the Extension of the Fingers, we need not wonder that the Muscles, employed in that Office, are no larger in proportion to their Antagonists.

THE *Proper* Muscles of the Fingers now offer themselves to the Knife, which we shall treat of in the Order they are above named in.

CXXVII.

Tab. LI.
LII.

INTEROSSEI MANUS.

THESE are diftinguifh'd into external and internal, and are aptly named from their Situation. Authors difagree in their Number, fome reckoning fix, others eight, amongft which they efteem the *Abductor Minimi Digiti* and *Indicis*; but we rather incline to the firft Opinion, fince the two laft named Mufcles are not placed between the Bones of the *Metacarpus*. They arife flefhy, internally, in the Palm from the fuperiour Parts of the Metacarpal Bones next the *Carpus*; whence defcending between the laft named Bones, they become tendinous at the firft Internode of each Finger laterally, and pafs to their Infertions with the laft treated of Mufcle, fending off in their way a fmall Slip to the beginning of the firft Internode. Each Interftice of the Metacarpal Bones entertains two of thefe Mufcles.

WHEN all the *Interoffei* act together, they draw the Fingers nearer each other, and affift in their Extenfion, as *Galen* * takes notice; at which time likewife part of thefe Mufcles, together with the *Abductor Indicis* and *Minimi Digiti*, are capable of divaricating the Fingers; which Action cannot without fome difficulty be performed by them, when the Fingers are bended; which Contrivance of the moft wife Architect is alfo obferv'd by *Galen* †.

CXXVIII.

Tab. V. VI.
VIII. LII.

EXTENSOR INDICIS, *feu* INDICATOR.

ARISES flefhy from the middle of the external part of the *Ulna* next the *Radius*, immediately below the *Extenfores Pollicis*, and defcending obliquely, becomes tendinous, as it paffes under its annular Ligament at the lower part of the *Radius* and *Carpus*; then paffing over the *Os Metacarpi Indicis*, and joining with the Tendon of the *Extenfor Communis*, it is inferted with it into the fuperiour Part of the third Bone of the fore Finger. The Tendon of it is fometimes divided. Its Name declares its Ufe.

CXXIX.

Tab. LI. P.
Tab. LII.

ABDUCTOR INDICIS.

THIS is not to be diffected, till the *Abductor Pollicis* is raifed; by fome it is reckoned among the *Interoffei*, as above noted. It arifes flefhy from the *Os Metacarpi*, that fuftains the fore Finger; and defcending over the firft Internode of the faid Finger, becomes tendinous, joining with the Tendon of one of the Lumbrical Mufcles, and is inferted with it, together with the Tendon of the former Mufcle. Its Name intimates its Ufe, in drawing the fore Finger from the reft.

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* *Lib.* 1. *de Ufu Part.*   † *Loco fuprà citato.*

CXXX.

CXXX.

EXTENSOR MINIMI DIGITI.

THIS arifes partly tendinous at the Extremity of the external *Apophyfis* of the *Os Humeri,* and partly flefhy from the fuperiour part of the *Ulna,* between the *Extenfor Communis Digitorum* and *Mufculus Ulnaris Extenfor,* and becoming tendinous, as it paffes under the *Ligamentum Annulare* at the *Carpus,* it is there divided into two, fometimes three Tendons, which are united into one at its Infertion into the fuperiour Part of the third Bone of the Little Finger. Its Name declares its Action.

CXXXI.

ABDUCTOR MINIMI DIGITI.

THIS appears in fome Bodies divided into two or three Mufcles, having each a differing Series of Fibres; the firft of which feems to be a *Flexor primi Internodii Minimi Digiti*; the fecond an *Abductor* of the fame; the third *Abductor Secundi & Tertii Internodii.* But this Divifion not being conftant, we fhall defcribe it as one Mufcle, to avoid a needlefs multiplying the Number of the Mufcles. It arifes flefhy, firft from the *Ligamentum Tranfverfale,* and fourth Bone of the *Carpus*; fecondly from the third Bone of the *Carpus*; thirdly and laftly from the fuperiour Part of the fubjacent *Os Metacarpi.* The two firft continue flefhy to their Infertions; the former terminating at the fuperiour part of the firft Bone of the little Finger Forwards, the latter ending at the fame part of the faid Bone laterally; the third and laft becoming tendinous like the *Interoffei,* is inferted like them, with the Tendon of the *Extenfor Minimi Digiti,* at the fuperiour part of the third Bone of the little Finger.

Chap. XXIX.
Of the MUSCLES *of the* Thumb.

Tab. II. III.
VI. LIII.

UTHORS difagree concerning the Number, Rife and Infertions of thefe Mufcles; which may partly proceed from that great Variety to be obferv'd in divers Subjects. As they have moft commonly appeared to me, I fhall endeavour to reprefent them; and firft the Benders of the Thumb.

CXXXII.
Flexor Tertii Internodii, *feu* Longissimus Pollicis.

This we have frequently obferv'd to have a twofold Beginning; the firft and fuperiour of which arifes tendinous from the internal Extuberance of the *Os Humeri*, between the *Perforatus* and *Perforans*, becoming a flefhy Belly, and then tendinous again, before it joins with the middle Tendon of its other larger Head. This firft Head is fometimes wanting, and fometimes it is found fpringing from the fuperiour and fore part of the *Ulna*. The fecond or inferiour Origine of this Mufcle is that part of it, which is commonly defcribed, arifing with a double Order of flefhy Fibres for fome fpace on the *Radius*, from immediately below its fuperiour Part, which unite in a middle Line or Tendon, (not unlike the *Fibrillæ* of a Feather joining to their *Stamina*) and paffing over the Articulation of the *Carpus*, it becomes entirely tendinous, as it runs over the *Flexor primi & fecundi Internodii* to its Implantation at the fuperiour Part of the third Bone of the Thumb. For the better Diffection of the reft of the Mufcles of this Part, raife firft the following Mufcle.

CXXXIII.
Abductor Pollicis.

Tab. XLIX.
LIII.

This arifes broad and flefhy from the *Os Carpi*, to which the Thumb is articulated, and the internal Part of the *Ligamentum Tranfverfale Carpi*, whence defcending, it leffens it felf, and becomes tendinous at its Implantation into the fuperiour and external Part of the fecond Bone of the Thumb laterally.

This

THIS draws the Thumb from the Fingers, from whence it derives its Name.

CXXXIV.

FLEXOR PRIMI & SECUNDI OSSIS POLLICIS.

Tab. III.
XLIX. LIII.

THIS is a large, difgregated, flefhy Mufcle, arifing from the *Ligamentum Tranfverfale Carpi,* the Bones of the *Carpus* at the *Bafis* of the *Mons Lunæ,* and the *Os Metacarpi* of the middle Finger, whence it paffes to its Infertion into the firft and fecond Bones of the Thumb. That part of this Mufcle, that arifes from the *Os Metacarpi* of the middle Finger, is divided from its other part by the Tendon of the *Flexor Pollicis Longus* paffing between them. Befides which, there is a fecond Divifion of this Mufcle in that Part, which arifes from the *Os Metacarpi,* infomuch that it has the appearance of three diftinct Mufcles, as *Vefalius* obferves. In its Tendon, near the Infertion into the firft Bone of the Thumb, are placed two *Offa Sefamoidea.*

ITS Actions are various, according to the diverfity of its *Series* of Fibres, bending the Thumb either directly, or obliquely, whether towards the *Carpus,* or the Palm of the Hand, which Motions are frequently made ufe of by Jugglers.

CXXXV.

ADDUCTOR POLLICIS.

Tab. LI. O.
Tab. LIII.

THIS arifes tendinous in common with the *Abductor Indicis* from the *Os Metacarpi* of the fore Finger, and becoming flefhy, afcends obliquely to its tendinous Termination at the fuperiour part of the firft Bone of the Thumb. This brings the Thumb nearer the fore Finger.

THE reft of the Mufcles employed in the Motion of the Thumb are Extenders. Though Anatomifts generally reckon but two of them, yet it does not occur to our Memory, that we ever found lefs than three diftinct flefhy Mufcles; neither do the Figures, that feem to be done after the Life, in *Vefalius* and *Bidloo,* exhibit them otherwife.

CXXXVI.

EXTENSOR PRIMI INTERNODII POLLICIS.

Tab. XLIX.
LIII.

THIS arifes partly tendinous, but chiefly flefhy, from the upper Part of the *Ulna,* immediately below the *Supinator Radii Brevis,* foon growing flefhy, and becoming tendinous again, as it defcends obliquely over the Tendons of the *Radialis Extenfor,* and is inferted into the lower part of the firft Bone of the Thumb. This we have fometimes found divided into two, and fometimes three, diftinct Mufcles.

Z   CXXXVII.

CXXXVII.

EXTENSOR SECUNDI INTERNODII POLLICIS.

THIS arifes broad and flefhy from part of the *Radius* next the *Ulna*, and becoming tendinous, paffes under the fame *Involucrum* with the Tendons of the former, to its Implantation at the lower part of the fecond Bone of the Thumb.

CXXXVIII.

EXTENSOR TERTII INTERNODII POLLICIS.

THIS has a broad, partly tendinous, but chiefly flefhy Origination from the *Ulna*, immediately below the beginning of the *Extenfor Primi Internodii*, or between it and the *Indicator*, as alfo from the Ligament between the laft named Bone and the *Radius*; whence defcending obliquely, it becomes tendinous, as it marches in a proper *Sinus* on the inferiour Appendix of the *Radius*, wherein it is inclofed by its annular Ligament, and paffes over the two Tendons of the *Radialis Extenfor*, to its Infertion at the lower part of the third Bone of the Thumb.

WHEN this acts, it does not only extend the Thumb, but brings it fomewhat backwards, in fo much that fome Perfons can bring it over the fuperiour and back part of the *Offa Metacarpi*

CHAP. XXX.
Of the MUSCLES *of the* WRIST, *or* CARPUS.

THESE are well defcribed by moft Authors, and receive their Names from their Situation and Ufe.

CXXXIX.
FLEXOR CARPI RADIALIS.

Tab. XLIX. LIII.

THIS arifeth tendinous from the internal Extuberance of the *Os Humeri*, and becoming flefhy, adheres ftrictly to the *Pronator Radii Teres*; and in half its oblique Progrefs to the *Carpus*, it becomes a flat Tendon, which paffeth under the annular Ligament, and is inferted into the upper part of the *Os Metacarpi*, which fuftains the fore Finger.

CXL.
FLEXOR CARPI ULNARIS.

Ibid.

THIS arifeth partly flefhy, but chiefly tendinous, from the fame Tubercle of the Shoulder-Bone with the former, as alfo from the fuperiour and external Part of the *Ulna*, where the *Mufculus Perforans* arifes; and continuing flefhy according to the length of the *Ulna*, is partly inferted by a fhort, ftrong Tendon, into the fourth Bone of the *Carpus*, and partly into the *Os Metacarpi*, which fuftains the little Finger.

CXLI.
EXTENSOR CARPI RADIALIS.

Ibid.

BY fome called *Bicornis* and *Radiæus Externus*. It hath two Beginnings, and indeed feems to be two diftinct Mufcles, the outermoft arifing flefhy above the external Protuberance of the *Os Humeri*, immediately below the *Supinator Radii Longus*, in its defcent becoming a flefhy Belly, and growing tendinous above the

the middle of the *Radius*. The other Beginning of this Muscle is partly fleshy and partly tendinous below the former, either from the *Apex* of the outward Extuberance of the *Os Humeri*, or the superiour Part of the *Radius*, and continues fleshy somewhat lower than the other; both Tendons marching under the *Extensores Pollicis*, run under the *Ligamentum Annulare*, and are inserted into the superiour Parts of the *Ossa Metacarpi* of the fore, and middle Fingers.

CXLII.

EXTENSOR CARPI ULNARIS.

THIS hath an acute tendinous Beginning from the outward Extuberance of the *Os Humeri*, and becomes fleshy, as it descends according to the length of the *Cubit*, growing tendinous again as it marches over the inferiour part of the *Ulna*; and passing under the annular Ligament, it is inserted into the superiour Part of the Metacarpal-Bone of the little Finger.

If this Muscle and the *Ulnaris Flexor* act, they move the Hand sideways towards the *Ulna*; and in like manner, if the *Radialis Flexor* and *Extensor* act, they move it towards the *Radius*. It is well observed by most Authors, that the Extenders, whether belonging to the Fingers or *Carpus*, arise from the outward Extuberance of the *Os Humeri*, and their Antagonists the Flexors, from the internal Protuberance of the same Bone, as also from the superiour and external Part of the *Ulna*, next the *Anconæus* (above treated of.)

CHAP.

CHAP. XXXI.
Of the MUSCLES *of the* RADIUS.

HE *Radius* is bent and extended in common with the *Ulna*, or *Cubitus*; but befides that, it hath alfo a proper Motion, in which the *Carpus* together with the Hand is chiefly moved, or turned, either up-wards or downwards. To this end there are two forts of Mufcles; of which fome are called *Pronato-res*, or thofe that turn the *Radius* inwards, and the Palm of the Hand downwards; and others *Supina-tores*, which turn it outwards, and the Palm of the Hand upwards. Thefe have their Names from their Figure and Ufe.

CXLIII.

PRONATOR RADII TERES.

HAS two Beginnings; the one from the internal Extuberance of the *Os Hu-meri*, where the Mufcles bending the *Carpus* and Fingers arife; the other from the upper Part of the *Ulna*. From thefe two Heads its flefhy Body marches obliquely, adhering ftrictly to the *Flexor Carpi Radialis*, fo as not to be fairly fe-parable from it, in its Paffage to its tendinous Infertion a little above the middle of the *Radius* externally.

CXLIV.

PRONATOR RADII QUADRATUS, *or* INFERIOR QUADRATUS.

IT arifeth with a broad Tendon, from the lower and inner Part of the *Ulna*, and paffing tranfverfly over the Ligament, that joins the *Radius* to the *Ulna*, is fo inferted into the fuperiour and external Part of the *Radius*.

A a   CXLV.

CXLV.

Tab. XLIX.
LIV.

SUPINATOR RADII LONGUS.

THIS ariseth broad and fleshy from the external Part of the *Os Humeri*, three Fingers breadth below the Termination of the *Deltoides*; and descending obliquely inwards, it gradually lessens it self, and becomes a flat, broad Tendon, which likewise grows narrower till it is inserted into the internal and inferiour Part of the *Radius*, near the *Carpus*.

CXLVI.

Tab. V. VI.
IX. LIV.

SUPINATOR RADII BREVIS.

THIS ariseth partly tendinous, and partly fleshy, from the superiour and external Part of the *Ulna* next the *Radius*; and passing obliquely over that Bone, is so inserted into its superiour Part below the Prominence of the *Radius*, where the round Tendon of the *Biceps* endeth.

WE come next to the Muscles of the Thigh, Leg, and Foot. Though Riolan *sharply reprehends* Caspar Bauhin, *in his* Animadversions *on his* Theatrum Anatomicum, *for Male-administration of the Muscles of the Leg, before those of the Thigh, alledging that those of the Thigh may be all demonstrated, while the Muscles of the Leg remain untouched; yet we cannot agree with him in that particular, knowing it to be absolutely necessary to separate divers Muscles of the* Tibia, *as well as to cut off some of those moving the* Os Femoris *it self, before we can have a tolerable Prospect of others; especially the* Rotator Femoris Extrorsum. *However since some Muscles, which belong to the Thigh, arise from the* Vertebræ *of the Back, Loins, and* Os Sacrum, *we shall begin with them, and then divide the* Os Ilium *from the* Sacrum, *and remove the Trunk of the Body; which Practice is not only convenient for Dissection, in respect that the Limb is more easily turned to and fro upon the Table; but in publick Demonstrations is done to avoid an offensive Scent apt to arise from the* Trunk. *This done, proceed to divest the rest of the Muscles of the Skin, Fat, and Membranes; taking care that the* Fascia Membranosa *of the Thigh and Leg be not wounded, and that you likewise take off all the Fat in the* Planta Pedis, *and avoid cutting the long Tendon of the* Musculus Plantaris, *as it descends by the inside of the great Tendon of the* Gasterocnemii, *near the* Os Calcis.

CHAP.

Chap. XXXII.

Of the MUSCLES of the Thigh.

HE Enumeration, Defcription and Office of the Mufcles belonging to this Part, is varioufly fet down by different Authors. * *Galen*, † *Vefalius*, and ‡ *Columbus* mention ten, *viz. Pfoas*, *Iliacus Internus*, *Pectineus*, *Glutæus Major*, *Glutæus Medius*, *Glutæus Minor*, *Pyriformis*, *Marfupialis*, *Triceps*, and *Obturator Externus*. To thefe ** *Falloppius* adds another called *Quadratus Femoris*, whofe Invention †† *Riolan* pretends is due to *Sylvius*, and defcribes another, which he calls *Pfoas Parvus*, lying on the great *Pfoas*. To thefe ‡‡ *Tho. Bartholin* adds yet another diftinct from that mentioned by *Riolan*, lying beneath it, having the fame flefhy Beginning about three Fingers in breadth, and being fo inferted into the upper Edge of the *Os Ilium* backwards, where the *Iliacus Internus* arifes: This he tells us he found in a ftrong Mufcular Body in the Year 1651; and the following Year he fays he faw it with *Michael Lyferus*, who had obferved it in a Monkey to equal the great *Pfoas*. That mentioned by *Riolan* we have frequently obferv'd, which notwithftanding is abfent in fome Bodies, as he has well remark'd. But the latter of *Bartholin* I could never yet difcover. If any fuch be

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* *De Mufc. Cap.* 31. † *Lib.* 2. *Cap.* 56. ‡ *Lib.* 5. *Cap.* 28. ** *Obfervat. Anatom.*
†† *Animad. in Theat. Anatom. Bauhini & Anthropog. Lib.* 5. *Cap.* 41. ‡‡ *Lib.* 4. *Cap.* 11.

found,

found, I conjecture it should rather be referred to the Loins, together with the *Quadratus Lumborum*, of which I suspect it is a Part, that may sometimes be distinct. The like *Lusus Naturæ* we frequently find in other Cases, of which the *Rhomboides Scapulæ* and *Triceps Femoris* afford us Examples.

CXLVII.

PSOAS PARVUS.

Tab. LIV.

THOUGH this ought to be counted among those belonging to the Loins, yet for its subserviency to the great *Psoas*, and our better convenience in Dissection, we choose rather to reserve it for this Place. It arises fleshy from the superiour part of the first *Vertebra* of the Loins internally and laterally, within the Cavity of the *Abdomen*, immediately below the *Diaphragm*, whence it descends obliquely inwards, towards the *Pelvis Abdominis*, where it ceases to be fleshy, in a manner embracing the great *Psoas*, and is inserted with a thin, broad, strong Tendon, into that part of the *Os Pubis* that is joined to the *Os Ilium*. This Muscle with its Partner may assist the *Recti Abdominis*, in drawing the *Offa Pubis* upwards, as in raising our selves from a decumbent Posture. Thus Rope-dancers hang by their Hands, and raise the inferiour parts of their Bodies, to take hold of the Rope with their Feet, though their proper Action seems to be to bend the Loins. The Tendons of these Muscles, embracing the two following, which we have frequently observed to extend over their inferiour Parts, not unlike the *Fascia Tendinosa Cubiti*, and *Lata* of the Thigh, do also corroborate them in their Action.

CXLVIII.

Tab. III. VI.
LIV. LV.

PSOAS MAGNUS, *seu* LUMBALIS.

SO called from its Situation. It's a round, somewhat large and fleshy Muscle, arising from all the *Vertebræ* of the Loins, and their transverse Processes, internally and laterally, within the Cavity of the *Abdomen*; from thence descending over the superiour part of the *Os Sacrum*, and Spine of the *Ilium*, where it is joined with the fleshy Fibres of the following Muscle, with which its inseparably united, at their partly fleshy, and partly tendinous Insertion into the inferiour part of the lesser *Trochanter* of the Thigh-Bone.

THIS assists the following in its Action.

CXLIX.

Tab. III. VI.
LIV.

ILIACUS INTERNUS.

THIS arises fleshy from above half the superiour, internal, concave part of the *Os Ilium*, and in its descent over the inferiour part of the same Bone, joins with the former, and is inserted with it as above-said, partly under the Termina-
tion

tion of the following Mufcle. This together with the former move the Thigh forwards in Progreffion.

CL.

PECTINEUS.

SO called from its beginning at the *Os Pubis* or *Pectinis*. It has a thick, broad, and flefhy Origination from the external part of the faid Bone, between the two laft defcribed Mufcles and fecond Head of the *Triceps*, and defcending oblique-ly backwards, it becomes a flat ftrong Tendon near its Implantation into the Af-perity on the pofteriour part of the *Os Femoris*, immediately below the leffer *Tro-chanter*, at the Infertion of the two former Mufcles.

THIS acting together with the two preceding, does not only affift in drawing the *Os Femoris* upwards, but likewife directs it outwards, by its Curve defcent from its Origination to its Infertion at the pofteriour part of the *Os Femoris*; which is a provident Contrivance of Nature in our walking, fince the Thigh-bones, by their oblique Pofition, render the Toes liable to turn inwards. Thefe three laft treated of Mufcles, befides the *Recti Abdominis*, and *Pfoas Parvus* on each fide, feem to ferve for the Inflexion of the Body, and to direct the whole Limb, to wit, the Thigh, Leg, and Foot outward, in a more graceful Step.

THE Mufculus Membranofus prefents it felf next to the Knife; therefore muft be raifed, before we can gain a View of the reft of the Mufcles, which move the Thigh-bone. This may be done, either by cutting it from its flefhy Origination at the point of the Spine of the Os Ilium, and turning it downwards; or after its well cleared of the Skin, Fat, and Membranes, it may be raifed contrariwife, by cutting off its tendinous Infertion at the fuperiour Appendix of the Fibula, freeing it from all the Mufcles of the Tibia, and leaving it at its Origination. Either of thefe being done, proceed to raife the Pyriformis from its Origine within the Pelvis of the Abdomen, and part of the flefhy Beginning of the Glutæus Major, from the external part of the Os Sacrum and Coccygis. The Body then being laid in a Supine Pofture, and the Legs divaricated, with a thin Knife firft divide the Offa Pubis from each other, and then the Os Ilium from the Sacrum.

CLI.

GLUTÆUS MAJOR.

SO called from its being the largeft Mufcle of thofe, which compofe the But-tocks. It has a large femicircular Beginning; forwards merely tendinous, from near two thirds of the external part of the Spine of the *Os Ilium*; backwards its Origination is thick and flefhy from the pofteriour part of its Spine, the hind-moft part of the *Sacrum* laterally, and the whole *Os Coccygis*, as alfo from a broad Ligament, that's extended between the two laft named Bones and the Tubercle of the *Os Ifchium*; its flefhy Fibres, defcending difgregately, in an almoft femicircular

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manner,

manner, become tendinous, as they approach the great *Trochanter*, where it is united with its first described tendinous Beginning, descending over the external part of the great *Trochanter*; then after being joined with the Tendon of the *Membranofus*, it proceeds to cover and strictly embrace all the external Muscles of the *Tibia*, as the external Tendon of the *Biceps* does those of the *Cubit:* But the other part of it proceeding from the fleshy Body of this Muscle, is largely inserted into the *Linea Aspera* on the back Part of the *Os Femoris*, near four Fingers breadth below the Great *Trochanter*.

THE first described tendinous Beginning of this Muscle doth not only serve to support its fleshy Body; but its Fibres intersecting those of the *Membranofus*, as they cover all the Muscles of the *Tibia*, do more adequately include them, whereby they are corroborated in their Action. When this Muscle acts, it pulls the Thigh directly backwards.

CLII.

GLUTÆUS MEDIUS.

THIS lies chiefly under the tendinous beginning of the former Muscle, and arising fleshy from almost the whole external part of the Spine of the *Os Ilium*, in its Descent becomes thicker and fleshy, and is inserted by a short strong Tendon into the superiour and external part of the great *Trochanter* in a semicircular manner.

IF the differing *Series* of Fibres in this Muscle are rightly consider'd, their Position will manifest, that they are not so useful in extending the Thigh, as Authors would persuade us, but rather employed in turning it inwards. This will plainly appear, if in the time of Dissection you give the Thigh that Motion, for you then may observe the fore part of this Muscle notably relax'd. And in living Persons, when the Thigh is turned inwards, you may see it tumified; or if, in performing that Action with your own Thigh, you lay your Thumb on this Muscle, you may feel it contract or move under the Skin. Besides its being partly useful in extending the Thigh with the former Muscle, it is also employ'd in divaricating the Legs, it co-operating with the *Musculus Membranofus* in that Action.

N. B. *IN raising this Muscle, begin towards the back Part of the* Os Ilium, *and thrust in your Finger between it and the* Glutæus Minor *lying under it, by which means they will easily be separated.*

CLIII.

GLUTÆUS MINOR.

LIES totally under the former Muscle, being as much less than the former, as the former is than the Precedent. It ariseth semicircular, broad and fleshy, from the *Dorfum Ilii*; from hence its fleshy Fibres descend to their tendinous Insertion at the superiour part of the Root of the great *Trochanter*.

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THE Fibres of this running parallel with thofe of the former, affift it in all its Actions. Whatfoever Authors have faid concerning a *Rotator Femoris Introrfum,* we are well affured, that there is no other Mufcle employ'd in that Action, but the fore Parts of thefe two only. They alfo affift in rendring the Articulation of the Thigh Bone with the *Coxa* more ftable, in ftanding erect.

CLIV.

PYRIFORMIS, *feu* ILIACUS EXTERNUS.

RECEIVES its firft Name from its Figure, the fecond from its Situation. Its Beginning is round and flefhy from the inferiour and internal Part of the *Os Sacrum,* in the *Pelvis* of the *Abdomen;* and defcending obliquely in the great *Sinus* of the *Os Ilium,* above the acute Procefs of the *Ifchium,* and joining with the *Glutæus Medius,* it is inferted by a round Tendon into the Root of the great *Trochanter.* This moves the *Os Femoris* fomewhat upwards, and turns it outwards.

CLV.

MARSUPIALIS, *feu* BURSALIS.

SO called from its tendinous running through (as it were) a fecond flefhy Beginning of it felf, which Duplication reprefents a Purfe: It is alfo called *Obturator Internus* from its Situation upon the great round hole of the *Os Ifchium,* which it fills and ftops up. It arifeth broad and flefhy from part of the *Os Ilium, Ifchium, Pubis,* and Ligament that is extended in the great *Foramen* of the two laft named Bones internally, and marching tranfverfly in the *Sinus* of the *Ifchium,* fenced on each fide by two Proceffes, the one acute, the other obtufe, is externally flefhy, but internally hath three, fome times four or five Tendons, paffing in fo many diftinct Furrows in the faid *Sinus,* like fo many Cords in a Quadruple Pulley, where it meets with the other flefhy Beginning, commonly called its *Marfupium,* arifing from the above-mentioned acute and obtufe Proceffes, which joins with the faid Tendons at their united Infertion into the fuperiour part of the Root of the great *Trochanter,* near the Implantation of the former Mufcle.

RIOLAN * makes two Mufcles of the *Marfupium;* which Error is taken notice of by † *Marchette.*

WHEN this Mufcle acteth, its Infertion is directed towards that part of the *Ifchium,* over which its Tendons run after the manner of a Pulley, and the *Os Femoris* is thereby turned outwards.

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* *Anthrop. Lib.* 5. *Cap.* 41. † *Anatom. Cap.* 19.

CLVI.

CLVI.

QUADRATUS FEMORIS.

So called from its Figure. It ariſeth broad and fleſhy from the *Apophyſis* of the *Os Iſchium*, and paſſes tranſverſly, with an equal Breadth and Thickneſs, to its partly fleſhy, and partly tendinous Inſertion at the poſteriour part of the *Os Femoris*, partly below the great *Trochanter*.

THIS aſſiſts the former Muſcle in turning the Thigh-Bone outwards.

N. B. *By thruſting in your Finger between this and the* Obturator Externus, *lying under it, you'll eaſily raiſe the one and diſcover the other.*

CLVII.

OBTURATOR EXTERNUS.

So called from its Situation, and *Rotator Femoris Extrorſum* from its Uſe. It hath a large fleſhy Beginning from the external Parts of the *Os Iſchium*, *Pubis*, and Membrane, that covers their *Foramen* externally, oppoſite to the Origination of the *Marſupialis*, or *Obturator Internus*, (already deſcribed) and paſſing tranſverſly backwards, leſſens it ſelf, and becomes tendinous at its Inſertion into the Root of the great *Trochanter* of the Thigh-Bone, near the Termination of the laſt named Muſcle. This turns the Thigh outwards.

CLVIII.

TRICEPS.

So called from its three Heads or Beginnings; the firſt and largeſt of which ariſeth broad and fleſhy from the inferiour Edges and external Parts of the *Os Iſchium* and *Pubis*, where they are joined to each other, lying between the *Semitendinoſus* and the *Gracilis*, and deſcending with an oblique Order of fleſhy Fibres, is inſerted partly tendinous, and partly fleſhy, near an Hands length in Breadth into the *Linea Aſpera* of the Thigh-Bone immediately below the Inſertion of the *Quadratus Femoris*; its inferiour part making a ſtrong round Tendon, inſerted into the ſuperiour part of the internal and lower *Appendix* of the Thigh-Bone. The ſecond Head or Beginning of this Muſcle ariſeth tendinous from the *Os Pubis*, but in its deſcent ſoon becomes fleſhy, and joins with the former, near to its Inſertion into the middle part of the *Linea Aſpera* of the Thigh-Bone. The third and laſt Beginning of this Muſcle ſpringeth from the inferiour part of the
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Os Pubis, between the Origination of its laſt deſcribed Head, and that of the *Pectineus,* and deſcending obliquely, joins with the firſt, near its Inſertion into the *Linea Aſpera* of the Thigh-Bone, immediately above the Termination of the ſecond Head.

This moves the Thigh variouſly according to the diverſity of its Beginnings; for the firſt deſcribed Part of it pulls the Thigh-Bone upwards, inwards, and ſome-what backwards; the ſecond and third Beginnings of it pull it more inwards, and turn it ſomewhat outwards, as when we put our Legs a-croſs each other.

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CHAP.

CHAP. XXXIII.

Of the MUSCLES *of the* LEG.

OLUMBUS * and *Spigelius* † after *Galen* ‡ mention ten Muscles, which move the *Tibia*, namely, *Membranosus*, *Sartorius*, *Gracilis*, *Seminervosus*, *Semimembranosus*, *Biceps*, *Rectus*, *Vastus Externus*, *Vastus Internus*, and *Popliteus*. To these *Jacobus Sylvius* **, *Laurentius*, and later Authors, add another Muscle lying between the two *Vasti*, and call it *Crureus*. Of these, we reckon the first seven, as *Common* both to the Thigh and Leg, since they arise either from the *Os Ilium*, *Pubis*, or *Ischium*, and are inserted into the *Tibia*, or *Fibula*, in moving of which they move the Thigh also: The other are *Proper*, arising from the *Os Femoris* only, and being inserted into the *Tibia*.

CLIX.

MEMBRANOSUS.

SO called from the large membranous Expansion it is continuous with, inclosing all the Muscles of the *Tibia* and *Tarsus*; whence it is also called *Fascia Lata*. It hath an acute fleshy Beginning from the fore part of the Spine of the *Os Ilium*, between the Origination of the *Sartorius* and tendinous Beginning of the *Glutæus Magnus*; and being dilated to a fleshy Belly, fills the Interstice made by the first of the two last named Muscles and upper part of the *Rectus*, and the fore part of the *Glutæus Medius*. In its oblique Descent it becomes tendinous, four Fingers breadth below the great *Trochanter*, whence it passes directly over the *Vastus Externus* to its proper Termination, at the superiour *Appendix* of the *Fibula*; but in its progress thither it is conjoined with the tendinous Expansion of the *Glutæus Magnus*, which ariseth from the Spine of the *Os Ilium*, covering the external part of the *Glutæus Medius*. This united Expansion, or *Fascia*, embraces all the external Muscles of the *Tibia*, as well as those of the Thigh-Bone; and descending over the *Patella*, comprehends the Muscles of the *Tarsus*, and joins with the

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* *Lib.* 5. *Cap.* 29.   † *Lib.* 4. *Cap.* 32.   ‡ *De Muscul.*   ** *Isagog. Anatom. lib.* 5. *cap.* 29.

Ligamentum

Ligamentum Annulare, which retains the Tendons of the Toes and Foot, unless it may be supposed that this *Fascia Lata* should end at the lower part of the Thigh-Bone, or superiour parts of the *Tibia* and *Fibula,* and that the last named Bones should give an Origination to the inferiour part of the said *Fascia,* which seems to be a Matter more of Controversy than Use. When this Muscle acteth, the Leg and Thigh are drawn outwards. Its tendon being joined with part of the *Glutæus Maximus,* and having a different Series of Fibres intersecting the other, they do thereby compose a strong *Involucrum,* as well including all the *Common* Muscles of the Leg, as covering the *Proper;* whereby they corroborate them in their Action, as the tendinous Expansion of the *Biceps Cubiti* doth those of the *Carpus* and Fingers.

CLX.

SARTORIUS.

IT receives this Denomination from the Use Taylors make of it, in bringing one Leg and Thigh over the other, to sit cross-leg'd: It is also called *Longissimus Femoris,* it exceeding the rest of the Muscles of that part in Length, and *Fascialis,* from its passing over the Muscles of the Thigh and Leg like a Swathe. It ariseth sharp and fleshy from the fore part of the Spine of the *Os Ilium,* close by the former Muscle; and descending obliquely inwards above the *Musculus Rectus* and *Vastus Internus,* and over part of the *Triceps,* of an equal Breadth and Thickness, meets with the *Gracilis,* below the middle of the Thigh internally, and descending with it, becomes tendinous in its Passage over the internal and inferiour Head of the Thigh-Bone, (under a strict Inclosure of the above describ'd *Fascia Lata)* and is inserted four Fingers Breadth below the superiour part of the *Tibia,* internally. Its Use is declared above.

CLXI.

GRACILIS.

SO called from being the slenderest of these Muscles: It ariseth somewhat broad and tendinous from the *Os Pubis* internally, between the first and second described Heads of the *Triceps;* and in its strait Descent in the inside of the Thigh, its fleshy Body grows narrow, and becomes tendinous a little above the former Muscle, and is so inserted (immediately beneath it) into the *Tibia.*

IT assisteth the former Muscle, in bending the Thigh and Leg inwards.

CLXII.

BICEPS.

Tab. V. VII.
VIII. LV.
LVI. LX.

OR *Biceps Femoris*, to diſtinguiſh it from that of the *Cubit:* It having two Heads, the ſuperiour and longeſt of which ariſeth with a round Tendon from the Protuberance of the *Iſchium*; in its Deſcent it becomes large and fleſhy, and in above half its progreſs leſſens it ſelf again, where it is joined with its other Head, having a broad, partly tendinous and partly fleſhy Beginning from the *Linea Aſpera* of the *Os Femoris*, immediately below the Termination of the *Glutæus Maximus*; it being thus united, grows tendinous, as it marcheth in a Chanel on the external part of the lower *Appendix* of the *Os Femoris*, becoming perfectly tendinous at its Implantation into the ſuperiour *Epiphyſis* of the *Fibula*.

BESIDES the Office commonly aſſigned to this Muſcle, in bending the *Tibia* together with the two following, it is likewiſe employed in turning the Leg, together with the Foot and Toes, outwards, when we ſit with the Knees bended.

CLXIII.

SEMINERVOSUS, *ſeu* SEMITENDINOSUS.

Tab. VII.
VIII. LV.
LVI. LX.

WHICH is ſo called from its being half tendinous, and Nerve-like. It ariſeth partly tendinous, and partly fleſhy, from the external part of the Protuberance of the *Os Iſchium*; and preſently being dilated to a large fleſhy Belly, becomes a round Tendon in half its progreſs, which deſcending over the fleſhy Belly of the following Muſcle, marcheth cloſe by the *Gaſterocnemius* on the poſteriour part of the ſuperiour *Appendix* of the *Tibia*, from whence it paſſes forwards to its Inſertion into the ſaid Bone, immediately below the Termination of the *Gracilis*.

THIS with the following Muſcle bend the *Tibia* directly backwards. Its Tendon, together with thoſe of the three former and the following Muſcle, make the Hamſtrings, as they are commonly called.

CLXIV.

SEMIMEMBRANOSUS.

SO called from its being half tendinous and Membrane-like, lying immediately under the former Muſcle. It ariſeth broad and tendinous from the Protuberance of the *Os Iſchium*; in its Deſcent it becomes broader, and in leſs than half its progreſs begins to grow fleſhy, (where the Belly of the former Muſcle leſſens it ſelf) and is dilated into a large and fleſhy Belly, lying under the long round Tendon of the former, becoming a ſhort thick Tendon inſerted into the ſuperiour part of the upper *Appendix* of the *Tibia* backwards.

N. B. THAT the fleſhy Belly of the former Muſcle is above, and that of this is below, and their Tendons on the contrary.

CLXV.

CLXV.

POPLITEUS.

Tab. VIII.
IX. LVI.
LX.

BY some called *Subpopliteus*, ariseth with a short, strong Tendon, from a *Sinus* in the external Head of the inferiour *Appendix* of the *Os Femoris*; from whence descending obliquely over the Juncture, it becomes fleshy, and expanding itself, is so inserted into the superiour part of the *Tibia* internally, immediately below its superiour *Appendix*. This doth not only assist the three former Muscles in bending the *Tibia*, but antagonizeth the *Biceps* by turning the Foot and Toes inwards.

CLXVI.

RECTUS FEMORIS.

Tab. I. II.
LV. LXI.

IS named from its streight Progress and Situation; it ariseth fleshy from a Tubercle of the *Os Ilium*, that is in the mid-way between the fore part of its Spine and the *Acetabulum*, as likewise from the Margin of the *Acetabulum*; from whence descending directly between the two following Muscles, and over the *Crureus*, its Fibres externally descend from a middle Line obliquely, laterally; internally they run according to its Length, and become entirely tendinous, four Fingers breadth above the *Patella*, where it is united with the Tendons of the three following Muscles, and inserted together with them at the upper part of the *Tibia*.

CLXVII.

VASTUS EXTERNUS.

Ibid.

SO called from its Magnitude and Situation; it arises outwardly tendinous, and inwardly fleshy, from the external part of the great *Trochanter* and the *Linea Aspera* of the Thigh-Bone, from whence its Fibres descend obliquely forwards, and on the contrary become outwardly fleshy, and tendinous internally; and so soon as they meet with the Tendon of the former Muscle, grow perfectly tendinous, and join with it, and those of the two following.

CLXVIII.

VASTUS INTERNUS.

Ibid.

THis like the former hath its Denomination from its Situation and Magnitude: Its Beginning is large, partly tendinous, and partly fleshy; it being continued from the *Linea Aspera* on the back part of the Thigh-bone, from immediately below the lesser *Trochanter*, till within three Fingers breadth above the

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inferiour

inferiour *Appendix* of the said Bone internally, and laterally; from hence its fleshy Fibres descend obliquely outwards, in an almost semicircular manner, and on a sudden (like the former Muscles) ceasing to be fleshy, its Tendon is united with that of the *Rectus*, together with the former and following Muscles, and inserted with them.

CLXIX.

CRUREUS, *seu* FEMOREUS.

SO called from its Situation on the Bone of the Thigh, like the *Musculus Brachiæus*, on that of the Arm: Its Origination is large and fleshy, being continued from between the greater and lesser *Trochanter* of the Thigh-Bone forwards, to its lower part, that is immediately above its inferiour *Appendix*; hence its fleshy Fibres descending directly, become perfectly tendinous, a little below the upper part of the Tendon of the *Rectus*, where it joins with it and the Tendons of the two last described Muscles, and passes over the external part of the *Patella*, (or on each side of it) and is inserted into a Prominence at the superiour and fore part of the *Tibia*.

THESE four Muscles last treated of, *viz. Rectus, Vastus Externus, Vastus Internus,* and *Crureus,* may be esteemed one, in regard they make but one Tendon at their Insertion, and serve for the same Use in extending the *Tibia*, or Leg, however they are divided into several Bodies, and one of them is inclosed on all sides by the *Fascia Lata*, namely the *Rectus*, and in themselves they have a multiform *Series* of fleshy Fibres, whereby they are render'd capable of performing their Office with greater Strength, which is absolutely necessary, not only in Running, Walking, Leaping, &c. but in Standing, to keep the Body erect, by opposing that Flexure at the Knee, which must otherwise necessarily happen through the superincumbent Pressure made by the whole Body. For this reason likewise we find these extending Muscles in so great a proportion larger than their Antagonists the Benders, which appeared by their Weight, when at the Request of my very good Friend Dr. *Brown*, (then Reader on the Muscular Dissections at Chirurgeons-Hall) these extending Muscles were weighed, and likewise their Antagonists the Benders in the same Body, whereby we found the former exceeded the latter two Pounds wanting an Ounce; the former, namely the *Extensores*, weighing three Pounds six Ounces, and their Antagonists the latter but one Pound seven Ounces. In another Body the Extenders weigh'd four Pounds, eight Ounces and a half, and the Benders but two Pounds two Ounces. Besides which, the Extenders have still a farther Advantage given them by Nature: For, by having a Bony Substance, as the *Patella*, placed between them and the Insertion of their Tendon, their Line of Direction is farther removed from the Center of Motion, and consequently they act with greater Strength in antagonizing the Benders, than they could otherwise have done.

CHAP.

CHAP. XXXIV.
Of the MUSCLES of the FOOT, or TARSUS.
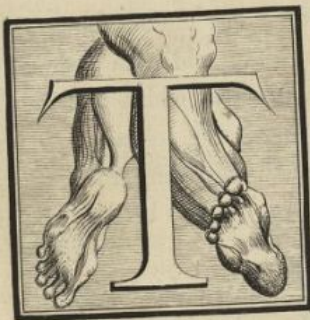
THE Foot has seven Muscles properly employ'd in its Motions, among which is reckon'd the *Plantaris:* But *Columbus**, *Falloppius†*, and other Anatomists, reckon eight Muscles belonging to each Foot, rejecting *Vesalius* his ninth, it being part of the *Extensor Digitorum Longus*, that is inserted into the Metatarsal-Bone of the little Toe. Notwithstanding which we choose to follow‡ *Spigelius*, ** *Veslingius*, and the later Authors, making of their two first the *Gasterocnemius Externus* and *Gasterocnemius Internus* only one Muscle, giving it the Name of *Gasterocnemius Externus*, and calling its subjacent Muscle *Gasterocnemius Internus*, which former Anatomists had named *Soleus*.

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* *Lib.* 5. *Cap.* 30.　　† *Observat. Anatom.*　　‡ *Lib.* 4. *cap.* 24.　　***Cap.* 19.

CLXX.

CLXX.

Tab. LV.
LVI. LXI.

TIBIALIS ANTICUS.

SO called from its Situation on the fore part of the *Tibia*; also by *Spigelius* called *Musculus Catenæ*, because, when it is divided, the Patient is forced to use a Sling to support the Foot in walking. Its Origination is fleshy from the lower part of the superiour Appendage of the *Tibia*, between its Prominence, where the great Tendon of all the extending Muscles of the Leg is inserted, and the Origination of the *Musculus Extensor Magnus Digitorum Pedis:* It also continues a disgregated fleshy Origination from near two thirds of the superiour part of the said *Tibia* externally and laterally, next the *Fibula*; which composing a fleshy Belly, lessens itself in half its Progress; and growing into a strong and somewhat round Tendon, descends obliquely over the inferiour part of the *Tibia*, and under the annular Ligament, and is inserted partly into the inside of the *Os Cuneiforme Majus*, but chiefly into the *Os Metatarsi Pollicis*.

THIS pulls the Foot upwards and forwards directly.

CLXXI.

Tab. LV.
LXII.

GASTEROCNEMIUS EXTERNUS, *seu* GEMELLUS.

SO called, because with the *Soleus*, or *Internus* of the same Name, it composes the Calf of the Leg: It is also called *Gemellus*, from its being as it were double. It has two distinct fleshy Originations, from the superiour and hindmost Parts of each Tubercle of the lower Appendage of the Thigh-Bone, which in their Descent are dilated into two large fleshy Bellies, the innermost of which is thickest and largest, having each a differing *Series* of fleshy Fibres, and joining to each other near where they make a broad strong Tendon, which narrowing it self, joins with the great Tendon of the *Gasterocnemius Internus*, four Fingers breadth above its Insertion into the *Os Calcis*.

RIOLAN * asserts, with *Vesalius*, that in the two Beginnings of this Muscle there are two *Officula Sesamoidea*, which we must acknowledge with *Marchette* have hitherto escaped our Observation, tho' its likely it may be so in aged Bodies, as it appear'd in a Subject I lately dissected on one side only.

WHEN this Muscle acts, the Foot is said to be extended, or pulled backwards; which Motion of it is very necessary in Walking, Running, Leaping, and standing on Tiptoe, *&c.* Hence it is, those that walk much, have these Muscles larger than others, through the frequent use of them, among which those that carry heavy Burthens, and especially Sedans or Chairs in this Town; and those, who wear low-heeled Shoes, have these Muscles remarkably larger than others.

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* *Lib.* 5. *Cap.* 43.

CLXXII.

CLXXII.

PLANTARIS.

Tab. VIII.
LXII.
LXV.

SO called from its Tendon expanded in the *Planta Pedis*, like that of the *Palmaris* in the Palm of the Hand. It arifes flefhy from the fuperiour and back part of the outermoft Tubercle of the lower Appendage of the Thigh-Bone, immediately under the external Beginning of the former Mufcle; and defcending obliquely between it and the following Mufcle, foon becomes a thin flat Tendon, which paffing out from between their flefhy Bellies, defcends internally laterally by their great Tendon; and marching clofe over the *Os Calcis*, joins with other Tendons arifing from the *Os Calcis*; all which expand themfelves on the Sole of the Foot, where they firmly adhere to the flefhy Body of the *Mufculus Flexor Digitorum Perforatus*; fome of them ending on the upper Parts of the *Offa Metatarfi*, and others on both fides the Extremities of thefe Bones, where the Toes are articulated.

WHEN this Mufcle acts, it affifts the *Gafterocnemii*, and its tendinous Expanfion on the bottom of the Foot ferves to defend the fubjacent Mufcles, Tendons, Nerves, and large Blood Veffels, from being too much comprefs'd in ftanding, walking, &c. I have frequently obferv'd the flefhy Beginning and long Tendon of this Mufcle to be wanting.

BESIDES this tendinous Expanfion on the bottom of the Foot, I lately obferv'd a fmall Tendon, or Ligament, arifing from the *Os Metatarfi* of the little Toe, and faftned to the Bone of the fame Name, that fupported the middle Toe; but in this Foot there was no *Mufculus Tranfverfalis*.

CLXXIII.

SOLEUS, *feu* GASTEROCNEMIUS INTERNUS.

Tab. V. VII.
VIII. LV.
LXII.

THIS is placed under the two former Mufcles. Its external flefhy Part is cover'd with a tranfparent tendinous Expanfion, which makes it appear of a livid Colour. Its Beginning is partly tendinous, but chiefly flefhy, from the hindmoft part of the upper *Appendix* of the *Fibula*, and back part of the *Tibia*, below the Infertion of the *Subpopliteus*, and increafes to a large flefhy Belly, compofed of various Orders of flefhy Fibres, fome of them underneath aptly expreffing the Figure of the top of a Feather, whofe *Stamina* here being tendinous, join with the great Tendon, which is about four Fingers breadth in Length, and inferted into the fuperiour and hindmoft part of the *Os Calcis*.

THE Foot, together with the Toes, being as it were a Leaver to the whole Body, ought therefore to be attended with Mufcles of great Strength to extend it; wherefore we find thefe Mufcles fo much to exceed their Antagonift the *Tibialis Anticus*, as well in the advantagious Conftruction of their differing Series of flefhy

E e   Fibres,

Fibres, as their Magnitude, the *Tibialis* weighing only five Ounces and a Quarter, whereas the two *Gasterocnemii* weigh one Pound ten Ounces; whereby they are not only render'd serviceable in Walking, Running, Leaping, &c. but do also support the *Tibiæ* in Standing, lest the superincumbent Pressure of the Weight of the Body should make them incline forwards, at their Articulations with the *Talus.*

CLXXIV.

PERONÆUS PRIMUS.

Tab. V. VIII.
IX. LV. LVI.
LXII. LXVI.

BY some called *Longus,* it being the longest Muscle seated on the *Fibula,* or *Os Perone.* It arises externally tendinous, and fleshy internally, from above half the superiour part of the said Bone; and marching somewhat backwards, becomes a strong, flat Tendon, four Fingers breadth in Length above the inferiour Appendage of the *Fibula* called *Malleolus Externus,* passing behind which in a Chanel, like a Rope in a Pully; and from thence being inflected forwards, together with the Tendon of the following Muscle, they both pass under an imbanding Ligament, as they run over the *Os Calcis*; but this Tendon declining from its Companion, marches over the *Os Cuboides,* under the *Musculus Abductor Minimi Digiti,* over the *Offa Cuneiformia* in the bottom of the Foot, and under the Tendons and Muscles bending the Toes, and is inserted into the superiour and hindmost part of the *Os Metatarsi* of the great Toe.

Tab. LXII.
N.
Tab. LXVI.
*

IN the Tendon of this Muscle is found a Bony Substance, which moves on the *Os Cubiforme,* not unlike the *Patella* of the Knee.

THE Passage of the Tendon of this Muscle over the hindmost part of the *Malleolus Externus,* as on a Pulley, is an elegant contrivance in Nature, whereby the Ball of the great Toe (as that part is commonly called, to which it is inserted) is directed towards a perpendicular bearing of the weight of the Body on the Leg, in standing on Tiptoe.

CLXXV.

PERONÆUS SECUNDUS.

Tab. V. LV.
LVI. LXII.

BY some called *Semi-fibulæus:* It has an acute fleshy Beginning above the middle of the external part of the *Fibula,* under the fleshy Belly of the former Muscle; it also continues its fleshy Beginning from the posteriour sharp edge of the *Fibula,* and becoming a fleshy Belly grows tendinous, as it runs under the *Malleolus Externus,* together with the Tendon of the former Muscle, and is inserted into the superiour and external part of the *Os Metatarsi* of the little Toe.

THE proper Action of this Muscle is to pull the Foot and Toes outwards.

CLXXVI.

CLXXVI.

TIBIALIS POSTICUS.

THIS being placed on the back part of the *Tibia*, is also called *Musculus Nau-ticus*, because Mariners chiefly use it in climbing up the Masts of their Ships. It lies partly under the *Flexor Tertii Internodii Pollicis*, which Muscle must be partly raised, together with the *Flexor Tertii Internodii Digitorum Pedis*, before we can have a clear Sight of it. It appears Biventral, arising partly tendinous and partly fleshy from the superiour and back part of the *Fibula*, as also from the Ligament that is continued between the said Bone and the *Tibia*; in near half its Progress it becomes less, and grows fleshy again, making a strong, flat Tendon, which runs in a *Sinus* on the back part of the lower Appendage of the *Tibia*, called the *Malleolus Internus*, under an annular Ligament, over the *Os Naviculare*, to which it is tack'd down by some tendinous Fibres, and ends internally and laterally on the *Os Cuneiforme Majus*.

THIS draws the Foot upwards and inwards.

IN the Tendon of this Muscle, as in that of the *Peronæus Primus*, I have frequently found a Bony Body, just where it marches over the *Os Naviculare*.

CHAP.
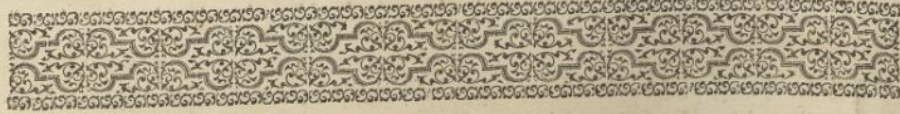
CHAP. XXXV.
Of the MUSCLES *of the* GREAT TOE.

HE great Toe is moved by its proper Muscles, which we reckon to be six in number, namely, *Extensor Pollicis Longus*, and *Extensor Brevis, Flexor Pollicis Longus*, and *Flexor Brevis, Adductor* and *Abductor Pollicis*. Though Anatomists commonly mention but four of these, yet we have observ'd them in several Dissections to be so many distinct Muscles, as they are accurately figured in *Bidloo* *. To these may be added the *Musculus Transversalis Placentini*, which our above-mention'd Author and some other make to be an *Adductor Pollicis*; but we take it rather to be an *Adductor Minimi Digiti*, wherefore it shall be described in the following Chapter.

CLXXVII.

EXTENSOR POLLICIS LONGUS.

THIS Muscle doth not arise, as most describe it, from the *Tibia*, or from the Ligament between it and the *Fibula*. Its Beginning is large and fleshy from the fore part of the *Fibula*, from immediately below its superiour *Appendix*, to four Fingers Breadth above the inferiour one, and descending under the *Ligamentum Annulare* of the *Tarsus*, between the Tendon of the *Tibialis Anticus* and those of the *Extensor Digitorum Pedis Longus*, and marching along the superiour part of the Foot, it is inserted into the upper part of the second Bone of the great Toe.

ITS Name intimates its Use.

THIS Muscle, just where it passes under the annular Ligament, sends off a small Tendon, which is inserted into the upper part of the first Bone of the great Toe externally and laterally, as has been frequently observ'd and demonstrated by that inquisitive and accurate Anatomist, Mr. *Joseph Tanner.*

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* *Tab.* 81. *&* 82.

CLXXVIII.

CLXXVIII.

EXTENSOR POLLICIS BREVIS.

THOUGH this Muscle is not mentioned by Anatomifts, yet we conftantly ob-ferve it in Diffection. It hath been commonly taken for part of the *Extenfor Digitorum Brevis*; but we frequently find it diftinct.

IT arifeth flefhy from the fore part of the *Os Calcis*, and being dilated into a flefhy Belly, foon becomes a long, flender Tendon, paffing obliquely over the upper part of the Foot, and is inferted into the fuperior part of the firft Bone of the great Toe, which it extends or pulls upwards.

CLXXIX.

FLEXOR POLLICIS LONGUS.

THIS is an Antagonift to the *Extenfor Longus*; arifing oppofite to it from the back part of the *Fibula*, with a double Order of flefhy Fibres, running to a middle Tendon, like the *Flexor Tertii Internodii Pollicis Manus* above. It ceafeth to be flefhy as it paffes over the Juncture, and runs through a Chanel on the internal part of the *Os Calcis*, under the Tendon of the *Mufculus Flexor Digitorum Longus Perforans*, to which Tendon it fends off a flefhy Slip over the following Mufcle, and is inferted into the upper end of the fecond Bone of the great Toe.

CLXXX.

FLEXOR POLLICIS BREVIS.

IS fhort, thick, and flefhy, feemingly divided into two Mufcles by the Tendon of the former paffing over it. It arifeth from the fuperiour part of the *Os Cuneiforme medium*, and running over the Termination of the *Mufculus Peronæus Primus*, is implanted into the *Offa Sefamoidea* of the great Toe, which are likewife tied to the fuperiour part of the fecond Bone of that Toe.

CLXXXI.

ADDUCTOR POLLICIS.

THIS is defcrib'd and figur'd by * *Veflingius*, and alfo mention'd by *Marchette*. It arifes with a broad, flat Tendon, from the *Os Calcis*, immediately under the *Mufculus Communis Lumbricalis*, and in half its Progrefs on the bottom of the Foot, it becomes flefhy, juft after it paffes over the Tendon of the *Peronæus Longus*, where it meets with another Beginning partly flefhy, and partly

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* *Cap.* 19.

F f

tendinous,

tendinous, from the inferiour part of the *Os Cuneiforme Tertium*; after which it marches obliquely to its Infertion into the inner *Os Sefamoideum* of the great Toe.

THIS draws the great Toe nearer to the reft.

CLXXXII.

ABDUCTOR POLLICIS.

THIS arifeth flefhy from the *Os Calcis* internally and laterally; in half its Progrefs becoming tendinous, it joins with another flefhy Beginning, fpringing from the *Os Cuneiforme Majus*; both which making one Tendon, join with the *Flexor Pollicis Brevis*, before they are inferted into the external part of the firft Bone of the great Toe laterally.

THIS pulls the great Toe from the reft.

Chap. XXXVI.
Of the MUSCLES *of the* Four Lesser Toes.

HESE (like the Muscles of the Fingers) we shall divide into *Common* and *Proper.*

The *Common* Muscles of the Toes are such, as have their Tendons inserted into all the lesser Toes, as the *Extensor Digitorum Pedis Longus, Extensor Brevis, Perforatus,* and *Perforans.* The rest are the *Proper* Muscles of the Toes, namely, *Lumbricales, Abductor Minimi Digiti, Transversalis Placentini, Flexor Primi Internodii Minimi Digiti Proprius,* and the *Interossei.* Of these in their Order.

CLXXXIII.
Extensor Digitorum Pedis Longus.

Tab. II. V.
LV. LVI.
LXIII.

THIS hath an acute fleshy Beginning externally from the inferiour part of the upper *Appendix* of the *Tibia* next the *Fibula;* as also a long fleshy one from the superiour part of the last named Bone; and lessening it self in half its Descent on the Leg, it joins with a second, broad, disgregated fleshy Beginning, continued for near half the inferiour part of the said *Fibula;* where descending under the *Ligamentum Annulare* of the *Talus,* it is divided into five Tendons, four of which are inserted into the third Bones of all the lesser Toes; the fifth into the superiour part of the *Os Metatarsi* of the little Toe, which Part of it *Vesalius* * makes his ninth Muscle belonging to the Foot.

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* *Lib.* 2. *Cap.* 60.

CLXXXIV.

CLXXXIV.

EXTENSOR DIGITORUM BREVIS.

THIS is a short fleshy Muscle, lying under the Tendon of the former, on the Foot. It ariseth fleshy from the external and fore part of the *Os Calcis*, soon dilating it self to a fleshy Belly; which being divided into four fleshy Portions, becomes so many Tendons, passing over the upper part of the Foot, and joining with the Tendons of the former Muscle, as they pass to their Insertions into the third Bone of each of the lesser Toes.

CLXXXV.

PERFORATUS.

SO called, because its Tendons are perforated, like those of the Fingers. It is also called *Flexor Secundi Internodii Digitorum Pedis*, from its Use, and *Sublimis* from its Situation. It springeth from the inferiour and internal Part of the *Os Calcis*, between the *Musculi Abductores* of the greater and lesser Toes. Dilating it self to a fleshy Belly, after it hath passed the middle of the *Planta Pedis*, it is divided into four fleshy Portions, which become so many Tendons, and are divided near their Terminations, to admit the Tendons of the following Muscle to pass through them to their Insertions; these being united again, pass underneath the other to their Implantations at the upper part of the second Bone of each lesser Toe.

CLXXXVI.

PERFORANS.

SO called, because its Tendons run through the Fissures in the Tendons of the former: It is also called *Flexor Tertii Internodii Digitorum Pedis* from its Use. It hath an acute fleshy Origination from the back part of the *Tibia*, immediately under the *Musculus Subpopliteus*, having a double Order of Fibres united in a middle Tendon, like the *Flexor Pollicis Longus*, but ceaseth to be fleshy, as it passeth behind the *Malleolus Internus*; and running in a Chanel over the internal Part of the *Os Calcis*, under its imbanding Ligaments, in half its Progress through the sole of the Foot, it is divided into four Tendons, which march through the Perforations of the Tendons of the former Muscle, and are inserted into the third Bone of every lesser Toe.

CLXXXVII.

CLXXXVII.

LUMBRICALES.

SO called from their Figure, like those of the Hand. Though Anatomists have generally describ'd them as arising from the Tendons of the last treated of Muscle, yet we rather think the *Carnea Massa* in the *Planta Pedis* is their true Origine. It springs from the internal Part of the *Os Calcis*, and becoming tendinous, joins with the Tendons of the former Muscle, in the middle of the Sole of the Foot; then dividing it self into four (as it were) distinct fleshy Muscles, they all become tendinous at their Insertions into the internal Parts of each lesser Toe laterally, next the great Toe.

CLXXXVIII.

ABDUCTOR MINIMI DIGITI.

ARISES outwardly tendinous, and inwardly fleshy, from the external part of the *Os Calcis*; and becoming entirely tendinous in half its Progress on the bottom of the Foot, passes over a small fleshy Muscle, which I call *Flexor Primi Internodii Minimi Digiti Proprius*, and is afterwards inserted into the first Bone of the little Toe externally and laterally.

CLXXXIX.

TRANSVERSALIS PEDIS.

SO called from its transverse Situation. It arises tendinous from the internal *Os Sesamoides* of the great Toe; and becoming a fleshy Belly in its Progress over the Metatarsal Bones of the two next Toes, grows broader, where it joins with a tendinous Ligament springing from the *Os Calcis*, and is inserted into a Cartilage on the first Articulation of the third lesser Toe, sending some fleshy Fibres likewise to the little Toe.

Its Use is to bring the lesser Toes nearer to the great Toe.

CXC.

FLEXOR PRIMI INTERNODII MINIMI DIGITI PROPRIUS.

IS a short fleshy Muscle, springing from the *Os Metatarsi Minimi Digiti*, and passing directly to its Insertion into the first Bone of the little Toe. In its Tendon are contained two *Ossa Sesamoidea*.

G g

THOUGH

THOUGH this is a diſtinct Muſcle, it has been commonly look'd on as a part of the *Abductor Minimi Digiti*; but, if you raiſe the laſt named Muſcle from its Origine, you will not find any Connexion between it and this.

CXCI.

Tab. LXIV.
LXVI.

INTEROSSEI PEDIS.

ARE eight ſmall fleſhy Muſcles, ariſing from the *Offa Metatarſi* of the leſſer Toes. Theſe are all alike in their Origine, Progreſs and Inſertion, filling the concave inferiour Surface of the Metatarſal Bones. Each of them becoming a Tendon, which has an *Os Seſamoides* placed in it, unites with its Fellow on the oppoſite Side, having one common inſertion into the ſuperiour and under part of the firſt Internode of the Toe.

WHEN theſe Muſcles act together, they bend the Toes: When they act ſeparately, thoſe that are placed on the inſide of each leſſer Toe, draw the leſſer Toes towards the great Toe, and the oppoſite ones pull them the contrary way.

EXPLANATION

OF THE

TABLES.

TAB. I.

*Reprefents the Mufcles appearing on the fore Side of a human
Body, after the external Teguments are removed.*

a   The Parotide Gland.
c   The Maxillary Gland.

TAB. II.

*The fame Body, with fome of the external Mufcles raifed, and
others taken off.*
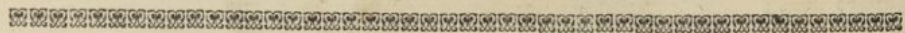
TAB. III.

Shews the fame Body farther denuded.

A *a* B   Three Perforations in the Diaphragm, for
A   The *Vena Cava,*
a   The *Oefophagus,*
B   The *Aorta.*

TAB. I.

TAB. II.

TAB. III.
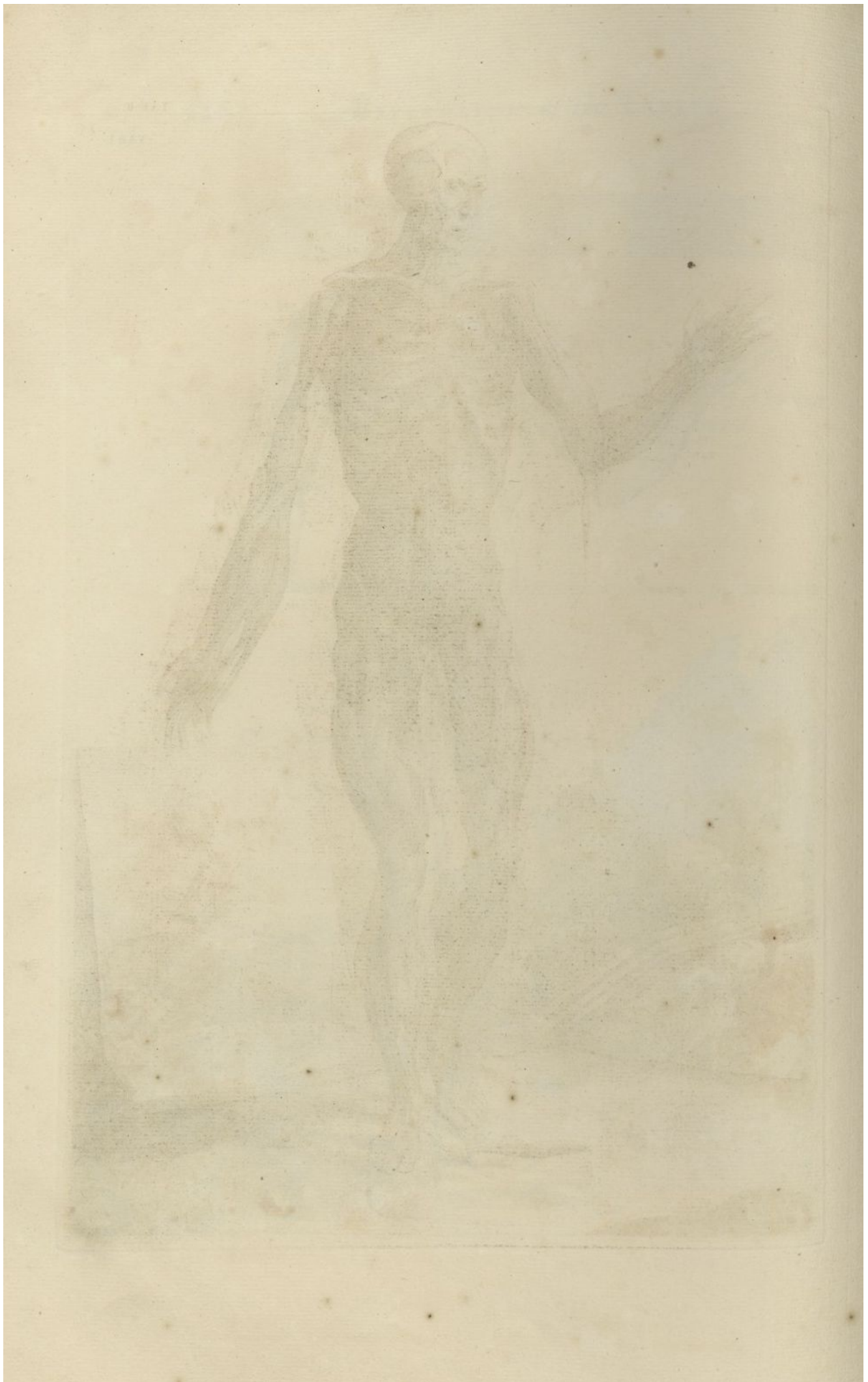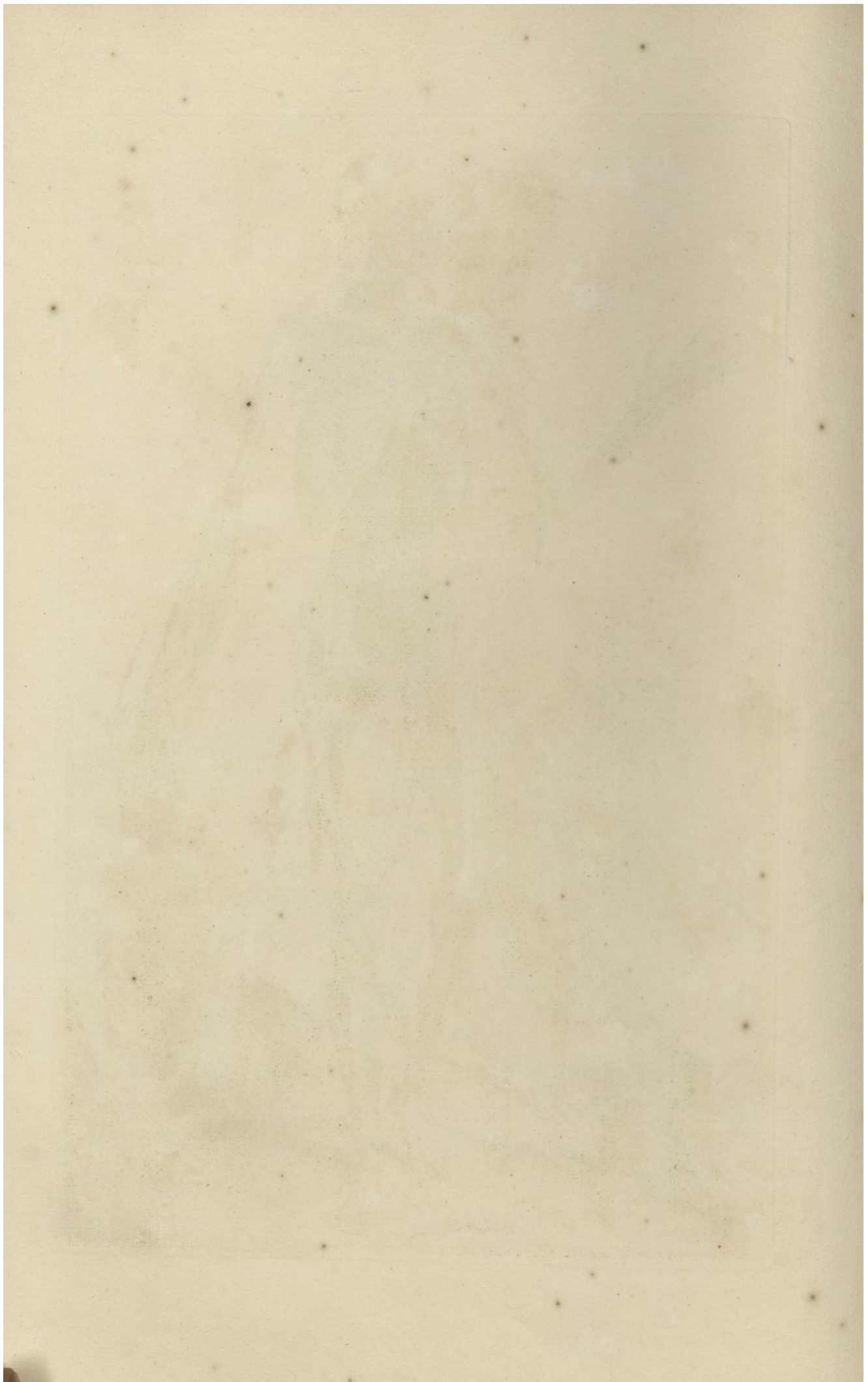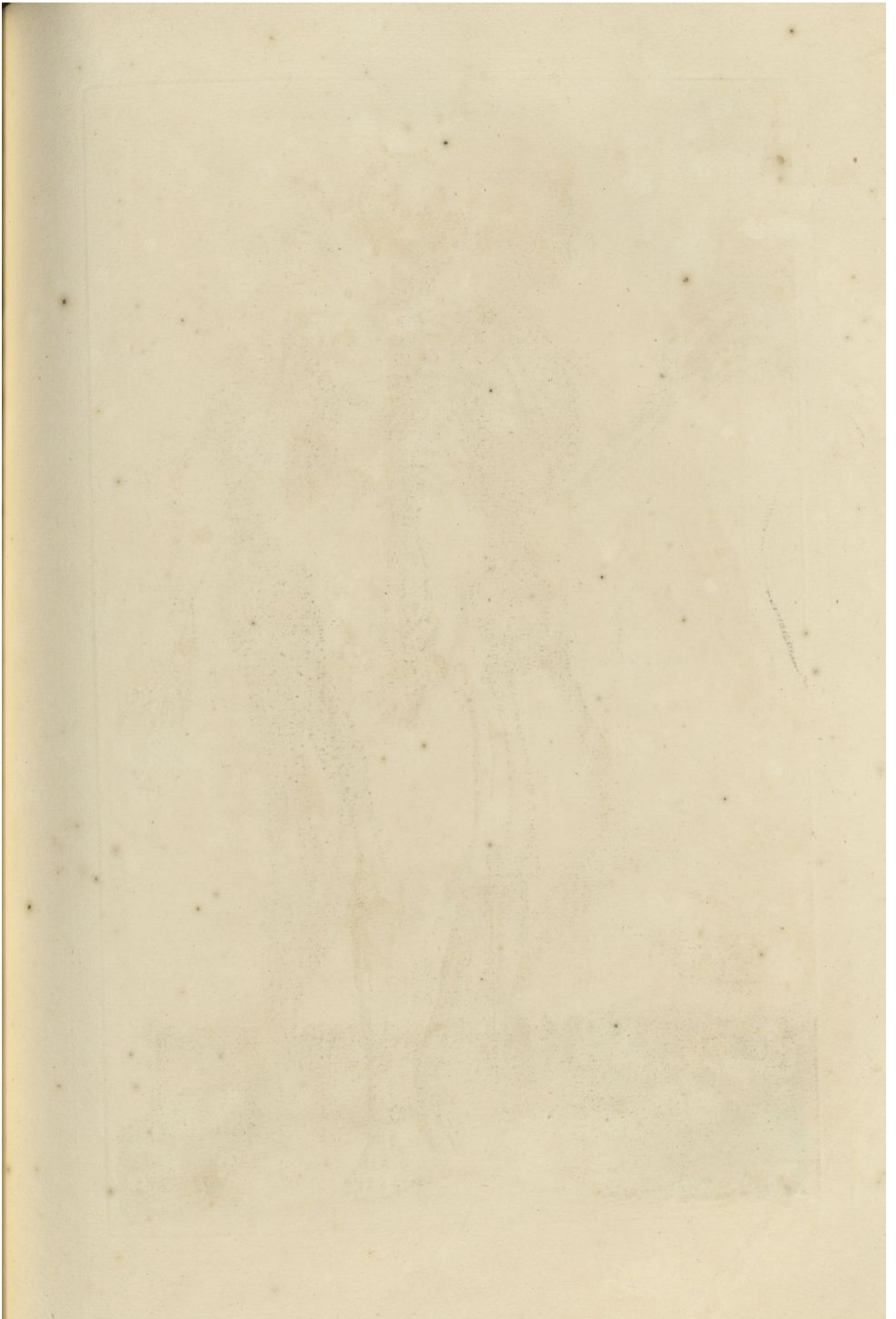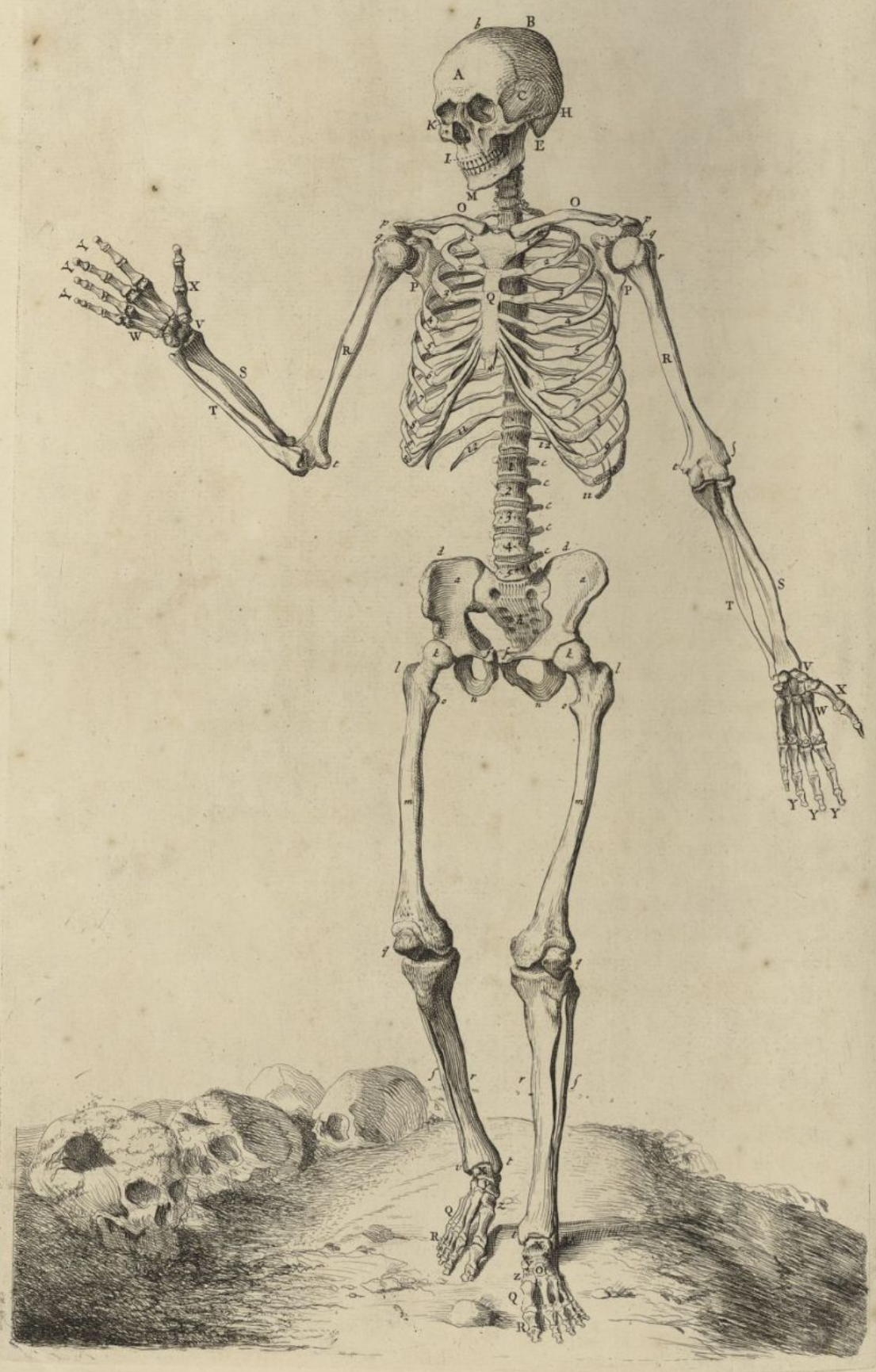
TAB. IV.

TAB. IV.

Shews the fore Part of the Skeleton of a Man.

A   *Os Frontis.*

B   *Os Sincipitis.*

b   The meeting of the Coronal and Sagittal Sutures.

C   *Os Temporum.*

E   The Mastoide Process.

H   *Os Jugale.*

I   The upper Jaw-Bone.

K   The Bones of the Nose.

M   The lower Jaw-Bone.

O   The Clavicle.

P   The *Scapula.*

p   *Acromium.*

q   *Processus Coracoides.*

Q   *Sternum.*

R   *Os Humeri.*

r   A *Sulcus,* in which passes one of the Heads of the *Biceps.*

ſ   The outer Protuberance of the *Humerus,* from which arise the Muscles extending the Wrist and the Fingers.

t   The inner Protuberance, whence the Benders of the Wrist and Fingers arise.

S   The *Radius.*

T   The *Ulna.*

V   The Bones of the *Carpus.*

W   of the *Metacarpus.*

X   of the Thumb.

Y   of the Fingers.

1, 2, 3, &c.   The twelve Ribs.

1, 2, 3, 4, 5.   The *Vertebræ* of the Loins.

c, c, c, c, c.   Their transverse Processes.

a   *Os Ilium.*

d   Its Spine.

h   *Os Sacrum.*

f   *Os Pubis.*

n   *Ischium.*

m   The Thigh-Bone.

k   Its Head.

l   The great *Trochanter.*

o   The lesser *Trochanter.*

q   The *Patella.*

r   The *Tibia.*

H h

ſ The

ſ   The *Fibula*.

t   The inner Ankle.

v   The outer Ankle.

x   The *Aſtragalus*.

y   *Os Naviculare*.

z   *Os Cuneiforme*, that joins the *Os Metatarſi* of the great Toe.

O   *Os Cuneiforme* of the ſecond Toe.

Q   The Bones of the *Metatarſus*.

R   The Bones of the Toes.

T A B.

TAB. V.

I.   II.
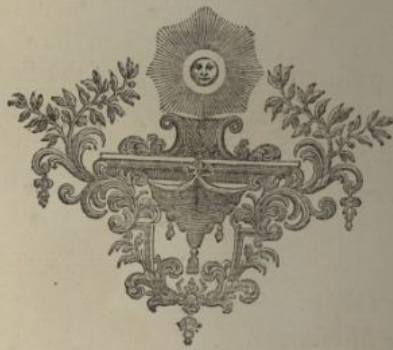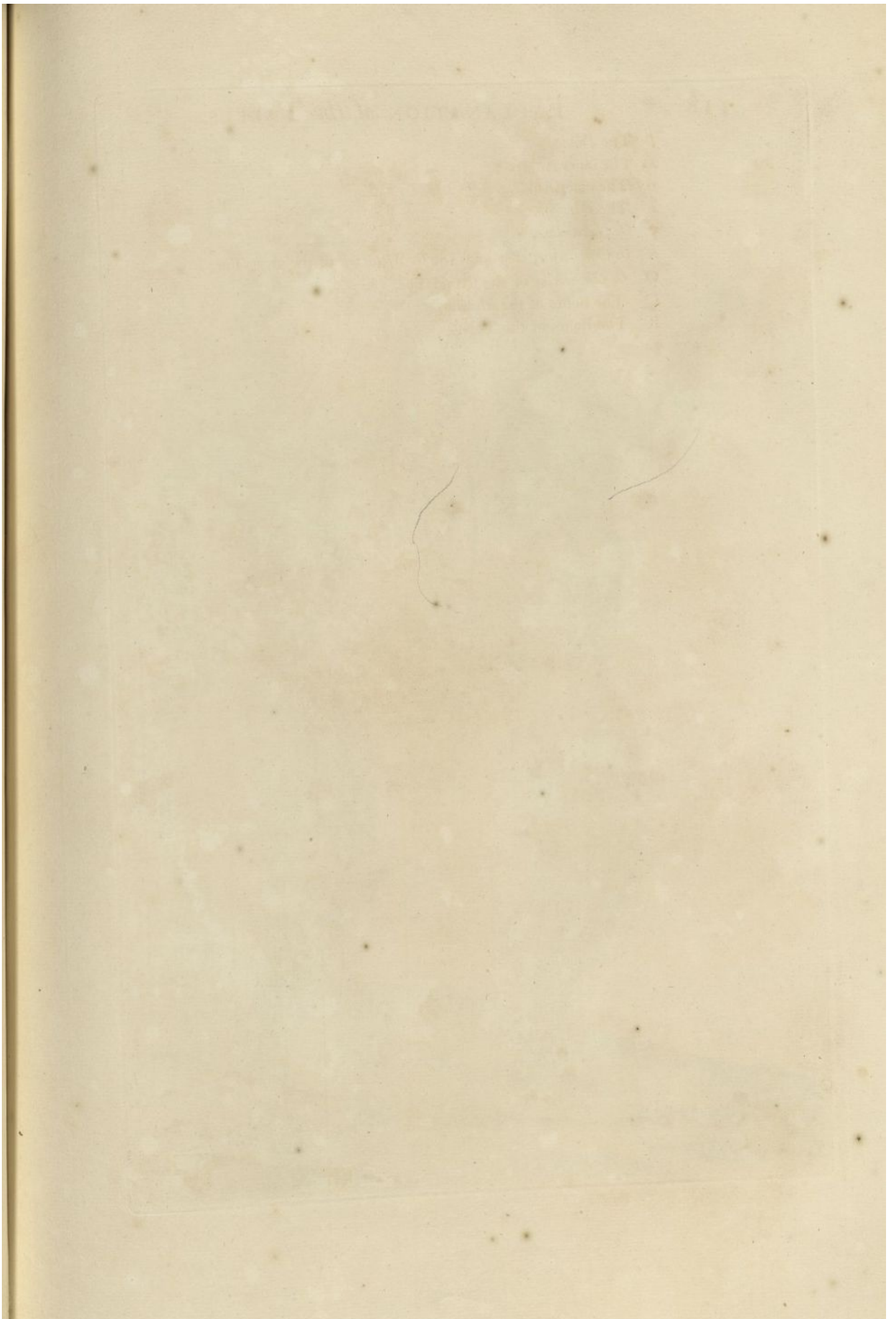
TAB. V.

Represents the Body in a Side View.

FIG. I.

A The *Os Jugale.*
C The Parotide Gland.
D The Submaxillary Gland.
G The Clavicle.
H The *Acromium.*
m The *Olecranum.*
n The lower Extremity of the *Ulna.*
✦ The annular Ligament of the *Carpus.*
N A large Branch of the Brachial Nerve, which paſſes in a Chanel on
P The inner Protuberance of the *Os Humeri.*
Q The Spine of the *Os Ilium.*
R The great *Trochanter.*
Y The Inſertion of the *Sartorius, Gracilis,* and *Semitendinoſus* in the *Tibia.*
Z The lower *Appendix* of the *Fibula,* or the outer Ankle.
* The lower *Appendix* of the *Tibia,* or the inner Ankle.
✦ The Ligament, under which paſs the Tendons of the *Tibialis Anticus,* and
     Extenſor Longus Digitorum Pedis.

FIG. II.

A The *Os Jugale.*
B The Maſtoide Proceſs bared.
E Part of the lower Jaw laid bare.
F The internal Jugular Vein.
G The Clavicle.
H The Spine of the *Scapula.*
I The *Sternum.*
K The *Proceſſus Coracoides,*
L The upper Part of the *Os Humeri* laid bare.
l The outer Protuberance of the *Humerus* bared.
M Part of the *Ulna.*
m The *Olecranum.*
n The lower Extremity of the *Ulna.*
o The Head of the *Radius.*
N The Nerve, and
P The *Sulcus,* as in the preceding Figure.

<div align="right">Q The</div>

Q   The Spine of the *Os Ilium.*
R   The great *Trochanter.*
S   The *Os Sacrum.*
T   The obtuse Procefs of the *Ifchium.*
V   The Trunk of the crural Nerve.
X   The *Patella.*
Y   The upper Part of the *Tibia* bared.
y   The Blood Veffels paffing between the Bones.
Z   The outer Ankle.
*   The inner Ankle.

TAB.
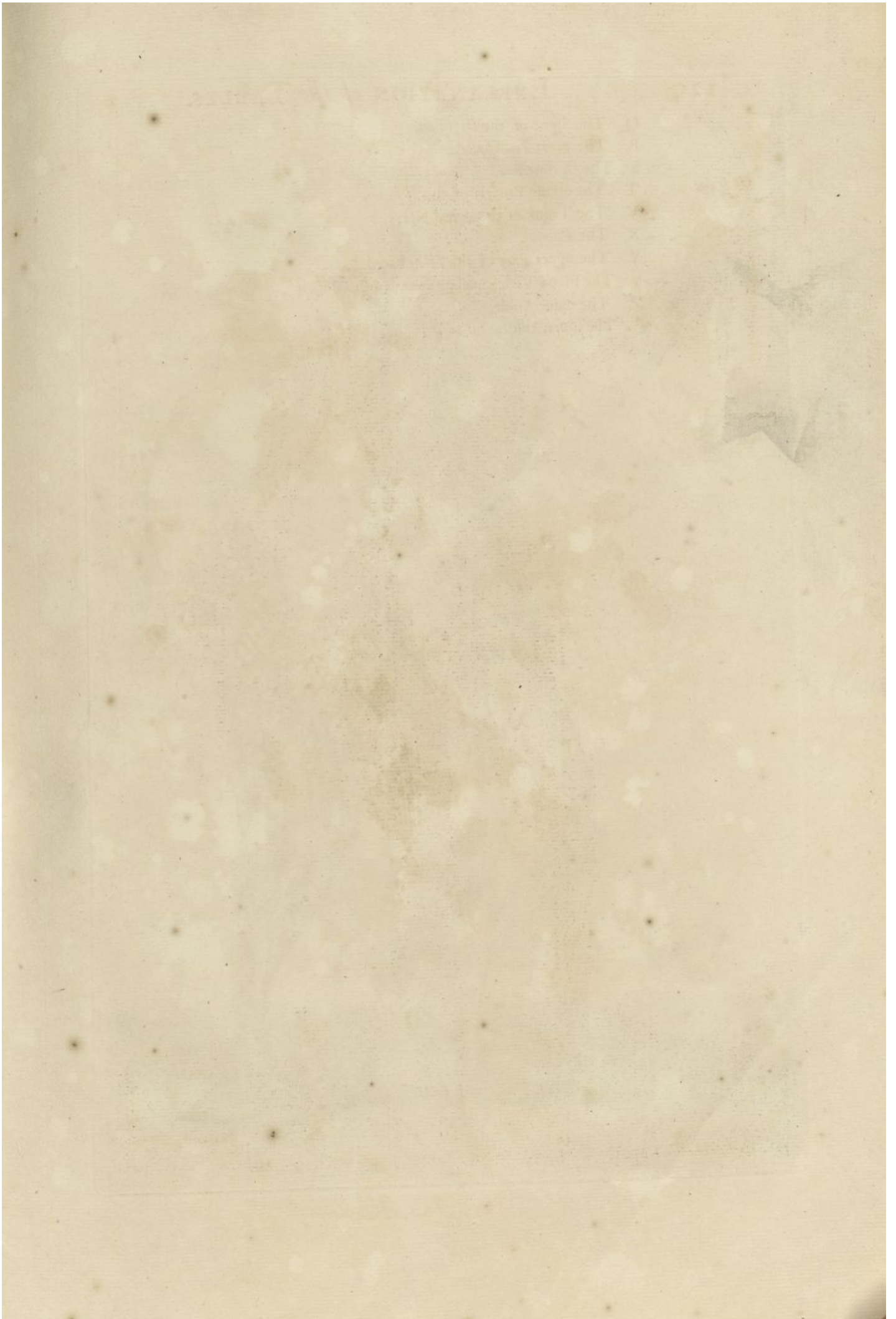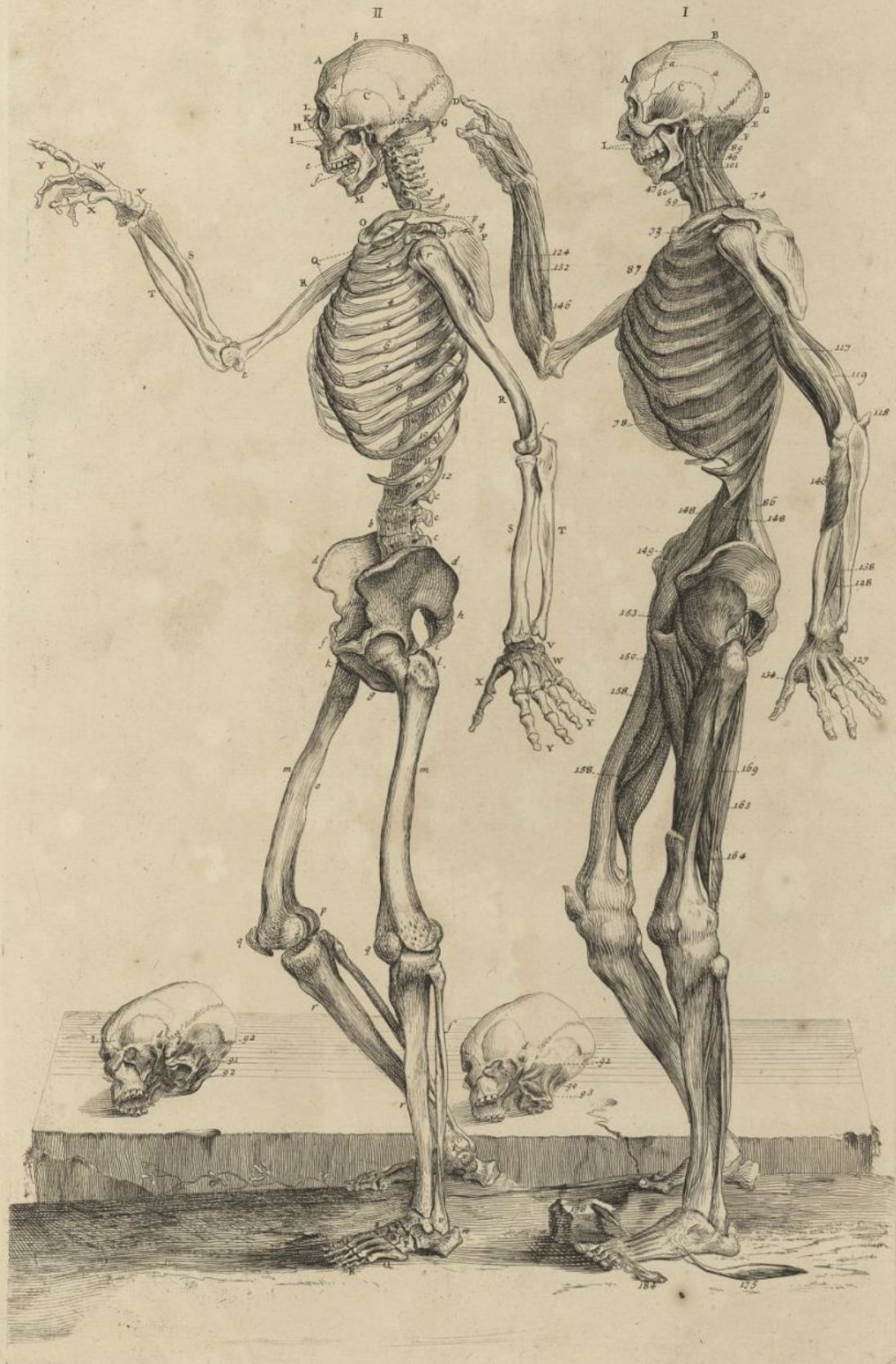
TAB.VI.

T AB. VI.

Reprefents the Side View of the Body partly denuded, and of the
Skeleton.

F I G. I. II.

A The *Os Frontis.*
B The *Bregma.*
C The *Os Temporale.*
D The *Os Occipitis.*
E *Proceffus Mammillaris.*
F *Proceffus Styloides.*
G *Meatus Auditorius.*
I *Maxilla Superior.*

a a The femicircular Afperity of the *Os Bregmatis,* from which the temporal Mufcle arifes.

F I G. II.

H *Os Jugale.*
K *Os Nafi.*
L Part of the Sphenoidal Bone.
M The lower Jaw-bone.
b The Union of the Sagittal and Coronal Sutures.
c The Rife of the Occipital Mufcle.
e The *Proceffus Corone.*
f The *Proceffus Condyloides.*
N The Bodies of the *Vertebræ Colli.*

1, 2, *&c.* 9. Their Spinal Proceffes, with thofe of the two uppermoft of the Back.

O The *Clavicula.*
P The *Scapula.*
p The *Acromium.*
q The *Proceffus Coracoides.*
Q The *Sternum.*
R The *Humerus.*
r The *Sulcus,* in which runs the Tendon of one Head of the *Biceps.*
f The outer Protuberance of the *Humerus.*
t The inner Protuberance.
S The *Radius.*
T The *Ulna.*
V The Bones of the *Carpus.*
W The *Metacarpus.*
X The Bones of the Thumb.
Y   of the Fingers.

I i

The

1, 2, 3, &c.   The twelve Ribs.

b   The Bodies of the *Vertebræ Lumborum.*

c, c, c.   Their Spinal Proceſſes.

d   The Spine of the *Os Ilium.*

f   The *Oſſa Pubis.*

g   The *Os Iſchium.*

h   The *Os Sacrum.*

i   *Os Coccygis.*

k   The Head of the *Os Femoris.*

l   The great *Trochanter.*

m   The Thigh Bone.

o   The *Linea Aſpera.*

p   The lower *Appendix*, with its two Heads, from which the *Gaſterocnemius* and *Soleus* ariſe.

q   The *Patella.*

r   The *Tibia.*

ſ   The *Fibula.*

t   The lower *Appendix* of the *Tibia*, or the inner Ankle.

v   The lower *Appendix* of the *Fibula*, or the outward Ankle.

w   The *Os Calcis.*

x   The *Aſtragalus.*

y   The *Os Naviculare.*

Z, O   The *Oſſa Cuneiformia.*

p   The *Os Cuboides.*

Q   *Oſſa Metatarſi.*

R   The Bones of the Toes.

F I G. III. IV.

L   Part of the Sphenoidal Bone.

d   The *Meatus Auditorius.*

TAB.

TAB. VII.

TAB. VIII.

Myotomia reformata : or an anatomical treatise on the muscles of the human ... - page 238 sur 434
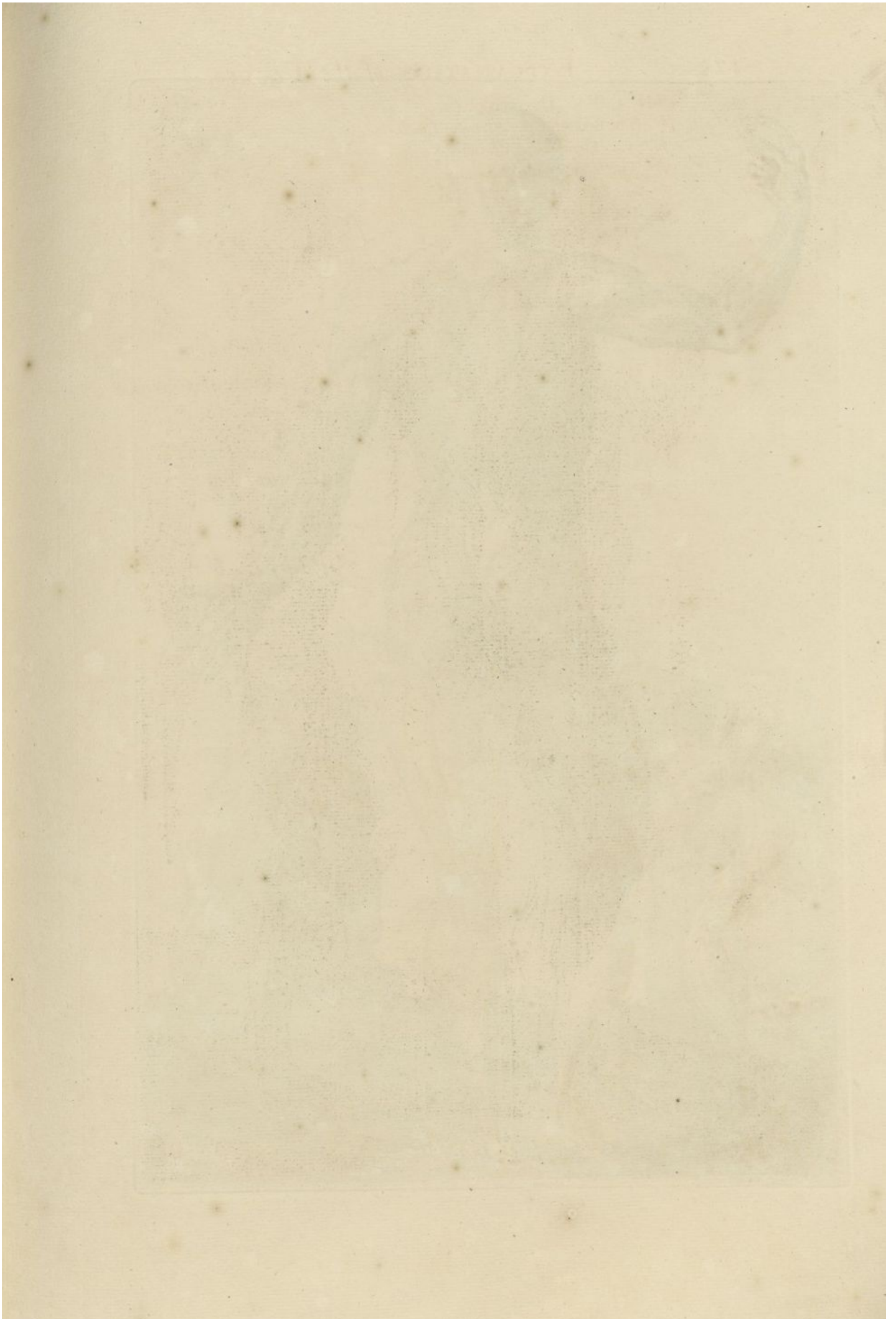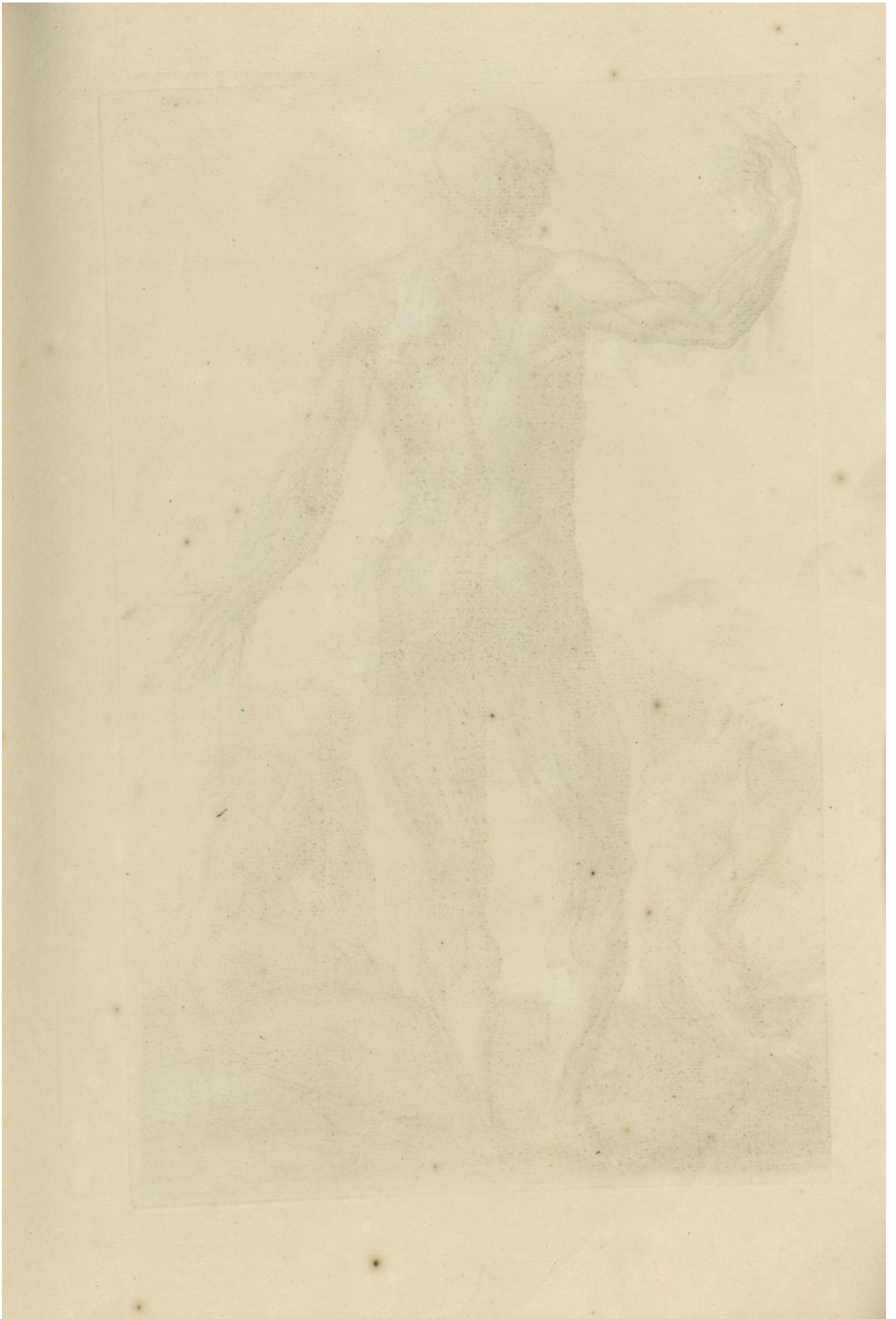
TAB. VII.

Shews the back View of the Body of a Man.

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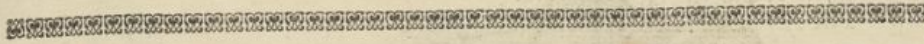
TAB. VIII.

The same Body with some of the external Muscles taken off.

a The Rise of the *Ligamentum Colli* from the *Os Occipitis*.
b The lower Jaw-bone partly bared.
c The *Clavicula*.
d The *Acromium*.
e The *Scapula*.
O The *Olecranon*.
P The outer, and
Q The inner Protuberance of the *Os Humeri*.
f The Spine of the *Os Ilium*.
g The Ligament between the obtuse Proces of the *Ischium* and the *Os Sacrum*.
H The great *Trochanter*.
h The obtuse Proces of the *Ischium*.
i Part of the *Os Ischium* laid bare.
k The Trunk of the Crural Nerve.
l The inner Head of the lower *Appendix* of the Thigh Bone.
m The Head of the *Tibia*.
n The outer Ankle.

TAB.

TAB. IX.

Reprefents the fame Body, with more of the Mufcles removed.

a   The Rife of the *Ligamentum Colli* from the *Occiput.*
c   The *Clavicula.*
d   The *Acromium.*
e   The *Scapula.*
o   The Olecranon.
P   The outer, and
Q   The inner Protuberance of the *Humerus.*
R   The Ligament between the *Radius* and *Ulna.*
f   The Spine of the *Os Ilium.*
h   The acute Procefs of the *Ifchium.*
L   The obtufe Procefs of the fame Bone.
g   The *Os Sacrum.*
o   The *Os Coccygis.*
i   The Head of the *Os Femoris* cover'd with the *Ligamentum Latum.*
k   The great *Trochanter.*
⊙   The Crural Artery.
l   The *Tibia.*
m   The *Fibula.*
n   The *Calcaneus.*

T A B.

TAB. IX.
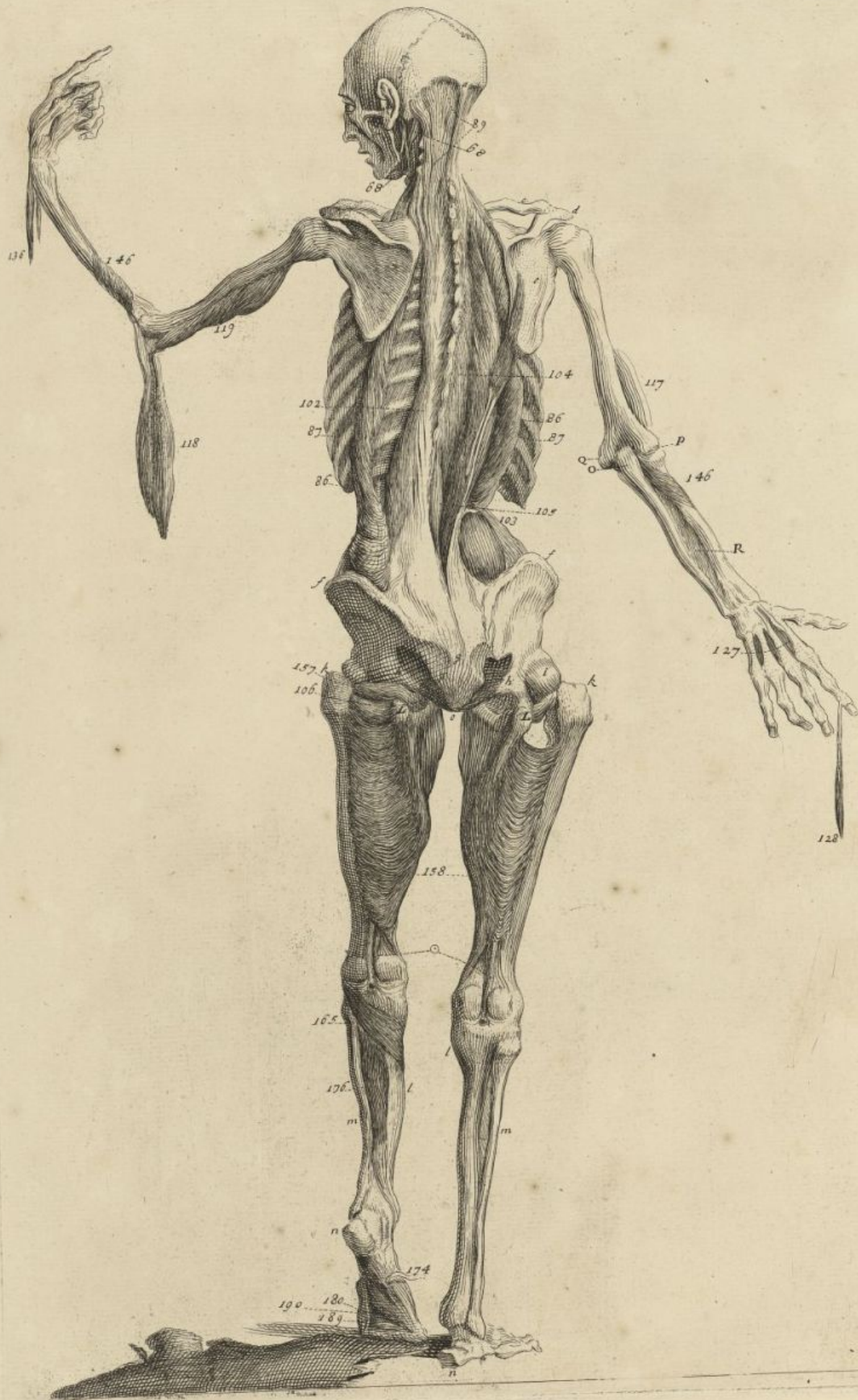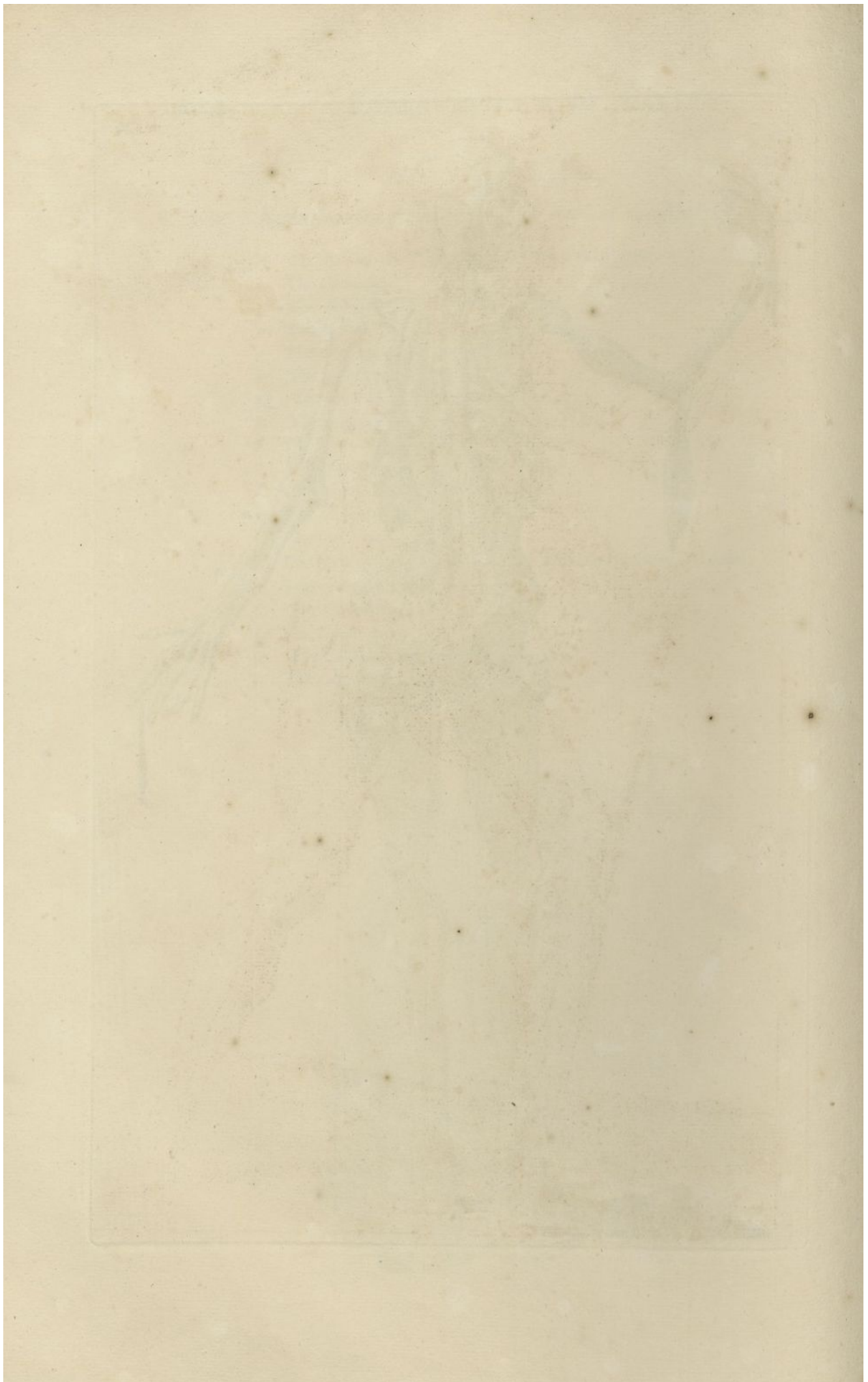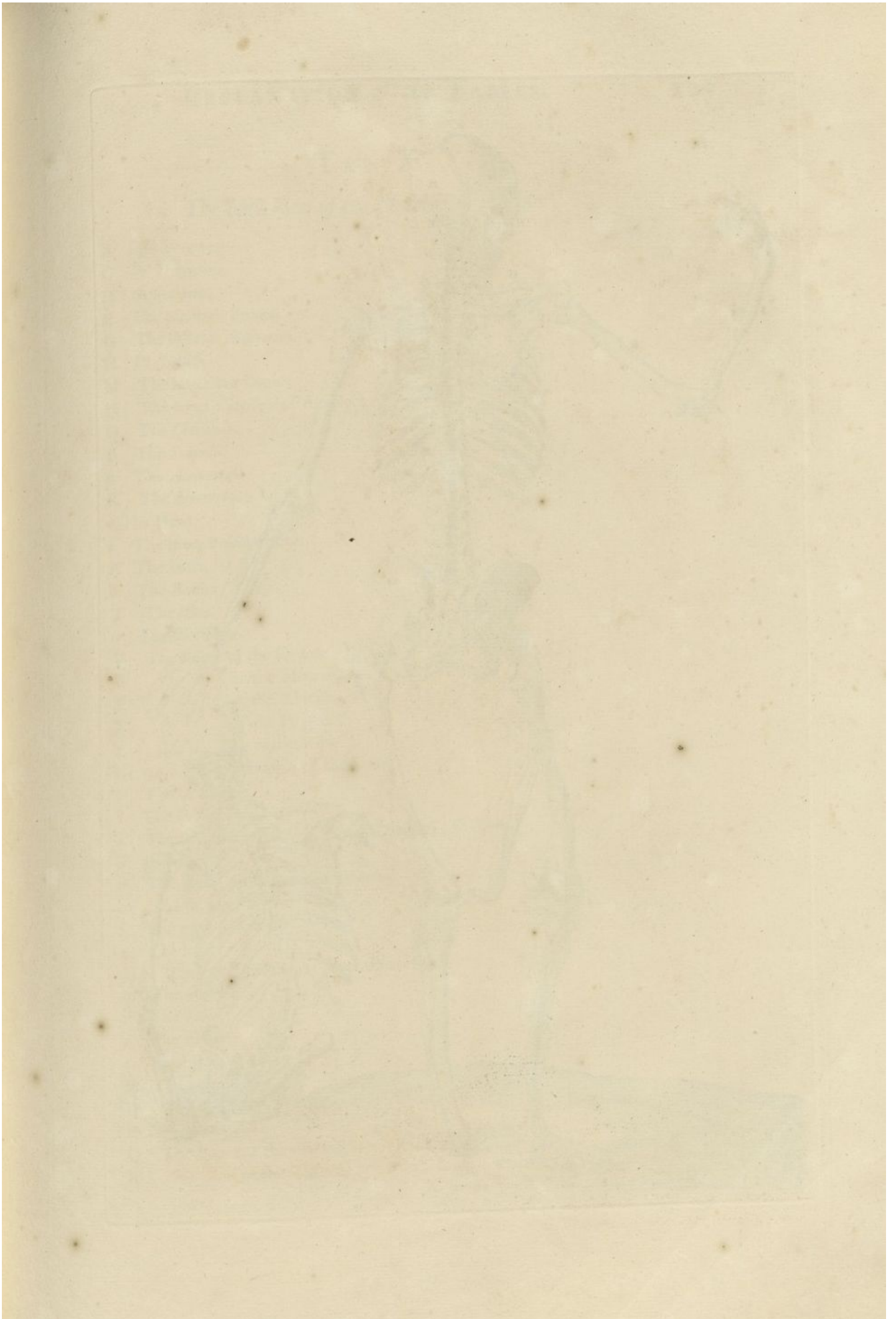
TAB. X.

TAB. X.

The back View of the Skeleton of a Man.

B   *Ossa Bregmatis.*
C   *Os Temporale.*
D   *Os Occipitis.*
E   The Maftoide Procefs.
G   The *Meatus Auditorius.*
H   *Os Jugale.*
M   The lower Jaw-bone.
N   The feven *Vertebræ* of the Neck.
O   The *Clavicula.*
P   The *Scapula.*
p   The *Acromium.*
R   The *Humerus.*
r   Its Head.
t   The inner Protuberance.
ſ   The outer.
S   The *Radius.*
T   The *Ulna.*
u   The *Olecranon.*
V   The Bones of the *Carpus.*
W   of the *Metacarpus.*
X   of the Thumb.
Y   of the Fingers.
1, 2, 3, &c.   The twelve Ribs.
c, c, c, c, c.   The *Vertebræ* of the Loins.
b   The *Os Sacrum.*
i   The *Os Coccygis.*
a   The Rife of the *Glutæus Minimus* from the *Os Ilium.*
d   Its Spine.
n   The obtufe Procefs of the *Ifchium.*
m   The *Os Femoris.*
l   The great *Trochanter.*
o   The lefſer.
p, p   The two Heads of its lower *Appendix.*
q   The *Patella.*
r   The *Tibia.*
ſ   The *Fibula.*
t   The inner,
v   The outer Ankle.
W   The *Os Calcis.*
P   The *Os Cuboides.*
Q   The Bones of the *Metatarſus.*
R   of the Toes.

K k   T A B.

TAB. XI. XII. XIII.

These Figures are chiefly design'd for the Use of Painters and Statuaries. The Outlines are copied from some of the greatest Masters, and the Muscles are laid in from the Life.

TAB.

TAB.XI.

TAB. XII.

TAB. XIII.

TAB.XIII.
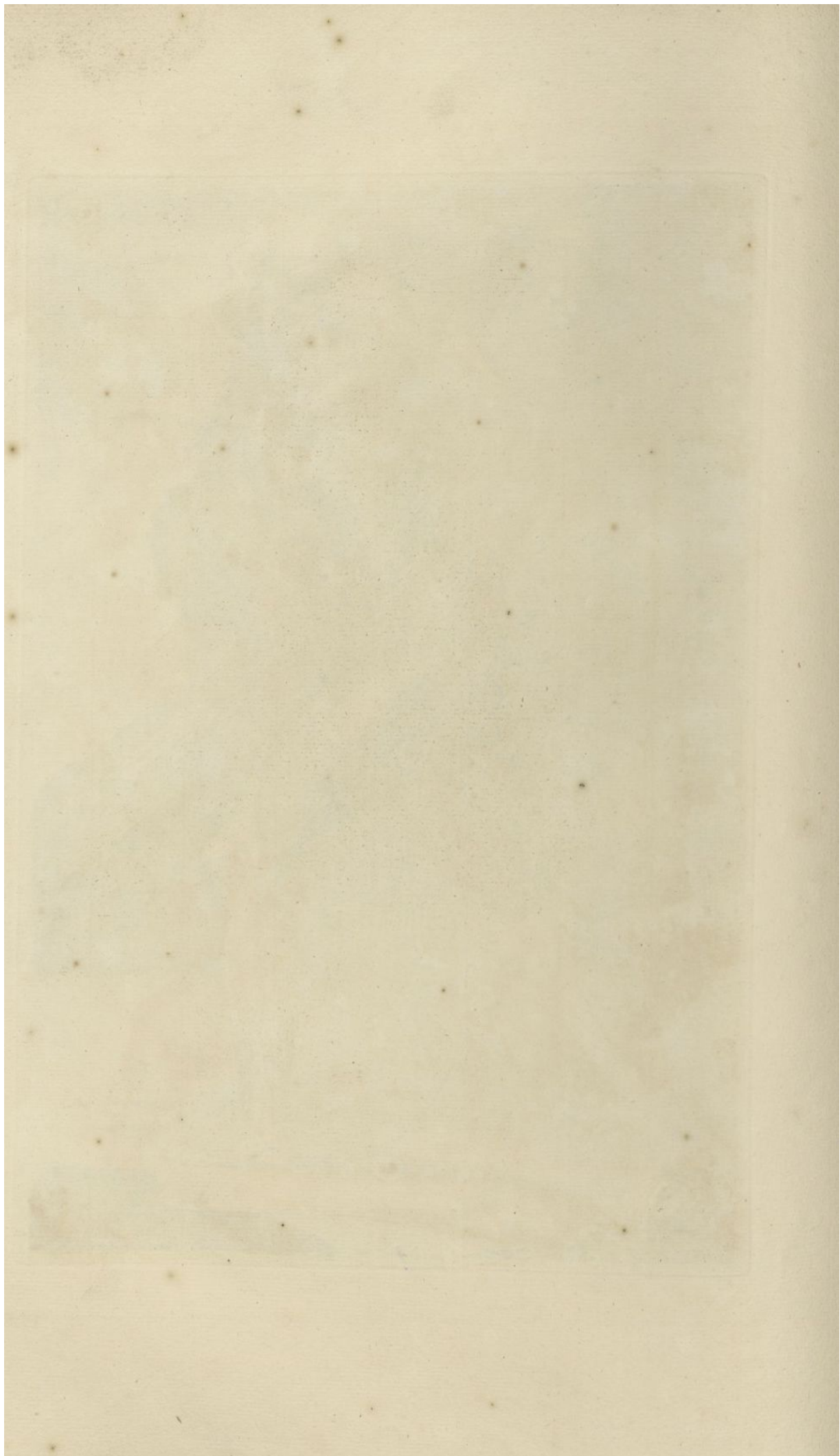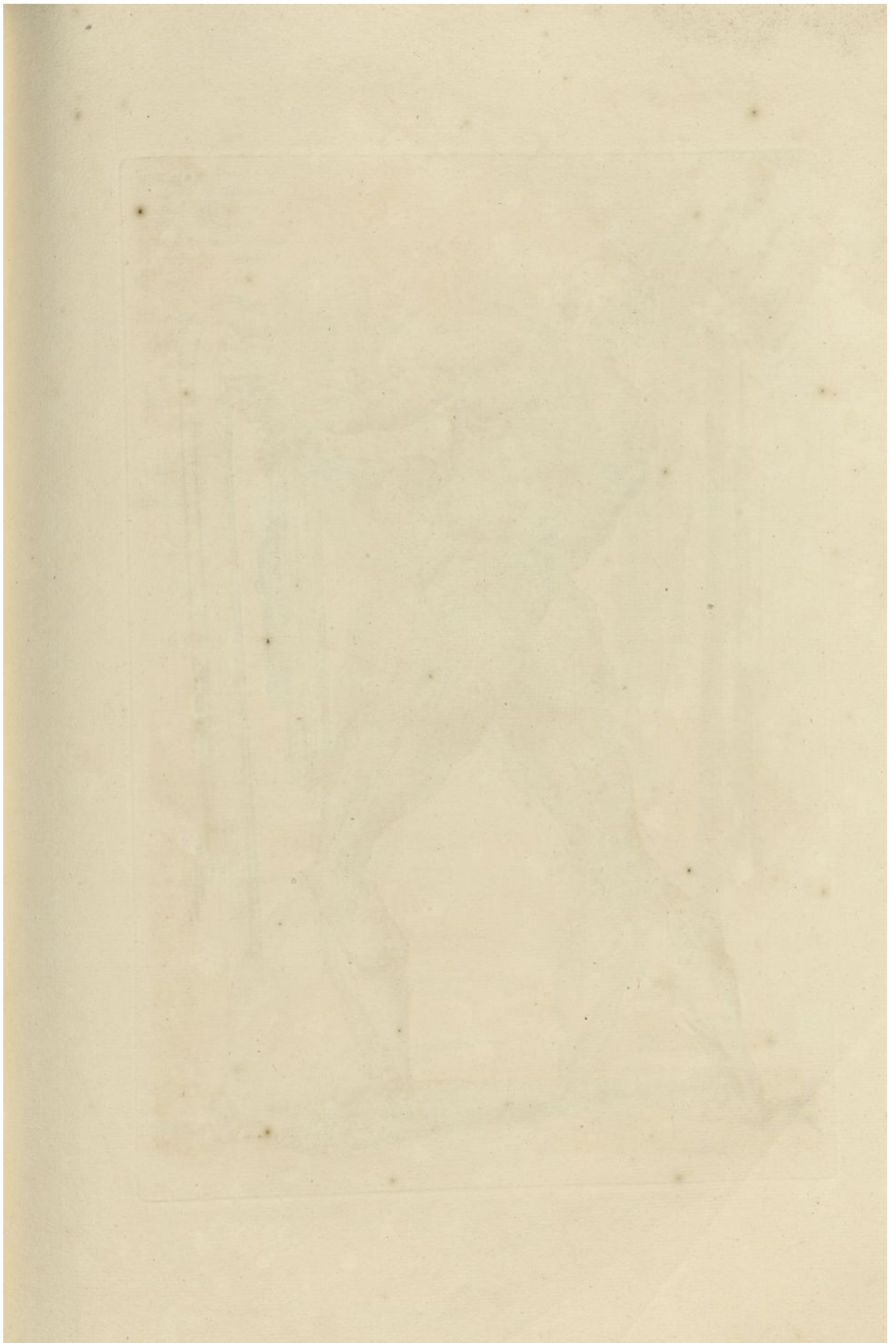
a. Spinæ Vertebrarum
b. Basis Scapulæ
✳ Spinæ Scapulæ
c. Ulnæ Appendix inferior
d. ———————— superior

Occipitalis

Temporalis
94 Mastoideus
Splenius
81 Cucullaris

Sacrolumbalis
82 Rhomboides

Latissimus dorsi
e Ossis Ilium spina

151 Glutæus major

f Trochanter major

158 Triceps
Gracilis
164 Semimembranosus
163 Seminervosus
162 Biceps

g Nervus popliteus

Deltoides
110 Infraspinalis
112 Retundus major
minor
Gemellus

94
81

145

Anconæus
Supinator Radij long
139
Perforatus
140
Palmaris long
Obliquus
descendens
Glutæus
medius

Membra-
nosus

Extensor Carpi Radialis
Extensor Digitorum comunis
Musculi Digiti Extensor
Extensor Pollicis
Abductor Indicis
+ Ligamentum Anulare
Increscit
Abductor minimi
Digiti
Ulnaris
Extensor
Ulnaris
Flexor

Interstitium Adipe
repletum
Sartorius

Gasterocnemius
externus

Gasterocnemius
internus

Plantaris Tendo

Flexor Digitorum pedis Perforans
Tibialis postici Tendo
Malleolus internus
Tibialis Antici Tendo

Abductor pollicis

162
163

Vastus externus

164
g

Patel
-la

Peroneus primus
Peroneus secundus
Digitorum Extensoris
Pedis longi Tendines
Malleolus externus
Extensor digitorum
pedis brevis

Abductor minimi digiti

TAB. XIV.

Obliquus Descendens

TAB. XIV.

1 *Shews the internal Surface of the* Mufculus Obliquus De-
fcendens, *when diffected and difplay'd.*

5, 6, 7, 8, 9, 10, 11, 12. Its Originations cut from the fifth, fixth, feventh,
eighth, ninth, tenth, eleventh, and twelfth Rib: The fuperiour three or four
Digitations being taken from between the like Endings of the *Serratus Major
Anticus.*

AA Its broad membranous Tendon, which terminated in the *Linea Alba,*
Spine of the *Os Ilium,* and fore part of the *Os Pubis.*

BB Part of the Tendon of the *Afcendens,* that cleaves infeparably to that of
the *Defcendens.*

C A Fiffure, commonly call'd a Perforation, in the Tendon of the *Defcendens,*
in which the Spermatick Veffels pafs to the *Scrotum.*

c The lower Margin of the Tendon of the *Defcendens,* call'd by fome the *Li-
gamentum Pubis,* cut from the Spine of the *Os Ilium* and *Os Pubis,* turn'd in towards
the Cavity of the *Abdomen,* as here exprefs'd. See Tab. XV. LL.

DD That part of this Mufcle, which is fix'd to the Spine of the *Os Ilium,* and
is employ'd in turning the Trunk of the Body to the contrary Side.

B The Blood Veffels of its lower Part.

TAB.

TAB. XV.

2 *The* Musculus Obliquus Afcendens, *with the* Rectus *and part of the Tendon of the* Defcendens, *together with the* Teftis *of the Left Side diffected and difplay'd*; *to fhew not only the Progrefs and Union of the Tendons of the two oblique Mufcles, over that of the* Rectus, *but the Artifice of Nature in tranfmitting the Spermatick Veffels from the Cavity of the* Abdomen *to the* Teftes, *whereby the conftant falling down of the fmall Guts into the* Inguina *and* Scrotum *is prevented.*

A B   The tendinous part of the *Afcendens*, that fprings from the Spine of the *Os Ilium* backwards.

B B   Its flefhy Part, which arifes from the anteriour Part of the Spine of the *Ilium*.

a b c   That part of the *Afcendens* that is fix'd to the lower Margin of the inferiour Rib, and is employed in bringing the Trunk of the Body towards the back part of the *Os Ilium* of the fame Side, in which Action it is affifted by the *Obliquus Defcendens* on the contrary Side, as before noted.

C D   A part of the *Afcendens*, that lies between the eleventh and twelfth Ribs.

D D   The Tendon of the *Afcendens* paffing over the *Rectus*, where it was fairly feparated, as here exprefs'd, from that of the *Defcendens*.

E E   Part of the Tendon of the *Defcendens* turn'd up, after the flefhy part of that Mufcle was cut off, to fhew where it adheres infeparably to the fubjacent Tendon of the *Afcendens*, as they both march together over the *Rectus* G G, to the *Linea Alba*.

F   Part of the *Tranfverfalis*.

H   The Navel.

I K L   A Portion of the Tendon of the *Obliquus Defcendens*.

I   That part of it which adher'd to the fore part of the Spine of the *Os Ilium*.

d d f f   Thofe Parts of this Tendon which were here divided from each other.

K K   That part of it which makes the *Annulus*, or Fiffure, by which the Spermatick Veffels pafs to the *Teftes*.

L L   Its internal Margin, commonly call'd the Ligament of the *Pubes*, which, being as it were turn'd in towards the Cavity of the *Abdomen*, does by that means prevent any Ruptures or Extrufions of the Guts in that part, that is between the *Os Pubis* and Spine of the *Os Ilium*, and upper part of the Thigh.

M N   Part of the *Peritonæum*, which defcends with the Spermatick Veffels into the *Scrotum*, and makes what is call'd the *Tunica Vaginalis*.

O P   The *Mufculus Cremafter*, which in this Subject was double at its Origine.

e The

TAB. XV.

Obliquus Ascendens

Pyramidalis
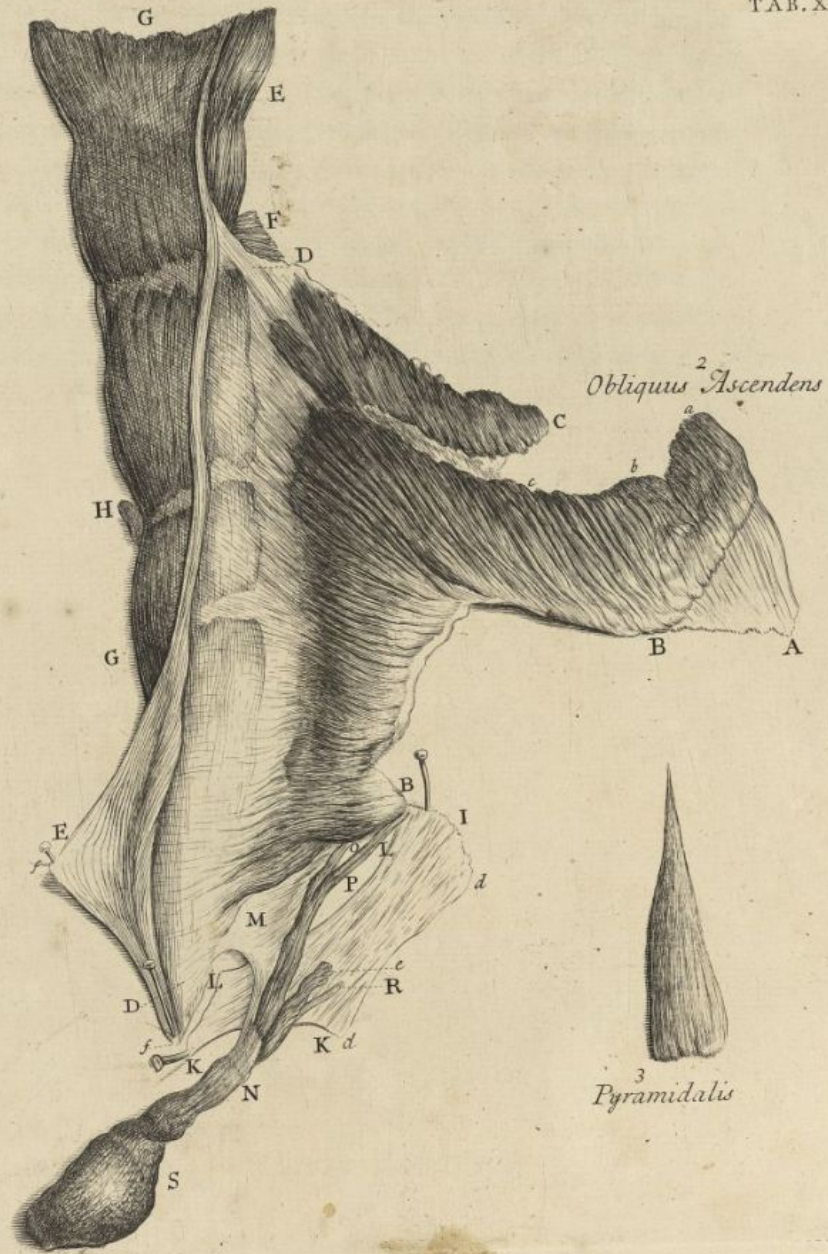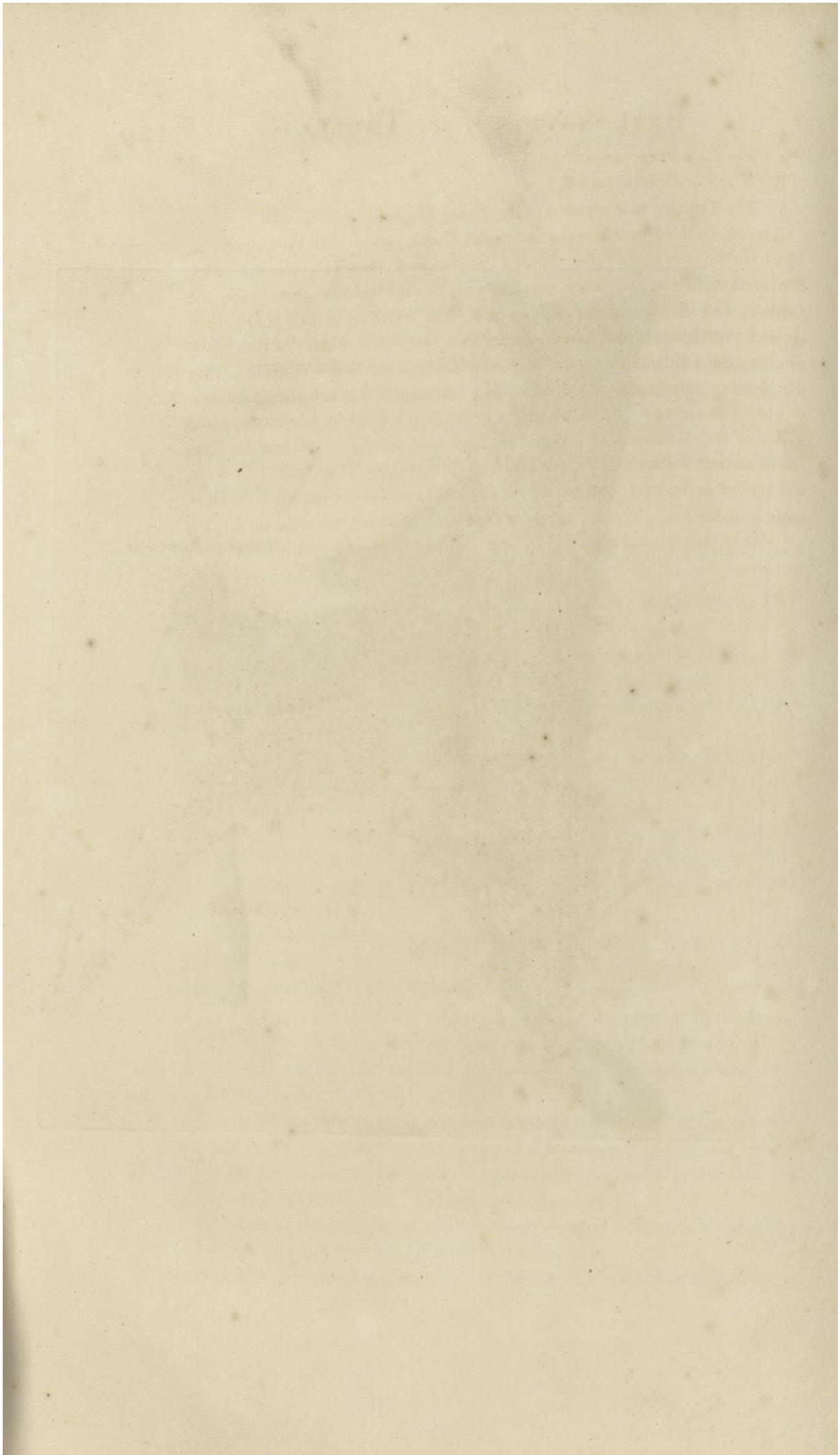
e   The *Vasa Præparantia*.

R   The *Vas Deferens* cut off.

S   The Testicle, as it appear'd in the *Tunica Vaginalis*.

It appears by this Figure how the Spermatick Veffels pafs between the two oblique Mufcles in their way to the *Teftes*. For the Perforations in thefe two oblique Mufcles, not correfponding to each other, neceffarily prevent the Inteftines from paffing the fame way with the Spermatick Veffels; which, had the Orifices in thefe Mufcles been oppofite to each other, muft have happened, as we fee it does, when that Diftemper, which we call a Rupture, attends thefe Parts; in which cafe it is very obvious, that the *Annulus*, or Perforation of the *Defcendens*, here exprefs'd at K K, being enlarg'd or fplit up according to the length of the Fibres of the Tendon, becomes oppofite to that of the *Afcendens* at O. Hence the fmall Guts neceffarily pafs into the *Scrotum* in an erect Pofture, unlefs prevented by a Comprefs, or Trufs, artificially made and applied to the Part; and we are affur'd from Experience, that, when this Remedy is us'd in young Perfons, or where the Malady is recent, it's often cur'd.

L l   T ᴀ ʙ.

TAB. XVI.

4 *The internal Surface of the* Rectus Abdominis *of the Left Side.*

AB   Tho' on the infide there appear'd but one tendinous Interfection at A, and half an one at B, in this Subject, yet the external Surface of this Mufcle had three compleat tendinous Interfections.   The Number and Situation of thefe Interfections vary in different Subjects, and in fome this Mufcle has been found without any.

CD   The Epigaftrick, C, and Mammary Veins and Arteries, D, (as they are call'd) but are no more than the common Blood Veffels of this Mufcle, and the fubjacent Parts.

E   The Tendon of the lower end of this Mufcle, which is implanted on the *Os Pubis.*

5 *The internal Surface of the* Tranfverfalis Abdominis *of the Left Side.*

ABCDD   Its tendinous Origine, that fprings from the *Vertebræ* of the Loins, A. Its flefhy Beginning from the Spine of the *Os Ilium*, B.   That part of it which adher'd to the lower Margin of the Tendon of the *Defcendens*, commonly call'd the *Ligamentum Pubis*, is exprefs'd at C, and that freed from the cartilaginous End-ings of the Ribs at DD.

E E   Its broad membranous Tendon, which adheres to the *Peritonæum*, as indeed does the whole Mufcle, except that part of it between ABD.

F   Shews where the Spermatick Veffels pafs it.

TAB.

TAB. XVI.

4.
Rectus.
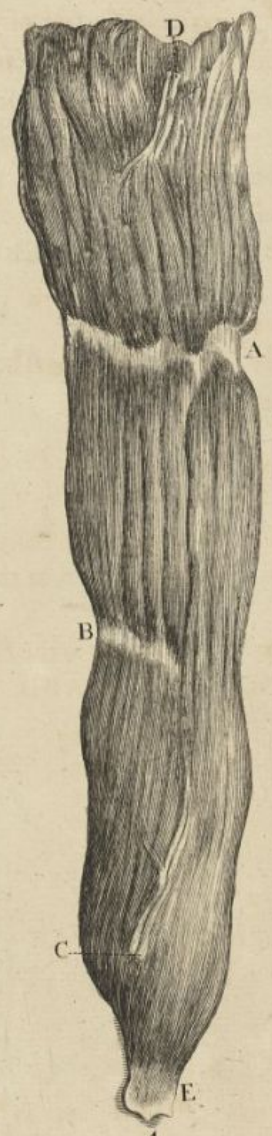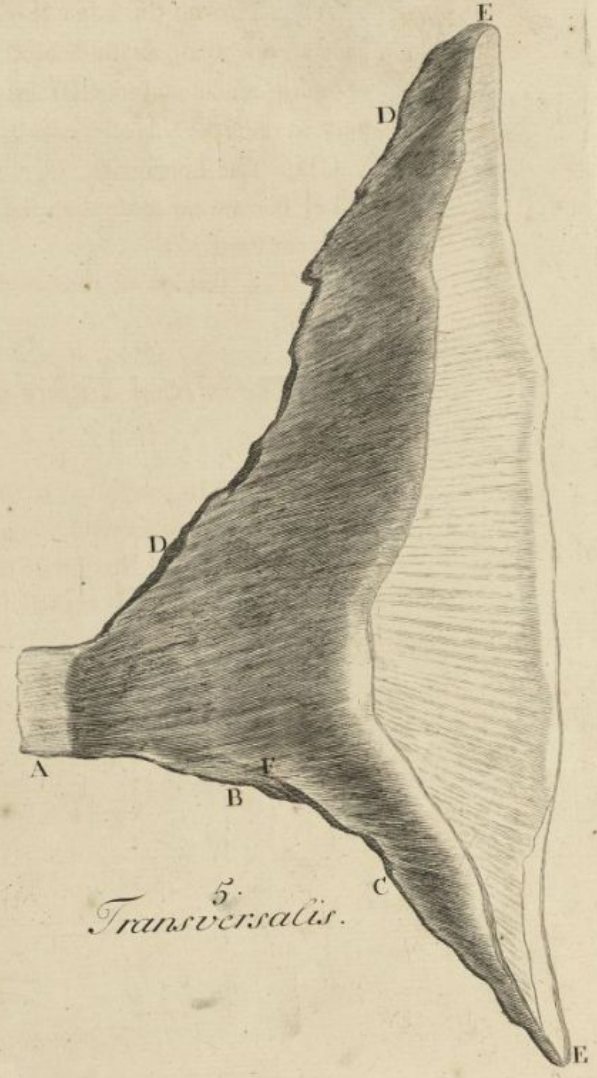
5.
Transversalis.

TAB. XVII.

6
Cremaster.

A *Accelerator Urinæ .7.*   D *Sphinteris Ani portio*

BB *Erectores Penis . 8.*   EE *Arteriæ*

CC *Transversales Penis .9.*   FF *Corpora Cavernosa* } *Penis*

                                      G *Corpus Cavernosum Vrethræ .*
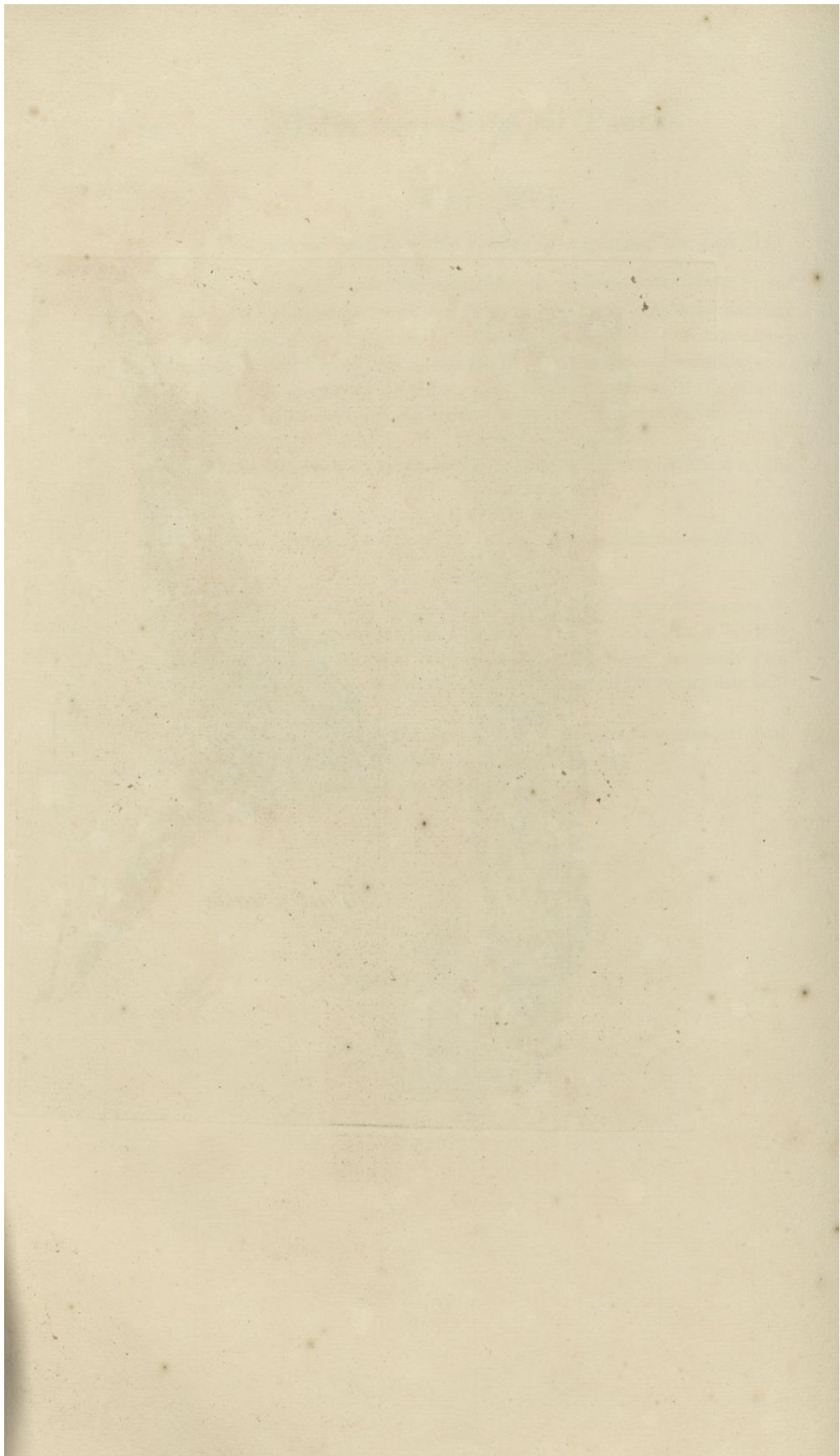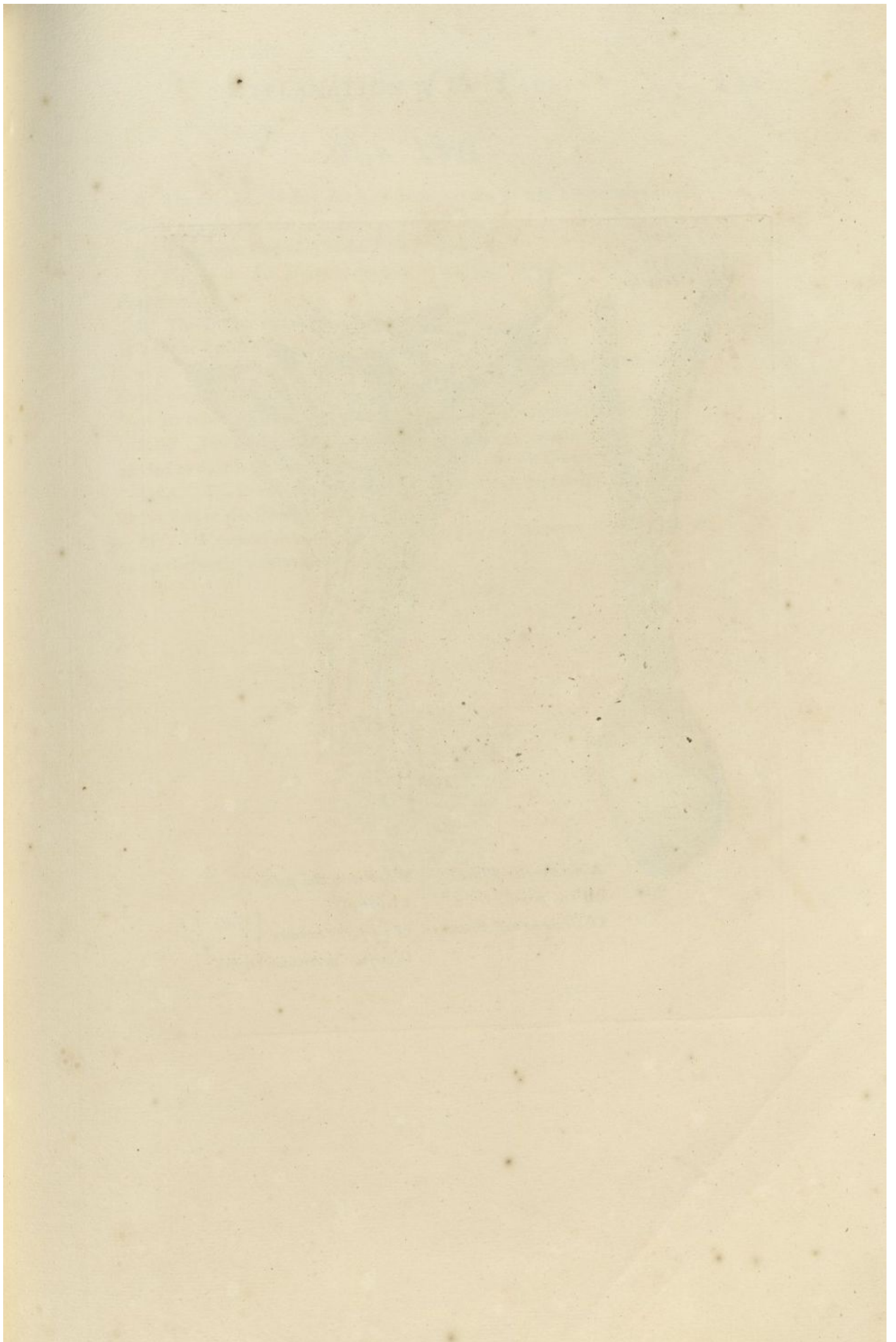
TAB. XVII.

6 The *Cremaster* Muscle, as I have found it expanded at its Termination on the *Tunica Vaginalis*, inclosing the *Testis* in a robust Subject.

A The *Corpus Varicosum* of the *Vasa Præparantia*.

B Part of the *Vas Deferens*, inclosed in the same Membrane with the *Vasa Præparantia*.

C The Testicle inclosed in the *Tunica Vaginalis*.

D The *Epididymis*, as it appears under the *Tunica Vaginalis*.

7 A The external Surface of the *Accelerator Urinæ* inclosing the Bulb of the *Corpus Cavernosum Urethræ*.

a Its two Productions inserted into the Sides of the *Corpora Cavernosa Penis*.

8 BB The *Erectores Penis*, cut off from their fleshy Originations at the *Ischion*, and left at their Insertions, at the beginning of the *Corpora Cavernosa Penis*, bb.

9 CC The *Transversales Penis*, as they appear'd in this Subject.

D Part of the *Sphincter Ani*.

EE The Arteries that convey Blood to the *Corpora Cavernosa Penis*, FF, and to the *Corpus Cavernosum Urethræ*, G.

TAB.

TAB. XVIII.

10. 10   The *Erectores Clitoridis* freed from their Originations, and left at their Infertions into the Beginnings of the cavernous Bodies of the *Clitoris*.

11   Part of the *Sphincter Vaginæ* freed from the *Vagina*, and left at its membranous Connexion to the *Clitoris*.

A A   The *Crura* of the *Clitoris*.

a a   Those parts of its cavernous Bodies that were cut from the *Offa Pubis*.

B   The Body of the *Clitoris*, with its Nerves and Blood Veffels.

C   Part of the *Nymphæ*.

12   The *Detrufor Urinæ*, as it appears in a Bladder I have now by me; but in other Subjects you muft not expect to find thefe Fibres fo confpicuous as here reprefented.

13   *Sphincter Veficæ*.

A   The *Urachus*.

BB   Part of the Ureters, near their Infertions into the Bladder.

TAB.

12
Detrusor Vrinæ
13
Sphincter Vesica

10
Erectores

Clitoridis
10

11
Sphincter

Vagina
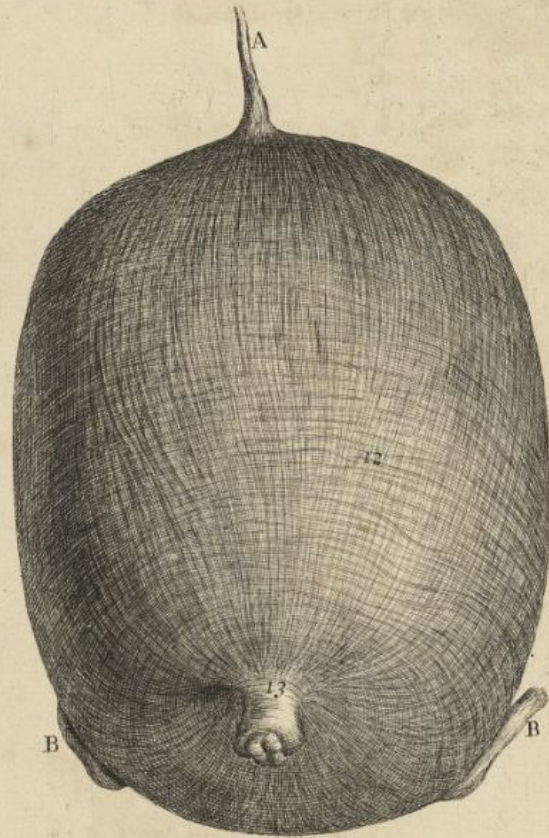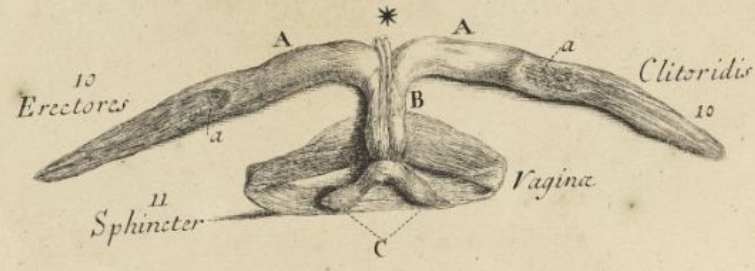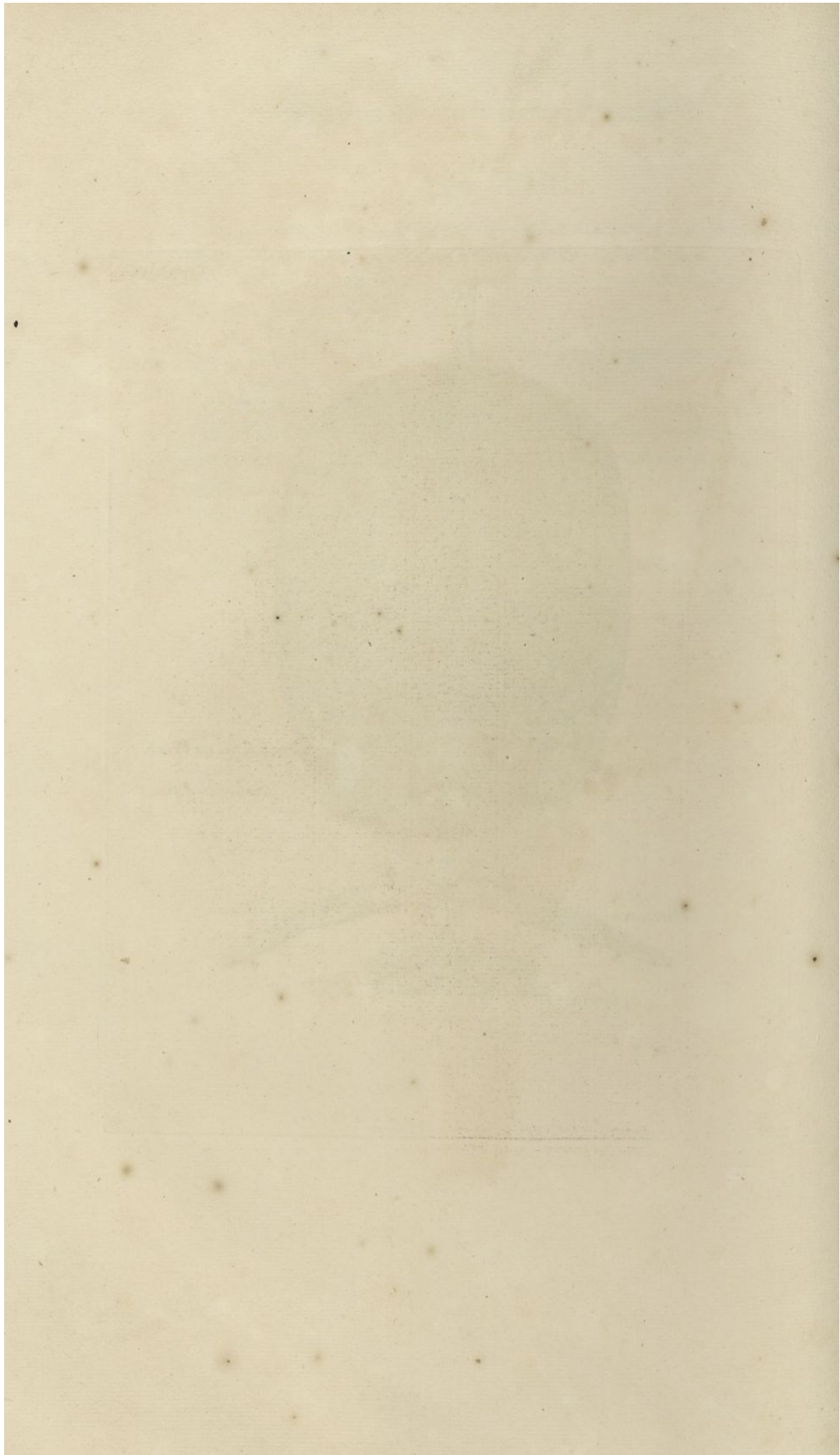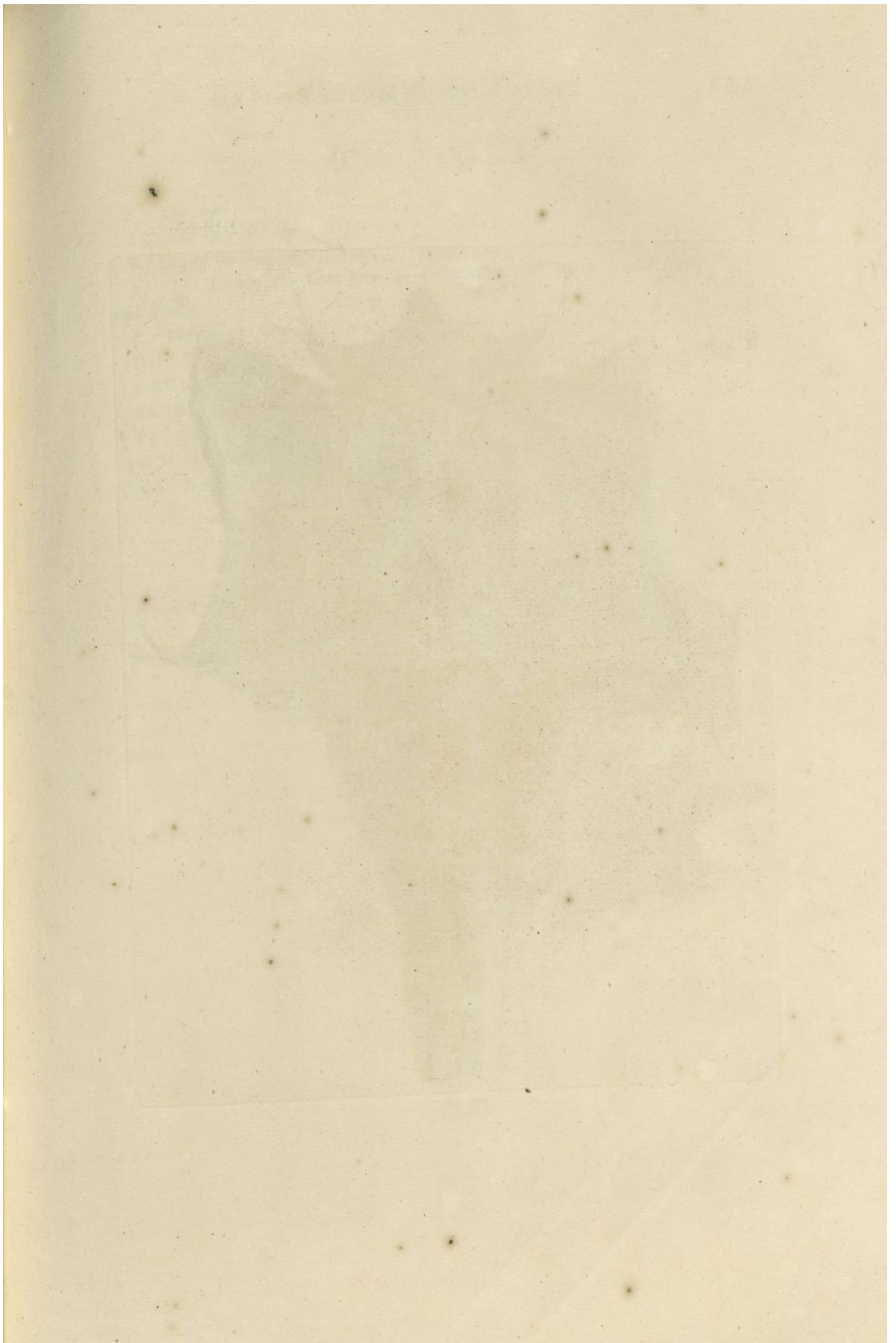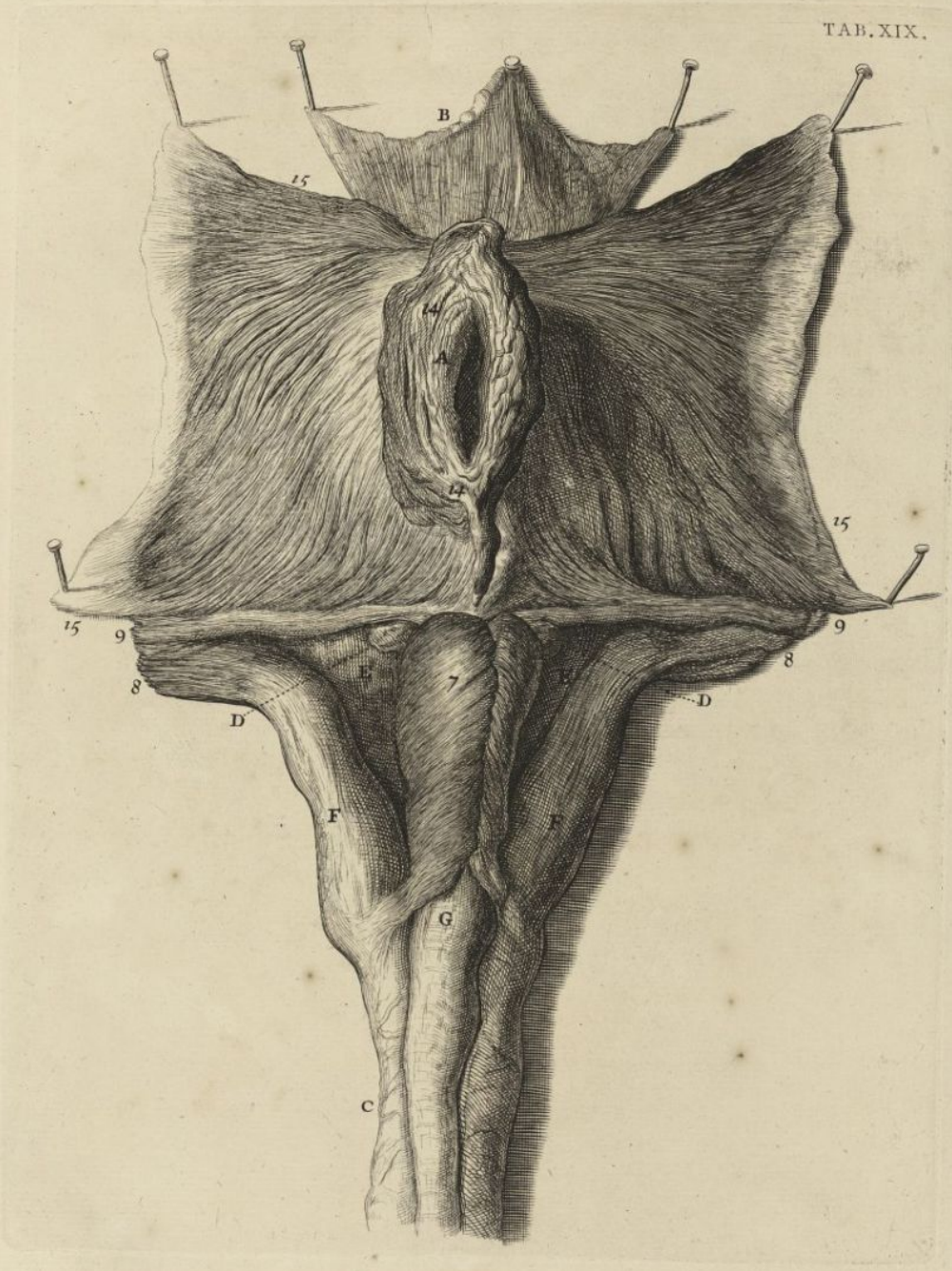
TAB. XIX.

TAB. XIX.

A   The *Anus.*

14   The *Sphincter Ani.*

B   Part of the *Rectum* pinn'd out.

15   The *Levator Ani* freed from its Origination, and left at its Infertion, pinn'd out.

C   The *Corpora Cavernofa Penis.*

DD   The *Glandulæ Mucofæ.*

7 EE   *Acceleratores Urinæ.*

88   The Origination of the *Erectores* cut from the *Offa Ifchia.*

FF   Their Infertion.

G   *Corpus Cavernofum Urethræ.*

99   *Tranfverfales Penis.*

M m

TAB.

TAB. XX.

A A   The *Sphincter Ani* encompassing the *Anus*.

a a   The internal Membrane of the *Anus*.

B B   The *Levator Ani* freed from its Origination, and left at its Insertion, here pinn'd out.

C C   The *Membrana Adipofa*, (which is continued from the *Peritonæum*) freed from the *Rectum*, and display'd.

D   The Body of the *Rectum*, with Muscular Fibres passing according to its Length.

E E   The circular Fibres, lying under the Longitudinal, which are here rais'd and turn'd off.

F   The internal Membrane of the *Rectum* pinn'd out. This internal Membrane, being much larger than the Muscular Inclosure, is seen full of Folds, on dividing the Gut according to its Length; sometimes 'tis so much relax'd, as to slip out at the *Anus*, which Case is called *Procidentia Ani*.

16   The *Occipitalis*.

17   The internal Surface of the *Frontalis*, of the Left Side.

A   The two tendinous Parts, which are continued to each other, on the upper part of the *Cranium*.

a   That part of the Frontal Muscle which arises from the lower part of the Bone of the Nose.

b   That part of the Frontal Muscle call'd *Corrugator*.

c c   A Branch of an Artery that passes a Perforation in the Scull, a little above the Orbit, and distributes its Capillary Branches, as here express'd, on the internal Surface of this Muscle.

d   Two Branches of the Nerve, which accompanies the Artery.

27   Part of the *Musculus Orbicularis Palpebrarum*.

TAB. XX.

A

A

*

15.
Occipitalis.

17.
Frontalis.

A Sphincter. 14.
B. Levator. 15.
} Ani.
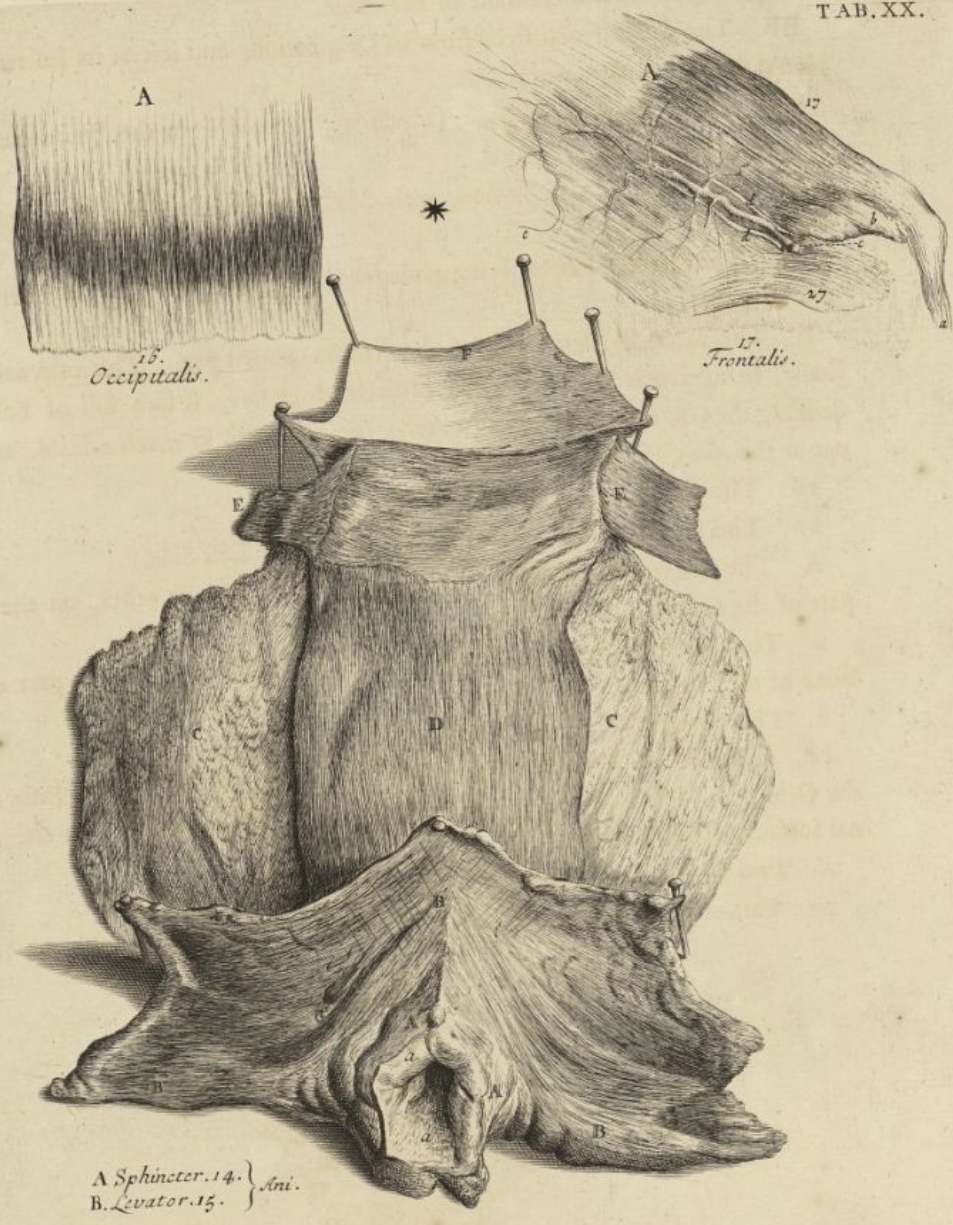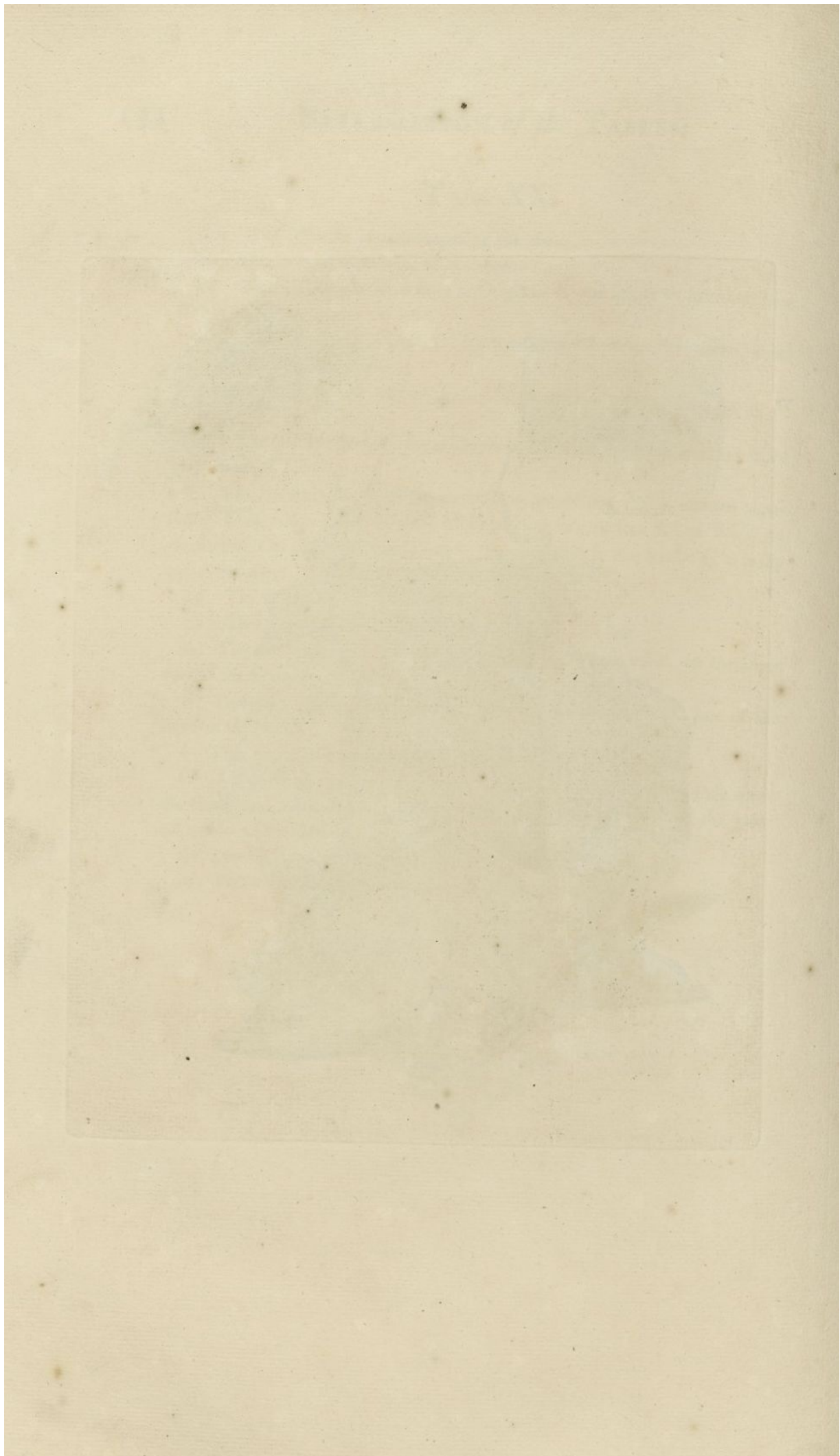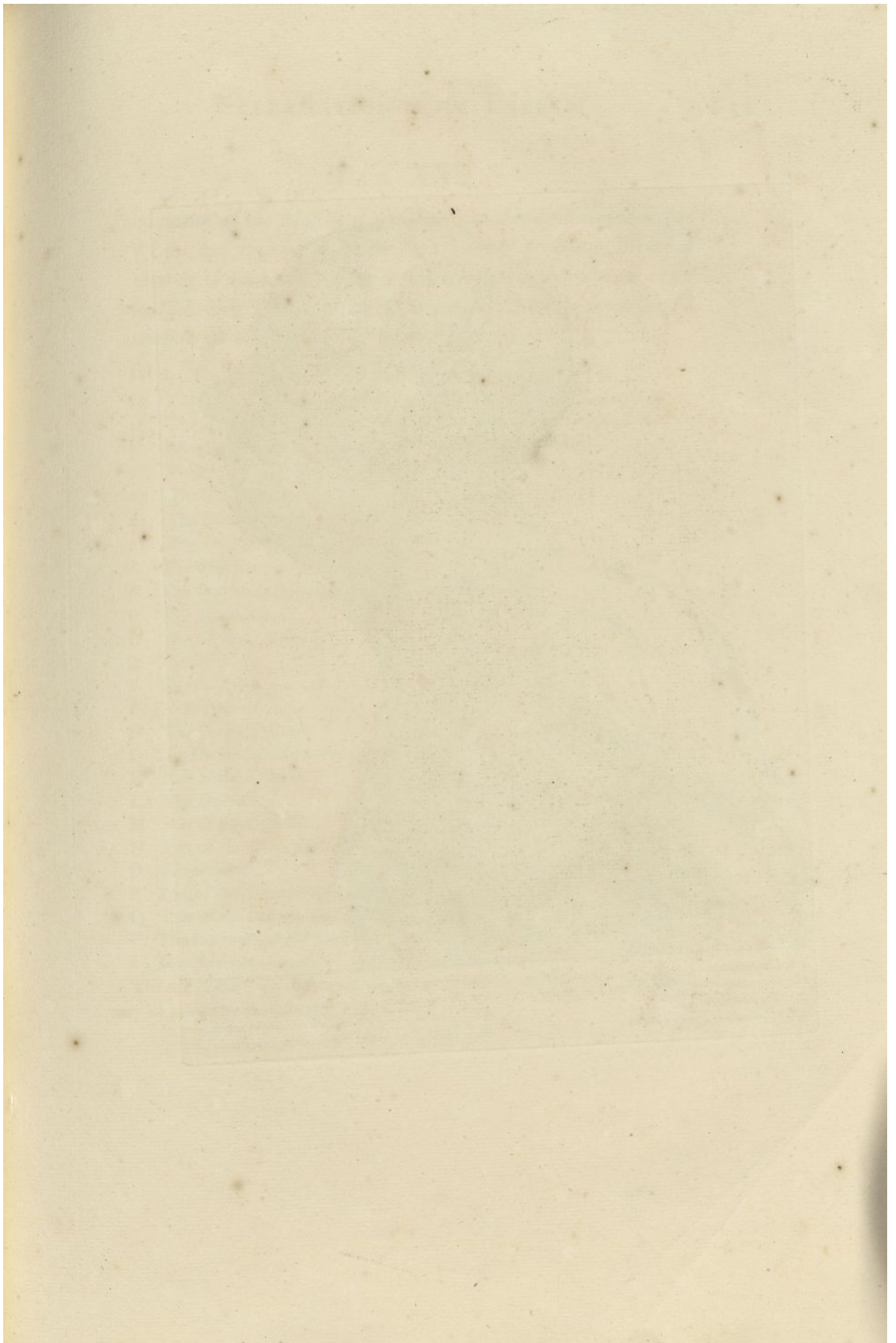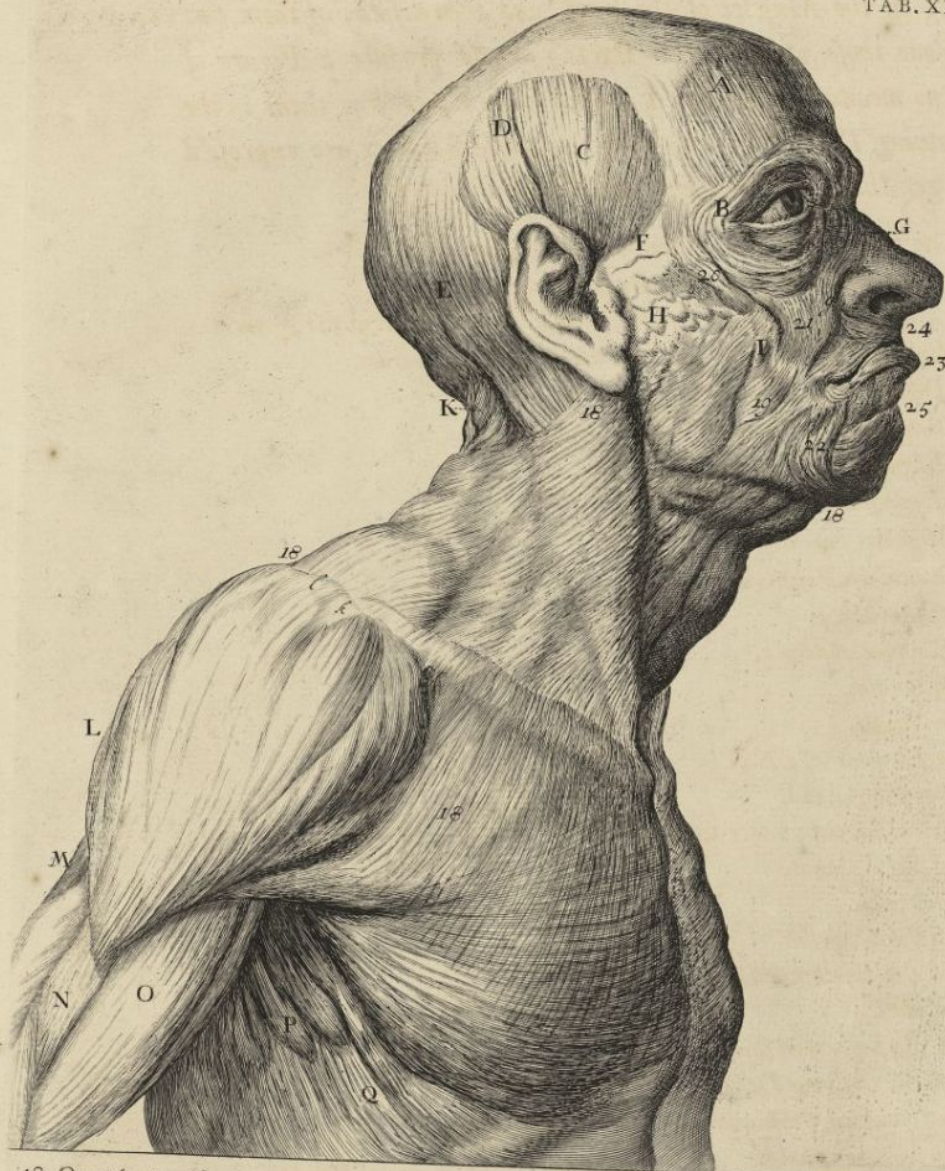
TAB. XXI.

18. *Quadratus Genæ, seu Quad. Colli.*
19. *Buccinator Quadrato Genæ tectus.*
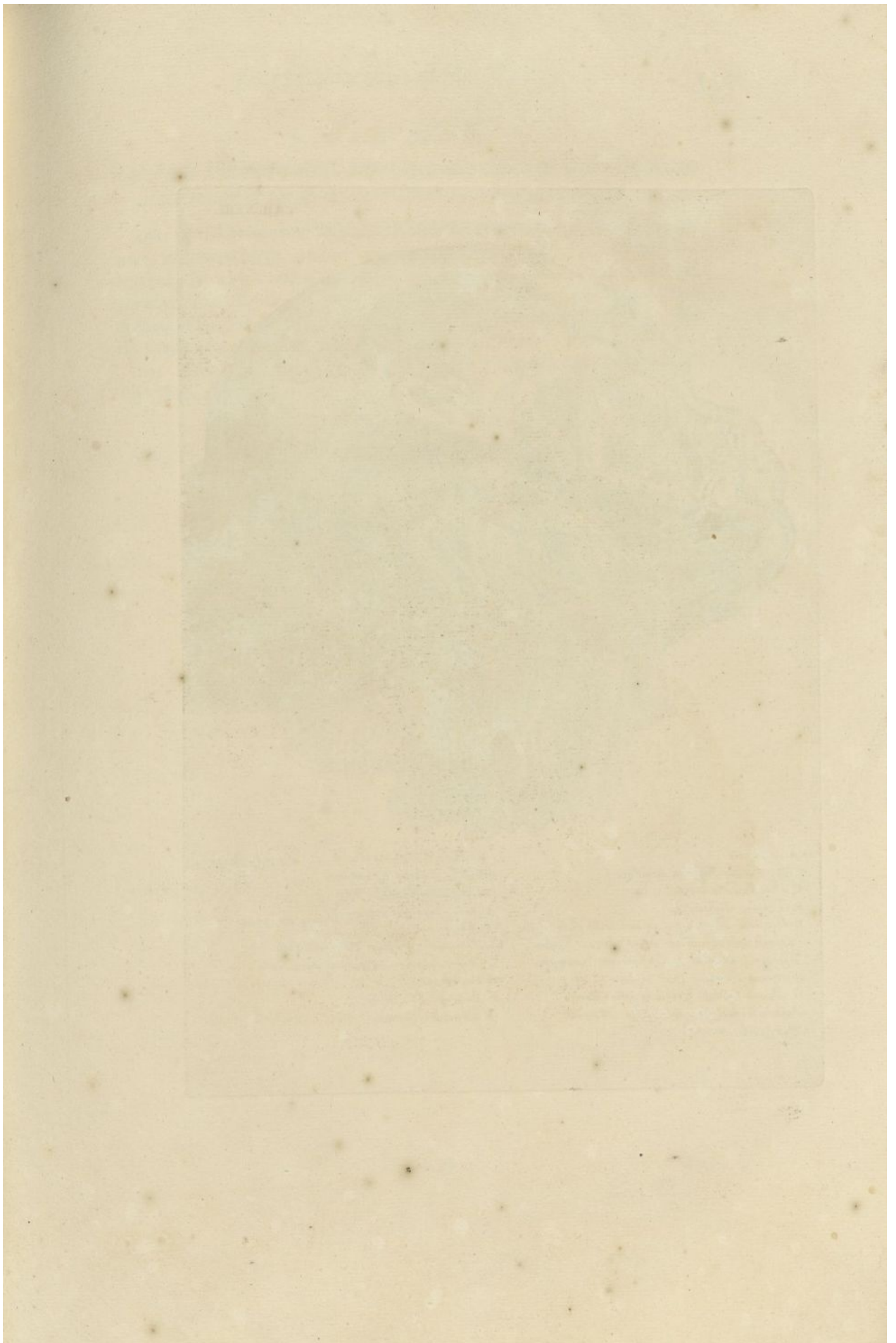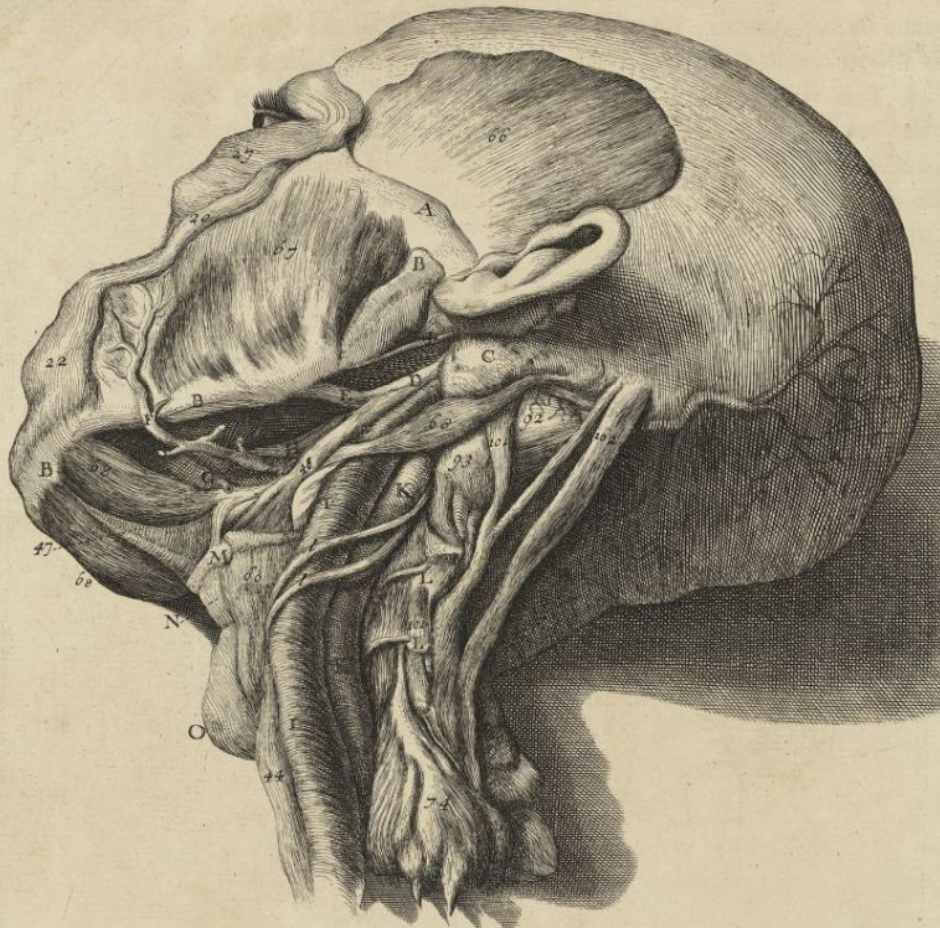20. *Zygomaticus.*
21. *Elevator Labiorum.*
22. *Depressor Labiorum.*
23. *Orbicularis Labiorum.*
24. *Elevator labii superioris proprius.*
25. *Depressor labii inferioris proprius.*

TAB. XXI.

Since cutting off the Muscles of the Face, and then displaying them, (as I have done those of most other Parts) would produce a Figure of them by no means instructive; I shall therefore represent them in the two following Tables in situ, in which these Muscles are express'd much larger than those in the whole Figures.

18　18　The *Quadratus Genæ*, as much as can be seen in one View.

19　That part of it that is over the *Buccinator*.

20　The *Zygomaticus*, the lower part of which lies under part of the *Quadratus*.

21　Another part of the *Quadratus*, on the *Elevator Labiorum*.

22　The *Depressor Labiorum*.

23　The *Orbicularis Labiorum*.

24　The *Elevator Labii Superioris*.

25　The *Depressor Labii Inferioris*.

A　The *Musculus Frontalis*.

B　The *Orbicularis Palpebrarum*.

C　The *Temporalis*.

D　The *Elevator Auriculæ*.

E　The *Occipitalis*.

F　The *Os Jugale*.

G, g　The *Elevator Alæ Nasi*.

H　The Parotide Gland.

I　The *Ductus Salivalis* under the *Quadratus*.

K　Part of the *Splenius*.

L　The *Deltoides*.

M　Part of the *Gemellus*.

N　Part of the *Brachiæus Internus*.

O　*Biceps Cubiti*.

P　Part of the *Serratus Major Anticus*.

Q　Part of the *Obliquus Descendens*.

k　The Extremity of the *Clavicula*, next

l　The *Acromium Scapulæ*.

The rest of the Parts that appear under the *Quadratus* on the Neck and Breast, may be known by the following Figure.

TAB.

TAB. XXII.

19   The *Buccinator.*

20   The *Zygomaticus.*

21   The *Elevator Labiorum.*

22   The *Depreſſor Labiorum.*

23   The *Orbicularis Labiorum.*

24. 24   The *Elevator Labii Superioris Proprius.*

25   The *Depreſſor Labii Inferioris Proprius.*

A   Part of the *Os Jugale.*

B   The Temporal Artery.

CC   The Parotide Salival Gland.

D   Its *Ductus Salivalis* paſſing on the *Muſculus Maſſeter*, and through the *Buccinator*, into the Mouth.

E   Part of the lower Jaw-Bone bared.

o, o, o, o, o,   A Branch of the Carotide Artery, which conſtantly paſſes this way to the Muſcles of the Lips and Parts adjacent.

N   A Branch of the external Jugular Vein.

f   An Appearance of the ſame Vein, before it paſſes the Body of the inferiour Maxillary Gland.

g   The Maxillary Salival Gland.

G   The *Clavicula* bared.

H   The *Acromium Scapulæ*, where it is joyn'd to the *Clavicula.*

b   A Trunk of the Nerves, that compoſe the Axillary Nerve.

I   The *Os Pectoris*, or *Sternum.*

i   Some Remains of the external Jugular Vein on the Maſtoide Muſcle.

* 72   Part of the *Serratus Major Anticus*, which appears, as here expreſs'd, above the *Clavicula*, in an Interſtice made by the *Scalenus* forwards, the *Levator Scapulæ* above, and the *Cucullaris.*

N. B. The reſt of the Figures, or Numbers, may be explain'd by the general Index of the Muſcles.

TAB. XXII.

19. *Buccinator*.
20. *Zygomaticus*.
21. *Elevator Labiorum*.
22. *Depressor Labiorum*.

23. *Orbicularis Labiorum*.
24.24. *Elevator Labij Superioris proprius*.
25. *Depressor Labij inferioris proprius*.

TAB. XXIII.

A Os Jugale
BBB Maxilla Inferior denudata
C Processus Mastoeides
D Processus Styloeides
E Musculus Parvus, qui in nonnullis Cadaveribus
  Ligamentum tantummodo est, ab Apice Processus
  Styloeidis ad Maxillam Inferiorem pertingens
F Arteriæ Ramulus Cera repletus
G Ductus Salivalis Glandulæ Maxillaris
Inferioris Absciffus quo loci fub Musculo
Mylohyoideo transit.

✝ Ramulus Quinti Nervorum Paris ad Dentes
  Maxillæ Inferioris pertinens
H Musculi Styloglossi pars
II Vena Jugularis interna ⎫
KK Arteria carotis   ⎬ utraq Cera plena
LL Processus Transversi Vertebrarū Colli
ll Nervi Intercostalis et Paris Vagi Trunci
M Os Hyoides
N Cartilago Scutiformis
O Glandula Thyroides

Tab. XXIII.

The Parts here represented, being sufficiently described in the References at the bottom of the Plate, need no other Explication, except

101 101 The lowermost of which denotes one of the *Intertransversales*, which were, discover'd by the Author, after his *Syllabus* and most of the Plates were finished, for which reason those Muscles could not be inserted under a distinct Number. *Vid.* Tab. XLIV. The uppermost shews te ticker and shorter Production of the *Transversalis*, which is inserted near the Mastoide Process. But the slenderer and longer Production of this Muscle is inserted beside.

102 Part of the *Longissimus Dorsi*, by others call'd *Par tertium Falloppii.* *Vid.* Tab. XLV.

N n   T A B.

TAB. XXIV.

This Table likewise needs no other Explication, than what is engraven on the bottom of the Plate, except

   a   The Nerve and Blood Veſſels paſſing intho the lower Jaw.

   e   The Ligament connecting the cartilaginous *Appendix* of the *Os Hyoides* to the Styloidal Proceſs.

TAB.

TAB. XXIV.
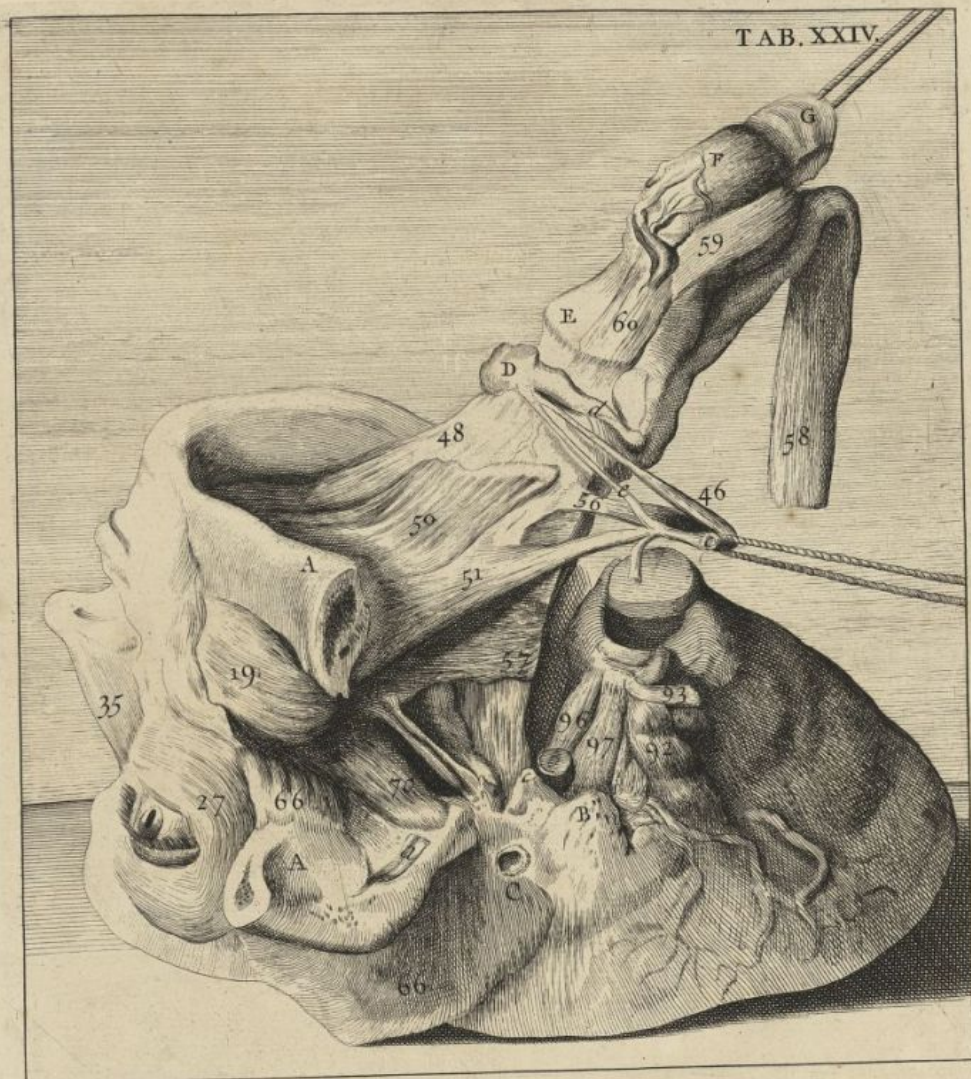
AA. *Maxilla inferior divisa.*

B. *Processus Mammillaris.*

b. *Arteria Carotis.*

C. *Meatus Auditorius.*

cc. *Processus Styloides divisus.*

D. *Os Hyoides.*

d. *Cornu dextrum ejusdem.*

E. *Cartilago Thyroides.*

F. *Glandula Thyroides.*

G. *Asperæ Arteriæ portio.*
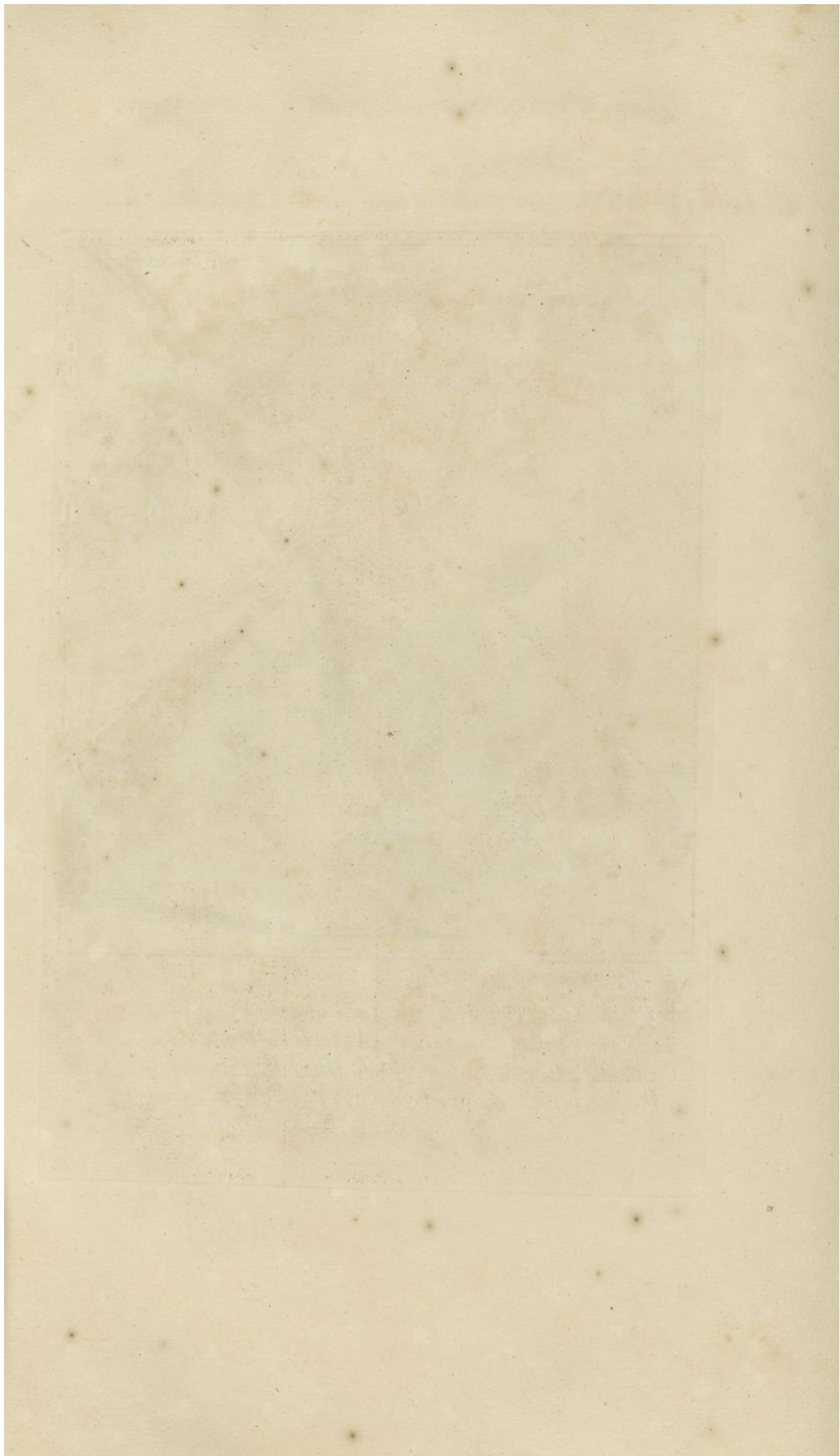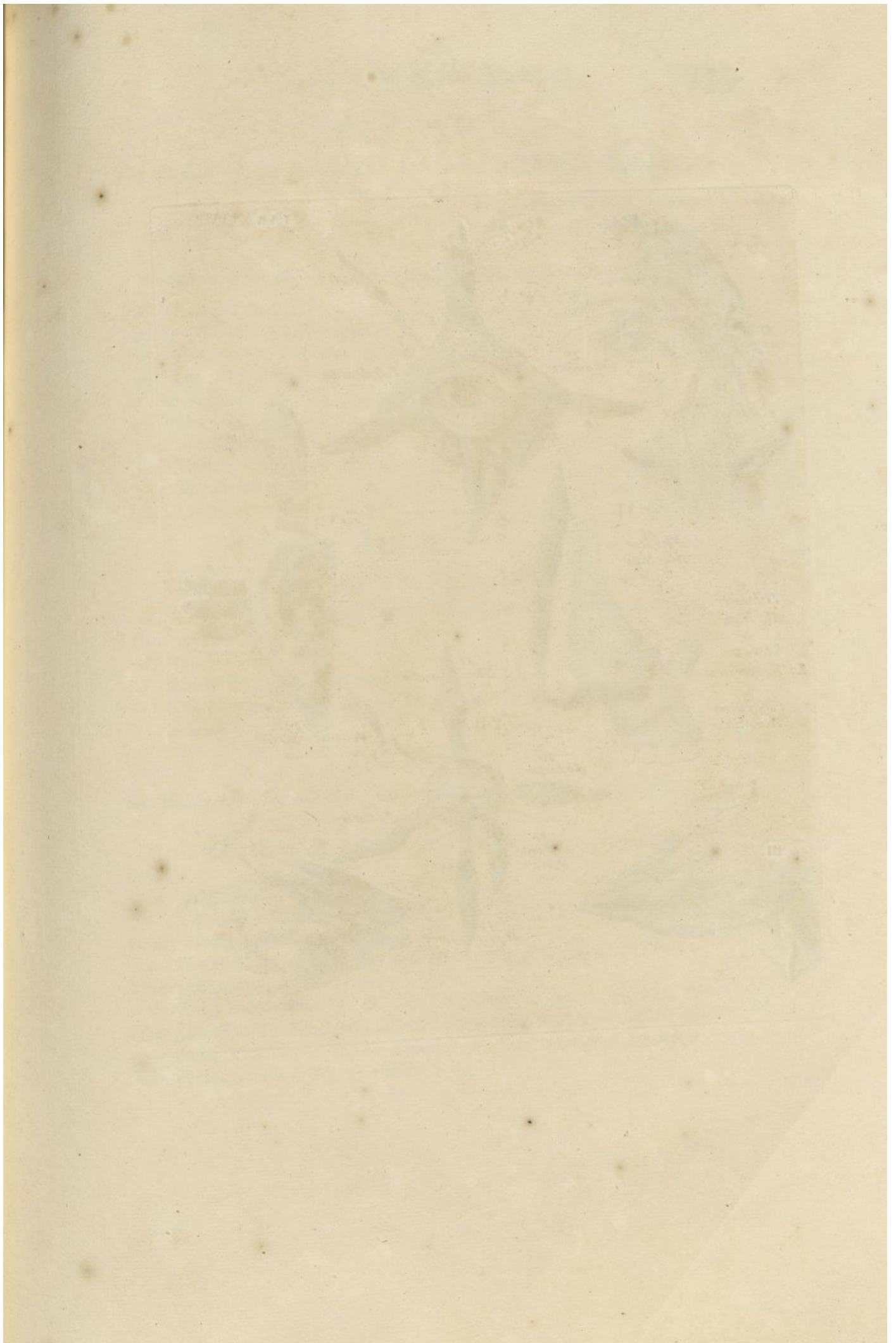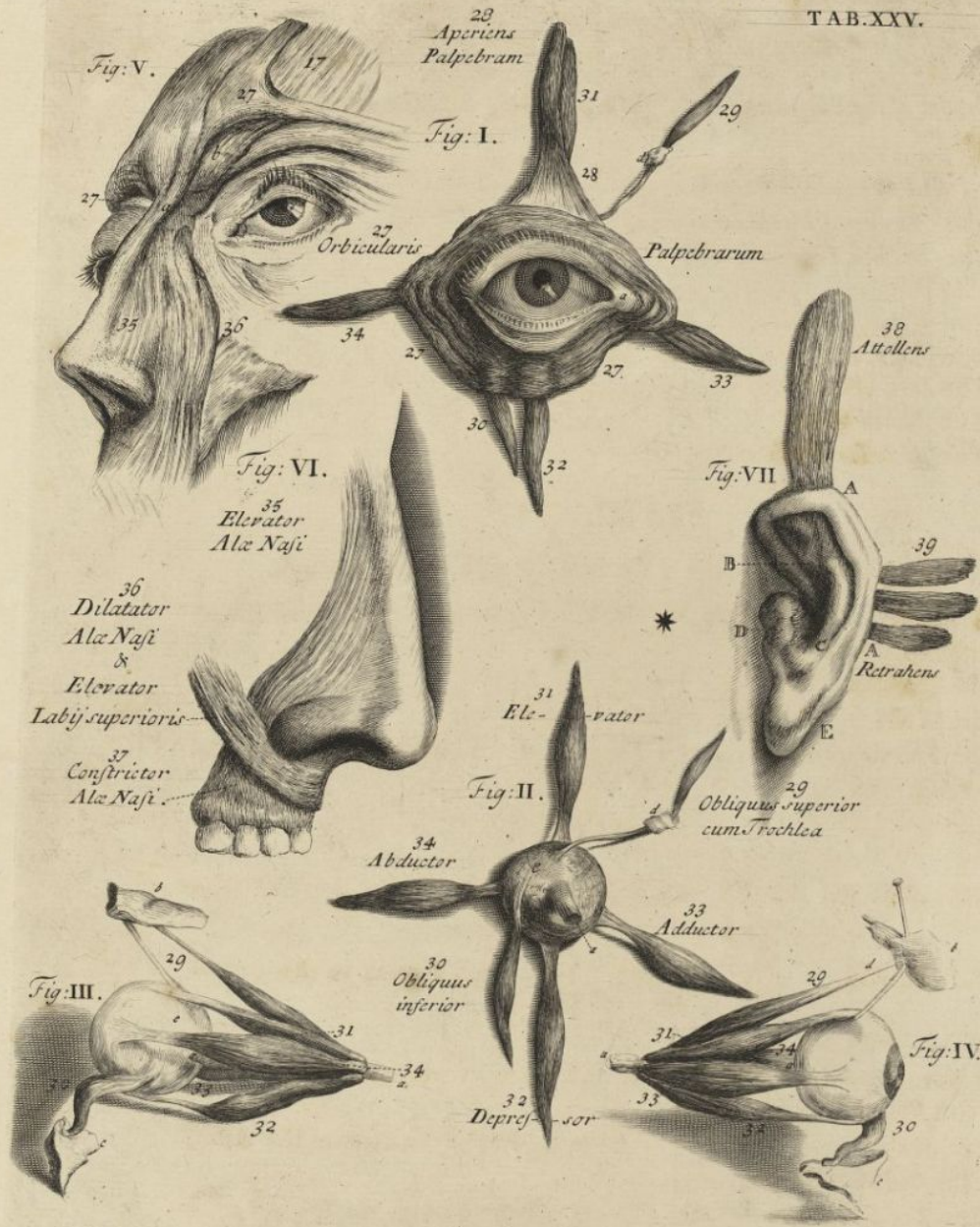
TAB. XXV.

The Muscles of the Eye-lid and Eye, the Ala Nasi & Auricula,
as big as the Life.

FIG. I.

The Muscles of the Palpebra, *and right Eye it self, dissected and display'd.*

a The inner *Canthus.*
27 27 The *Orbicularis Palpebræ.*
28 The *Aperiens Palpebram Rectus.*
29 The *Obliquus Superior;* with
d Its *Trochlea.*
30 The *Obliquus Inferior.*
31 The *Elevator.*
32 The *Depressor.*
33 The *Adductor.*
34 The *Abductor Oculi.*

FIG. II.

The back part of the Muscles of the Left Eye dissected and display'd.

N. B. The Names of each Muscle being graved on the Copper-Plate,
I shall only add here.

d The *Trochlea.*
a Part of the Optick Nerve cut off.
e The Terminations of the two Tendons of the oblique Muscles on the
   Sclerotis.

FIG. III. IV.

The Muscles of the Eye dissected, and so dispos'd, as to shew the natural Position of each Muscle in the Left Eye.

N. B. The Muscles are explain'd by the perceding Figure, or the general
Index.

a a The Optick Nerve.
b A Portion of the external Margin of the upper part of the Bone of the
Orbit; to which the *Trochlea* is fix'd.
c Part of the external Margin of the lower part of the Bone of the Orbit,
whence the *Obliquus Inferior* arises.
d The Tendon of the *Obliquus Superior* passing through the *Trochlea,* the
other part of its Tendon is here expres'd, marching under thath of the *Elevator* to its Termination on the *Sclerotis,* near the Insertion of the *Obliquus
Inferior,* as expres'd in Fig. II. and III. at *e.*

FIG.

FIG. V. VI.

35   The *Elevator Alæ Nasi.*

36   The *Dilatator Alæ Nasi & Elevator Labii Superioris.*

37   The *Constrictor Alæ Nasi.*

N. B. In Fig. v. is expref'd.

17   Part of the *Frontalis.*

27   The *Orbicularis*, part of that of the Left Side at the great Angle being raifed, to fhew.

b   The internal and flefhy Production of the *Musculus Frontalis.*

a   The external Production of the Frontal Mufcle, fpringing from the Bones of the Nofe, which is very vifible in fome Perfons when in Paffion.

FIG. VII.

The Left Ear, with its Mufcles, as I have moft commonly found them, they varying in their Figure in different Subjects.

38   *Attolens Auriculam.*

39   *Retrahens Auriculam.*

A A   That part of the Ear called *Helix.*

B   *Anthelix.*

C   *Tragus.*

D   *Antitragus.*

E   *Lobus Auris.*

T A B.

Tab: XXVI.

Fig: I.

Fig: VIII.

40 Externus Auris.

Fig: III.

42 Internus Auris

41 Obliquus Auris

Fig: II.

41 ——— 42

Fig: IV.

Musculus Stapedis } 43   42. Internus ———

41 Obliquus ———

40 Externus Auris

Fig: V.

Fig: VI.

Fig: VII.
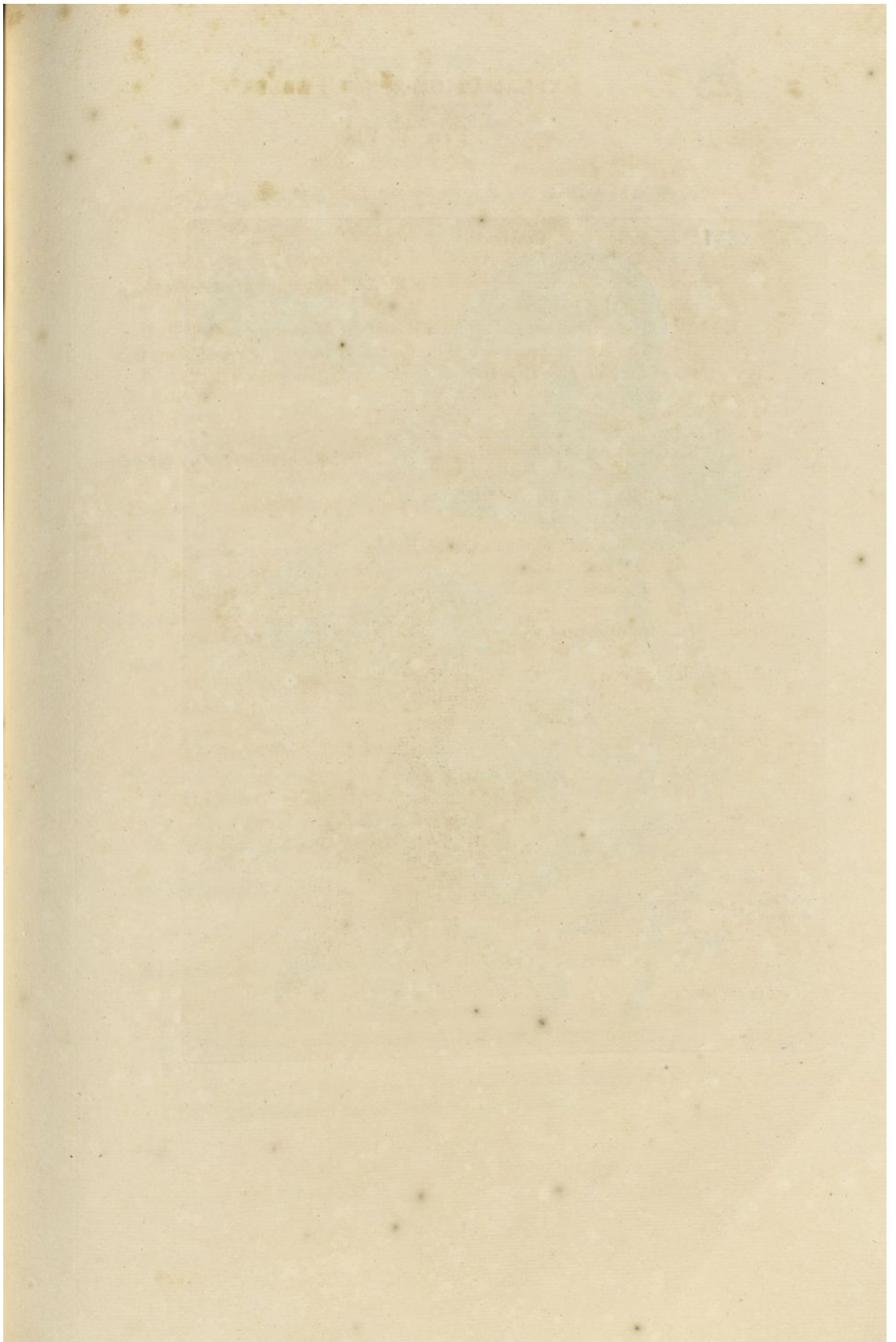
TAB. XXVI.

Fig. I.

Part of the Right Os Temporale, &c. containingh the Organs of Hearing of the Right Side as big as the Life.

A   The external convex Surface.
B   Part of the *Os Sincipitis.*
C   The *Proceſſus Maſtoides.*
D   Part of the *Os Jugale* cut off.
E   The *Proceſſus Styloides.*
F   Part of the *Os Temporum*, behind which the Carotide Artery paſſes to the Brain.
G   Part of the *Os Sphenoides.*
H   An acute Proceſs of the laſt mention'd Bone, at the Root of which the Muſcles of the *Uvula* ſpring.
I   A Probe inſerted inter a Perforation, between the *Os Sphenoides* and *Os Temporum*, by which the *Ductus à Palato* paſſes into the *Tympanum*, as expreſs'd Fig. II.
K   The ſixth *Foramen* of the *Os Sphenoides*, near the Root of the *Proceſ-ſus Pterygoides*, by which the fifth pair of Nerves paſs.
a   The upper part of the Paſſage from the outward Ear to the *Membrana Tympani.*
b   The breaking off of the Bone, which makes the lower part of the Paſ-ſage.
40   The *Muſculus Externus Auris.* Vid. Fig. IV.
c   The Proceſs of the *Malleus*, on the *Membrana Tympani.*
d   The *Membrana Tympani*, commonly call'd the Drum of the Ear.
e   The *Sinus* of the *Os Temporum*, for the Articulation of the *Proceſſus Condyloides* of the lower Jaw.
f   The Suture or Conjuction of the *Os Sphenoides* with the *Os Temporum.*
gg   The Edges of the laſt named Bones ſaw'd off.
h   The Suture between the *Os Temporale* and *Sincipitis.*
i   A *Sulcus* in the *Os Temporum*, whence the Digaſtrick Muſcle of the lower Jaw ſprings.

Fig. II.

The internal Surface of the ſame Bones, with the Organs of Hearing, repreſented in the preceding Figure.

A A   The inſide of the lower part of the *Os Sincipitis*, next the Brain.
a a   The Furrows cauſed by the Blood Veſſels of the *Dura Mater.*
B   Part of the *Os Occipitis.*
b b   The *Sutura Squamoſa* of the *Os Temporum* with the *Sinciput* and *Occiput.*
CCC   The Surface of the *Os Temporum* next the Brain.

O o   D   Part

D   Part of the *Os Sphenoides.*
E   Part of the *Os Jugale.*
F   The *Os Petrosum.*
I   The Probe in the *Ductus a Palato ad Aurem.*
c   The Edge of the *Os Sphenoides.*
e   The external ſemicircular Canal laid open.
f   The internal ſpongious part of the Bone.
g   The *Foramen* expreſs'd at K in the preceding Figure.
The remaining Parts of this Figure are explain'd in the References to Fig. III.

FIG. III.

Part of the preceding Figure at f, G, H, 41, 42, *magnify'd.*

a   The *Ligamentum Vaginale* of the *Muſculus Internus Auris*, ſlit open and turn'd down, to ſhew the incloſed Muſcle.
42   The *Internus Auris.*
b   The Proceſs of the *Os Petroſum*, on which the Tendon of the laſt named Muſcle paſſes.
C   The Tendon of the ſaid Muſcle deſcending to its Inſertion on the *Malleus.*
B   Part of the Handle of the *Malleus.*
G   The Head of the *Malleus.*
H   The *Incus.*
I   Its long Proceſs, which is articulated with the *Stapes*, by the Mediation of
K   The *Os Orbiculare.*
M   Part of the *Stapes*, as it appears *in ſitu.*
L   The Tendon of the *Muſculus Stapedis.*
N   The external ſemicircular Duct opened.

FIG. IV.

The four little Bones of the right Ear taken out with their Muſcles.

A   The *Stapes.*
B   Part of the Handle of the *Malleus.*
C   The Tendon of the *Muſculus Internus.*
H   The Head of the *Malleus.*
The long Proceſs of the *Incus.*
K   The *Os Orbiculare.*
L   The ſhort thick Proceſs of the *Incus.*

FIG.

FIG. V. VI. VII.

Tho Malleus, Incns, *and* Stapes, *as big as the Life, and magnify'd.*

A   The *Bafis Stapedis.*
a   The Membrane in the hollow of the *Stapes.*
b   The *Sinus* on the Head of the *Stapes*, which receives the *Os Orbiculare.*
C   The *Sinus* of the *Incus*, which receives the *Malleus.*
D   The part of the *Malleus*, which is receiv'd by the *Incus.*
B   The Handle of the *Malleus.*
E   That part of the *Malleus*, where the Tendon of the *Mufculus Internus* is inferted.
F   A Procefs of the *Malleus*, where it begins to adhere to the *Membrana Tympani.*
G   A flender long Procefs of the *Malleus*, to which the Tendon of the *Mufculus Obliquus* is faftened.
H   The Head of the *Malleus.*
I   The long Procefs of the *Incus*, at the Extremity of which is.
K   The *Os Orbiculare*, which is receiv'd in the Cavity of the *Stapes*, at *b.*

FIG. VIII.

The fame Organs of the Left Ear magnify'd in the fame Pofition, as in Fig. III. *the Letters of Reference to both being the fame, except that*

N   Shews a Branch of the Auditory Nerve, in this Figure.

TAB.

TAB. XXVII.

FIG. I.

The upper Surface of the Os Hyoides, *when freed from its Muscles.*

A   The fore Bone, called the *Basis* of the *Os Hyoides.*

BB   The two Extremities called *Cornua*, one of which in this Subject happen'd to be bent, as appears in the Figure.

CC   Two cartilaginous Appendices, from which,

DD   Two Ligaments are continued to the Extremities of the Styloidal Processes.

E   Part of the Styloidal Process of the Right Side.

FIG. II.

The internal Surface of the same Os Hyoides.

FIG. III. IV.

The internal and external Surface of the Os Hyoides *from another Body.*
The two other Figures represent the Os Hyoides *taken out with its Muscles.*

A   The fore Bone, or *Basis* of the *Os Hyoides.*

B   Its right *Cornu.*

44.   44   *Par Sternohyoideum.*

45.   45   *Par Coracohyoideum.*

47.   47   The upper Figure shews the external Surface of the *Mylohyoideus*, the lower the internal Surface.

46   The *Stylohyoideus.*

Ỿ   Its Perforation, by which passes the middle Tendon of the *Musculus Digastricus* of the lower the Jaw.

48   *Par Geniohyoideum.*

TAB.

TAB. XXVII.

Mylo-   hyoideus

47

46
Stylohyoideus

E

D

Fig. I.
Ossis Hyoidis Facies
superior

D

B

B

C   A   C

46

Fig II.
ejusdem
Facies inferior
sive
interna

A

45
Coracohyoideus

B

Sternohyoideus

44

45

44

48
* Geniohyoideum

46

46

Fig III.
Facies
externa
vel superior

Fig IV.
interna

47

Os Hyoides alio Subjecto

47
Mylohyoidei
Facies interna

45

45

44

Fig. I.

56 Stylopharyngæus

49 Genioglossus

50 Ceratoglossus

52 Basioglossus

57 Oesophagæus

51 Styloglossus

Fig. II.

55 Pterygestaphi= linus

54 Sphenosta= =philinus

Fig. III. T AB. XXVIII.

Fig. IV.

TAB. XXVIII.

FIG. I.

The Tongue, with its Muſcles cut from their Originations, and left at their Inſertions into the Body of the Tongue.

49 The *Genioglossus.*
a The Origination of it, cut from the internal part of the Jaw-bone.
50 The *Ceratoglossus.* *bb* The Originations of theſe Muſcles cut from the Cornua of the *Os Hyoides.*
51 The *Styloglossus.*
52 The *Basioglossus.*
A The Tip of the Tongue pinn'd out.
B Part of its *Corpus Villosum,* as it appear'd on its Sides in this Poſition.
CC The *Basis,* or Root of the Tongue.
D The Membrane, that is continued from the Tongue on the *Epiglottis,* with its Salival Miliary Glands E, as they appear'd on its internal Surface. Theſe Glands are very conſpicuous in Oxen: You may ſee them on the *Epiglottis* of a dry'd Neat's Tongue, as its call'd, on which, I muſt confeſs, I firſt obſerv'd them, and afterwards diſcover'd them in human Bodies. When the Exeretory Ducts of theſe (E) and the neighbouring Glands are obſtructed, the Patient is oblig'd to ſwallow the Spittle very often to moiſten theſe Parts; an Inſtance of which I found in a Gentleman, that is now my Patient, who has a hard Tumour on the upper part of the Scutiformal Cartilage of the *Larynx.*

FIG. II.

The back part of the Muſcles of the Uvula, *with the upper part of thoſe of the* Fauces, *when diſſected.*

FF The Extremities of the *Proceſſus Pterygoidei* broken off, to ſhew the Progreſs of the Tendons of the *Muſculi Pterygoſtaphylini* (55) over them on each Side.
G The cartilaginous beginning of the Tube between the *Fauces* and the Ear, cut out, to ſhew its Connexion to the laſt mention'd Muſcle, 55.
H The hind part of the *Uvula.*
I The back part of the *Fauces* pinn'd up.
53 Part of the *Muſculi Glossostaphylini.*
54 The *Sphenostaphylini.*
55 The *Pterygostaphylini.*
K Their Tendons ſeparated from the *Os Palati.*
LL The Fibres of that part of the *Muſculus Oesophagæus,* which ſprings from the laſt mention'd Tendons on each Side, and the Extremities of the *Proceſſus Pterygoidei.* This I formerly call'd *Pterygopharyngæus;* but finding it ſo compli-

cated

P P

cated with the *Oesophagæus*, I choose to represent it under that Title, being willing to retrench, as much as possible, the number of the Muscles, especially such as are not fairly to be separated from each other.

MM   Another part of the *Musculus Oesophagæus*, which springs from the lower Jaw-bone.

NN   A third Series of Fibres of the *Oesophagæus*, springing from the *Uvula*, and ending in the Sides of the *Fauces* and Scutiformal Cartilage. *Vid.* Tab. xxix. Fig. i. and ii. N. N.

OO   A fourth part of the *Oesophagæus*, that arises from a Cartilaginous Appendix of the *Os Hyoides*. *Vid.* Fig. iii. O, and Tab. xxix. Fig. ii.

PP   Another part of the *Oesophagæus*, that comes from the Sides of the Scutiformal Cartilage, express'd at P, Fig. iii.

Fig. III.

The back part of the Muscles of the Fauces, *connected to the* Os Hyoides *and* Larynx.

C   The Cartilaginous Rings of the *Larynx*.

D   Its back part, which is membranous, to give way for the Dilatation of the *Oesophagus* in swallowing.

LLL   That part of the *Oesophagæus*, that springs from the *Processus Pterygoidei*, the Tendons of the *Musculi Pterygostaphylini*, and the *Os Occipitis*, and has a different Order of Fibres from its external ones express'd at I, which are connected to the middle of the anteriour *Appendix* of the *Os Occipitis*.

MM   Those parts of the *Oesophagæus*, that arise from the lower Jaw.

NN   Its Fibres, that spring from the Root of the Tongue.

O   From the *Os Hyoides*.

P   From the Scutiformal Cartilage.

Q   From the *Cartilago Cricoides*.

R   The *Os Hyoides*.   *r.* Its Cartilaginous Appendix.

S   The *Cartilago Thyroides*.

T   The *Processus Styloides*.

VV   Two Ligaments fastened to the Extremities of the *Processus Styloides* and Cartilaginous Appendices of the *Os Hyoides* on each Side.

XX   A pair of Muscles, most commonly found springing fleshy from the *Processus Styloides*, and terminating in the Cartilaginous *Appendices* of the *Os Hyoides*, r.

56   The *Stylopharyngæi*, with their Originations from the *Processus Styloides* and their Insertions into the *Pharynx*.

57. 57.   The back part of the *Oesophagæus*.

58. 58.   The external Surface of the *Vaginalis Gulæ*, as it appears, when distended with Wind.

59 The

59   The *Sternothyroideus* left at its Implantation into the *Cartilago Thyroides*.

60   The *Hyothyroideus in Situ*.

61   The *Cricothyroideus in Situ*.

FIG. IV.

The Muscles of the Uvula, *clear'd and left in their natural Situation.*

a   The *Uvula* pinn'd up.

bb   The *Proceſſus Pterygoideus* bar'd.

c   A Ligament, which is continu'd from the Extremity of an acute Proceſs of the *Os Sphenoides*, d, to the *Proceſſus Pterygoideus*.

e   The *Septum Narium*.

ff   The Cartilaginous Extremities of the Tube, between the Palate and Cavity of the *Tympanum*.

g   Part of the *Muſculus Pterygoideus Internus* of the lower Jaw.

54   The *Sphenoſtaphylinus*.

55   The *Pterygoſtaphylinus*.

TAB.

TAB. XXIX.

FIG. I. II.

The fore Parts of the Muscles of the Uvula *and* Fauces *dissected and cleared of their Glandulous Membranes.*

F G H   The fore Parts of the same Organs explain'd in the preceding Table at F. G. H. Fig. II.

H Fig. II.   The back part of the *Uvula*, here seen by its being pinn'd up.

I I   The internal Series of fleshy Fibres of the *Oesophagæus* Muscle, that arise from the *Appendix* of the *Os Occipitis*, and decussate the external Fibres, express'd Fig. II. and III. of the foregoing Table, at I, I, 57, 57. These Fibres are join'd with others springing from the Tendons (K) of the *Pterygostaphylini*, at L L, from the lower Jaw, at M M, and *Uvula*, at N N.

53   The *Glossostaphylinus*, with part of the Tongue remaining.

54   The *Sphenostaphylinus*.

55   The *Pterygostaphylinus*.

56   The *Stylopharyngæus*.

57: 57   The *Oesophagæus*. Those Parts of it which decussate the Fibres at I, L, M, and N, arise at O from the Cartilaginous *Appendices* of the *Os Hyoides*, and its Extremities; at P P, from the *Cartilago Thyroides*; at Q, from the *Cricoides*.

58   Part of the *Vaginalis Gulæ*.

R   The internal Membrane of the *Gula*, which makes the *Glottis*, supported on a Pin.

S S   The *Amygdalæ*, or *Tonsillæ*.

T   Some small Glands left, on taking off the internal Membrane, to shew the Series of Fibres underneath.

V V   The Glandulous Body of the Palate, cut from the *Os Palati*.

FIG. III.

The Gula *distended with Wind, to shew*

58   The *Vaginalis Gulæ*.

A   Its external Surface, compos'd of Fibres passing somewhat obliquely, according to its Length.

B B   Its internal circular Fibres.

C C   The external and internal Fibres raised, to shew their Decussation.

FIG. IV.

The Musculus Vaginalis Gulæ, *ending on the Left Orifice of the Stomach.*

A A   Its external Fibres.

B   Its internal Fibres still crossing the former on the Stomach.

TAB.

TAB. XXIX.

Fig. I.

Glossostaphilinus

Stylopha-
-ryngœus

Fig. II.

Fig. III.

Gula

Vaginalis

Fig. IV.

TAB.XXX.

Fig: II.

Fig: I:

Fig: IV.

60
Hyothyroideus

61
Cricothyroideus

59
Sternothyroideus

Fig: III.

64
Thyroarytænoideus
63.
Cricoarytænoideus lateralis
62.
Cricoarytænoideus posticus

65
Arytænoideus

Fig: V.
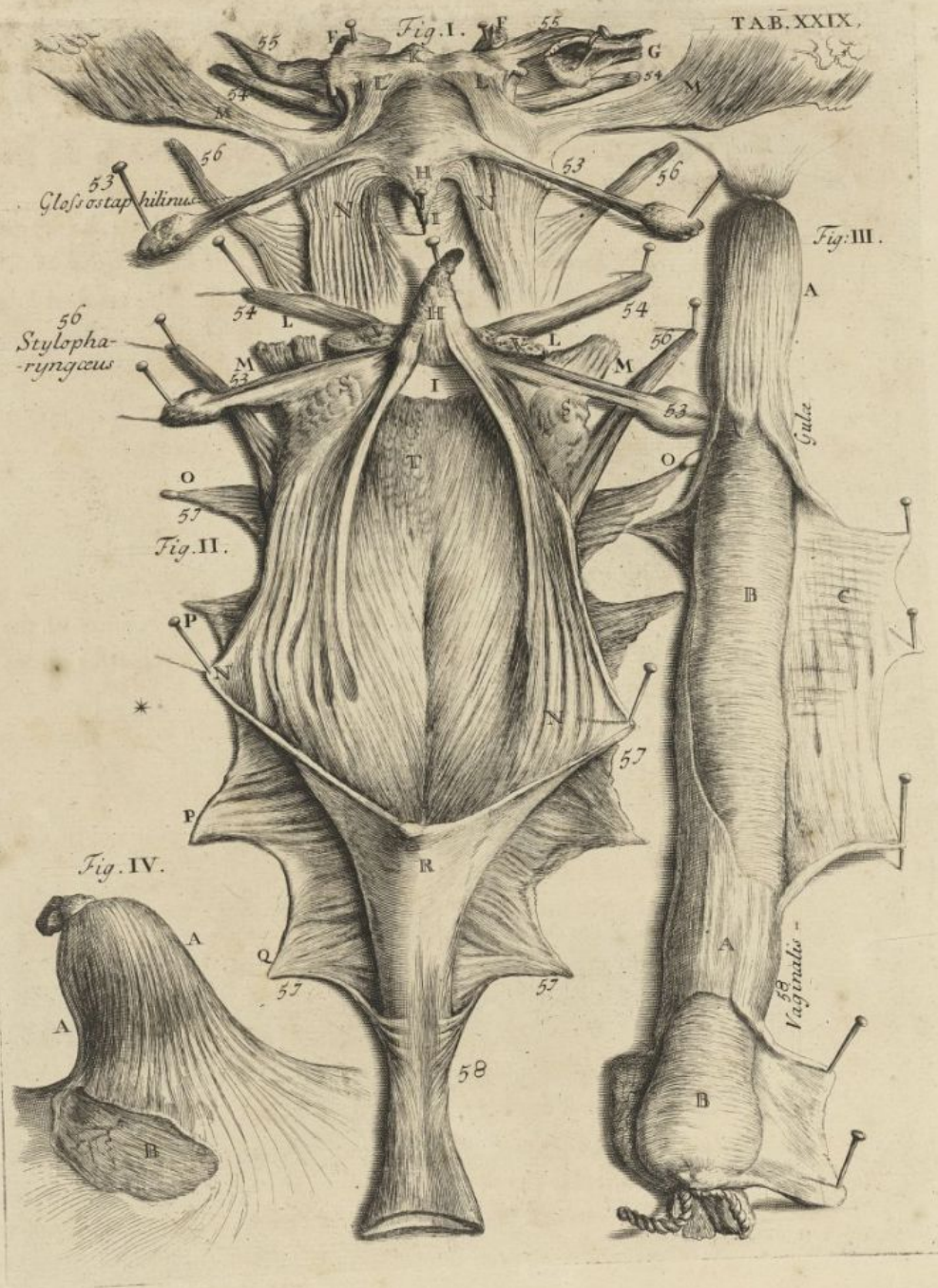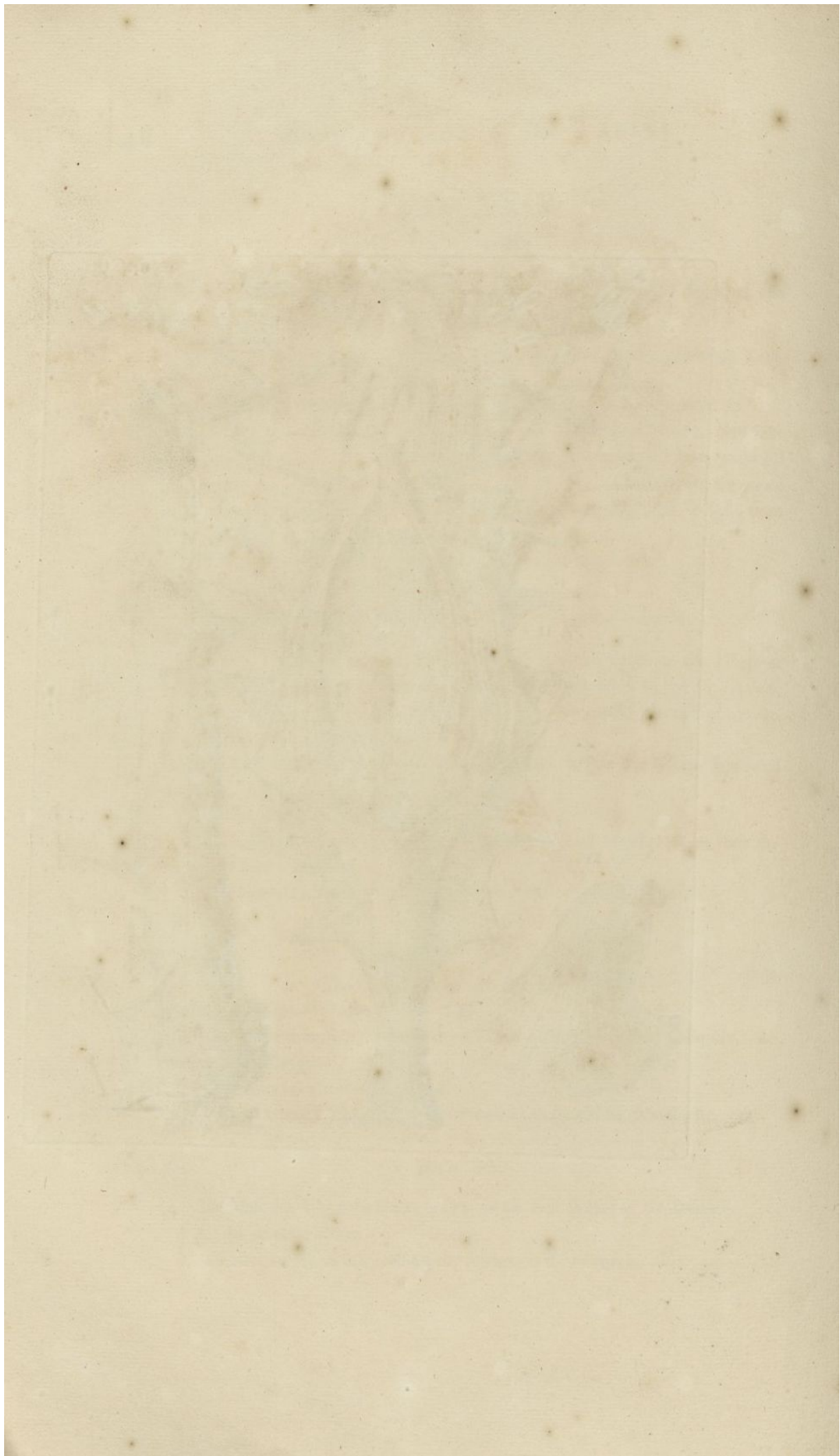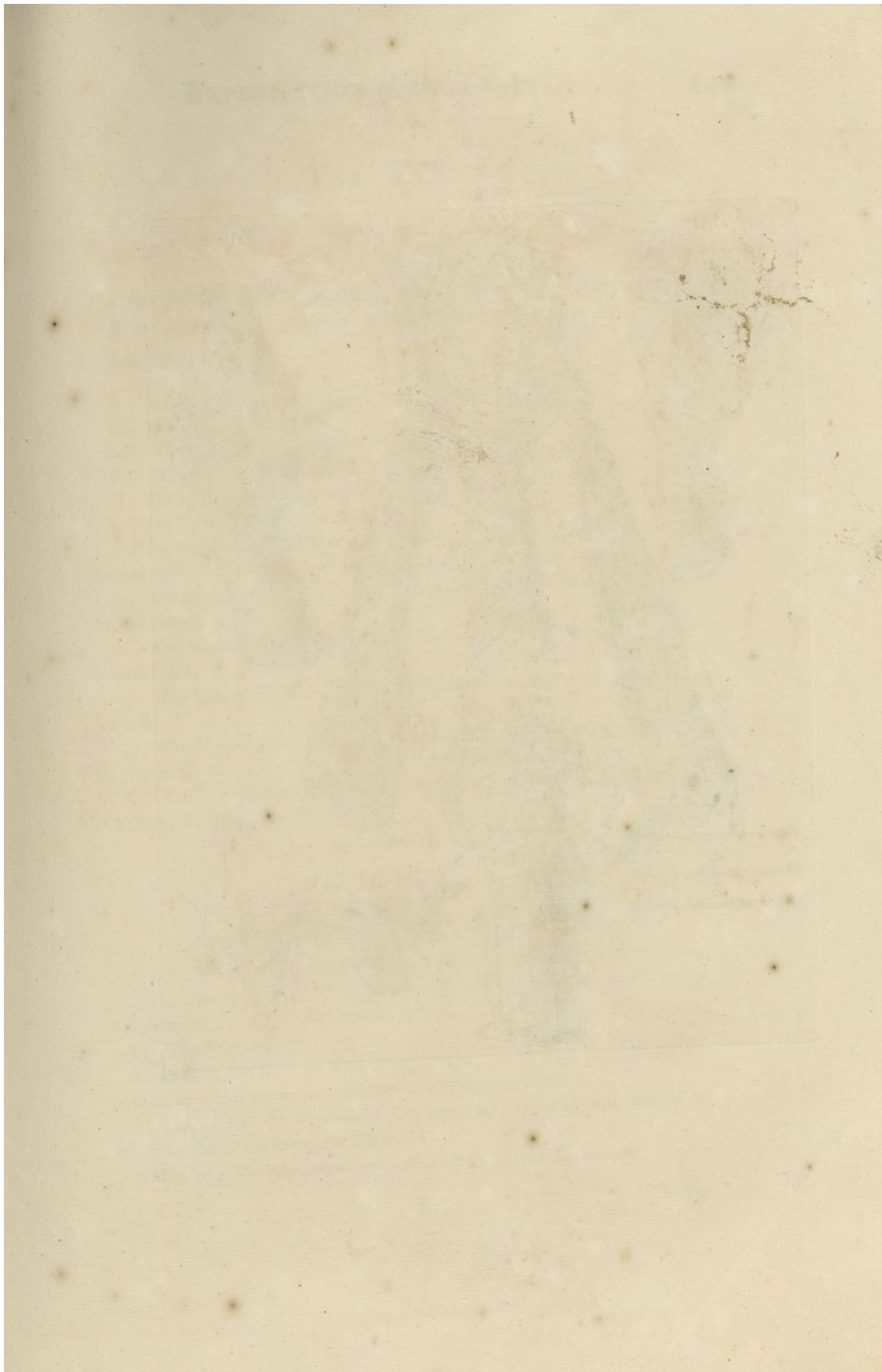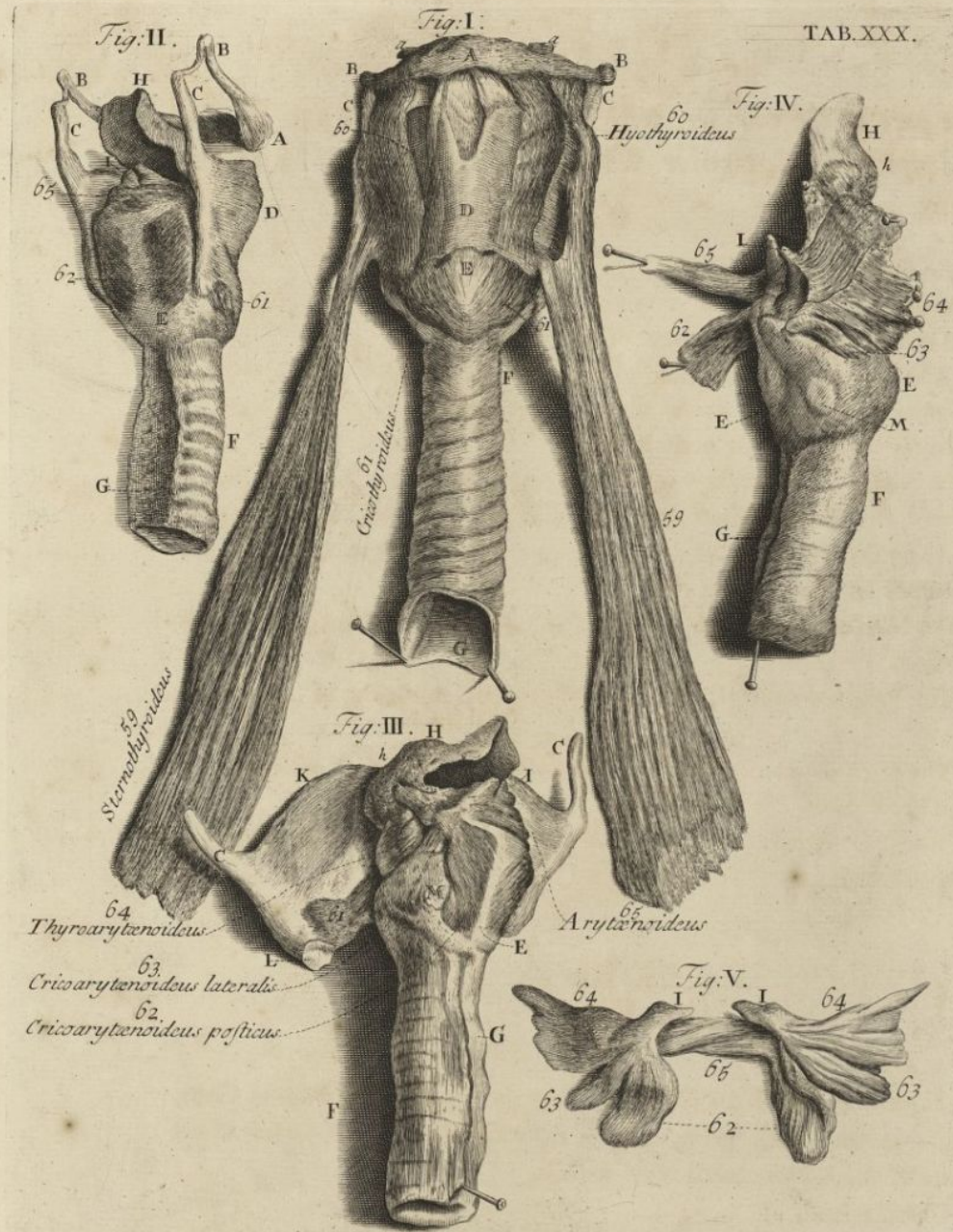
TAB. XXX.

FIG. I.

The fore part of the Larynx, *with the* Os Hyoides *and part of the* Wind-pipe *annex'd, together with all the common* Muscles *of the* Larynx.

A   The *Os Hyoides.*

a a   Its Cartilaginous *Appendices.*

BB   The Extremities of the *Cornua* of the *Os Hyoides.*

CC   The Processes of the Scutiformal Cartilage. *Vid.* Fig. II.

D   The external and fore part of the *Cartilago Scutiformis.*

E   The *Cartilago Cricoides,* or *Annularis.*

F   The Semicircular Cartilages of the Wind-pipe, which in this Subject (being an emaciated morbid Body) was drawn down to the right Side, by means of a large Ulcer on that Side of the Lungs, that caused the Lobes to adhere to the *Thorax* entirely on that Side.

G   The Membranous Substance on the back part of the Wind-pipe, that is next the *Gula.*

59   The *Sternothyroideus,* cut from its Origination, and left at its Insertion on each Side.

60   The *Hyothyroideus,* which on the right Side in this Subject was double, as appears in the Figure.

61   The *Cricothyroideus in Situ.* In Fig. III. it is raised from the Cricoidal Cartilage, and left at the Thyroidal.

FIG. II. III. IV. V.

Shew different Views of the Larynx, *and its proper* Muscles.

A, B, C, D, E, F, and G are placed on, or by the same Parts, in different Views, with Fig. I. except that G, in Fig. II. shews the external Glandulous Surface of the Membrane of the *Aspera Arteria* next the *Gula.*

H   The *Epiglottis.*

b   Its Root, cut from the Basis of the Tongue, where many small Glands appear on it, which are very conspicuous in the *Epiglottis* of an Ox.

I   The Tips of the Arytænoidal Cartilages, here bared of that Membrane, which on these Parts frames the *Glottis.*

K Fig. III. The internal concave Surface of the Thyroidal Cartilage.

Q q

L Fig.

L Fig. III. The lower fhort Procefs of this Cartilage, on the Left Side, freed from its Connexion to the Cricoidal Cartilage exprefs'd at M.

62 The *Cricoarytænoideus Pofticus in Situ,* Fig. II. and III. In Fig. IV. it is raifed from the Cricoidal Cartilage, and pinn'd out.

63 *Cricoarytænoideus Lateralis in Situ,* Fig. III. and IV.

64 *Thyroarytænoideus, in Situ,* Fig. III. In Fig. IV. it is cut from its Origination, and left at its Infertion.

65 The *Mufculus Arytænoideus, in Situ,* Fig. II. and III. rais'd and pinn'd out in Fig. IV.

In Fig. V. all the laft named Mufcles are diffected, and left at their Terminations on the Arytænoidal Cartilages.

TAB.

TAB. XXXI.

Digastricus.

Temporalis.

Masseter.

Depressor Labii inferioris proprius.

Pterygoidei interni.

Pterygoidei externi.

Elevator Labii inferioris proprius.

Masseter.
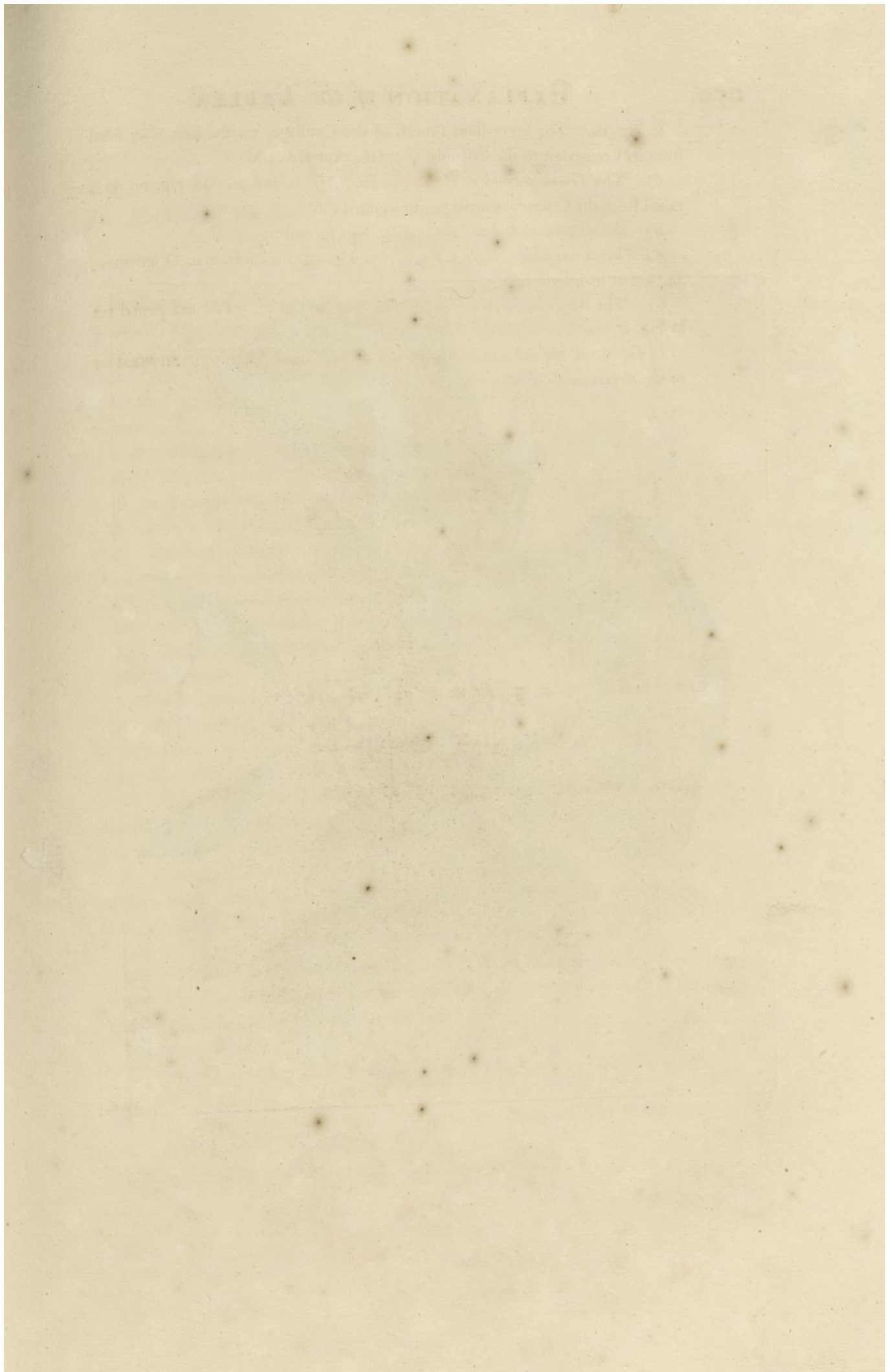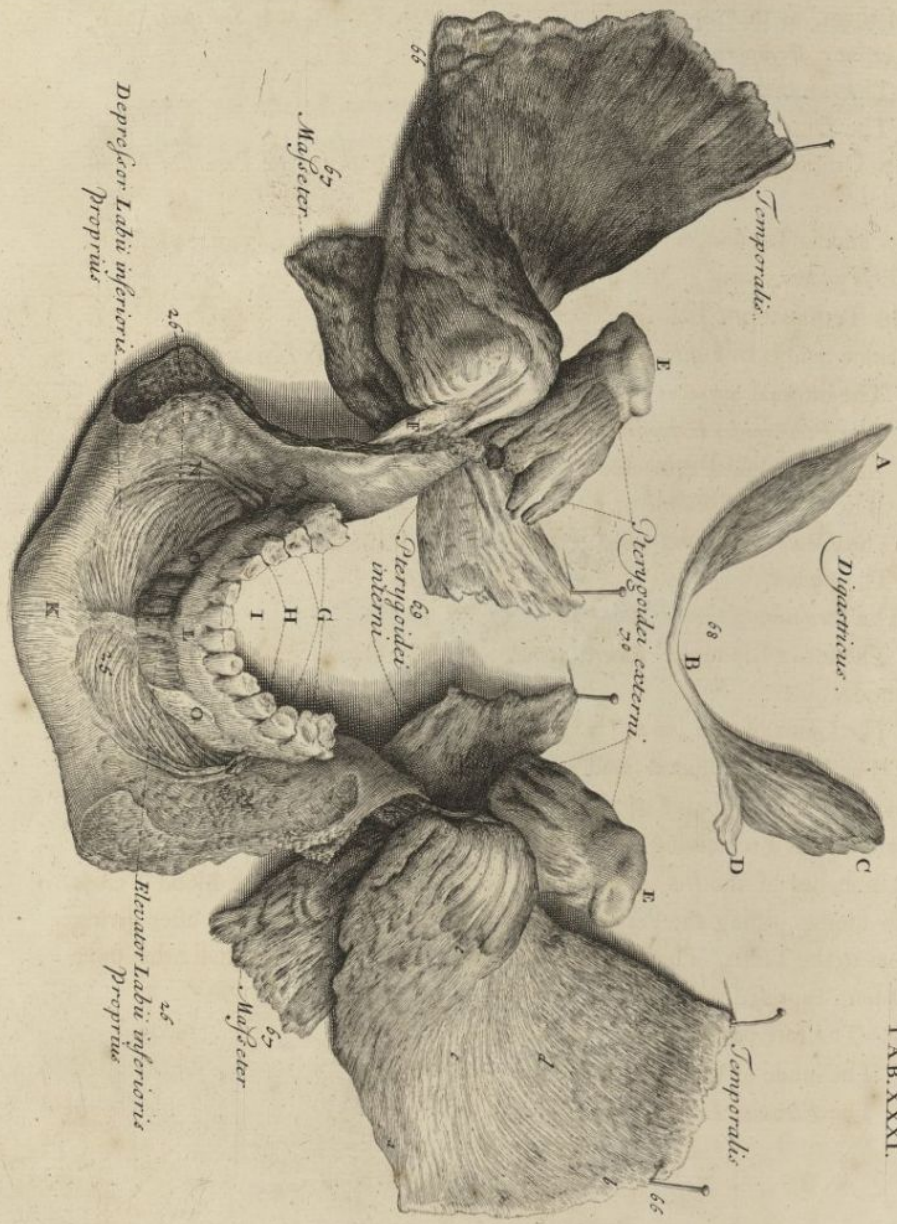
Temporalis.

TAB. XXXI.

The Muscles of the lower Jaw, as they appear, when freed from the Cranium.

66 The Infides of the Temporal Mufcles, where may be feen divers flefhy Fibres of them, as they appear, when cut from the *Os Frontis*, at a, *Sincipitis*, at b, *Sphenoides*, at c, *Temporale*, at d, and *Os Jugale*, at e.

67 The internal Surface of the Maffeter.

68 The *Digaftricus*.

A Its Origination from the Chink by the back part of the *Proceffus Mam-miformis*.

B Its middle Tendon, which is braced down by an annular Ligament faftened to the *Os Hyoides*.

C Its Termination, cut from the lower Jaw.

D Some tendinous Fibres of this Mufcle, cut from the *Os Hyoides*.

69 The internal Surfaces of the *Pterygoidei Interni*.

70 The *Pterygoidei Externi*, hanging down from

EE the Condyloidal Proceffes of the lower Jaw.

FF The *Proceffus Acutus*, or *Corone*, partly feen.

G The *Dentes Molares*, which remain'd in this Subject.

H The *Canini*.

I The *Incifores*.

K The lower Lip turned down, to fhew the Glandulous and Mufcular Texture of its infide.

L The Gums of the lower Jaw.

M The Labial, or Buccal fmall Salival Glands, as they appear on the Left Side, after the internal Membrane of that part is raifed. The Membrane on the other Side here exprefs'd remaining on.

N Branches of the *Par Quintum Nervorum*, accompanied with Blood Veffels of both kinds, paffing the Perforations on each Side the lower Jaw, after giving Branches to the Teeth. They diftribute themfelves on the Lips, efpecially the lower Lip, as here exprefs'd.

OO The fore part of the lower Jaw bared.

25 The infide of the *Depreffor Labii Inferioris*.

26 The *Elevator Labii Inferioris in Situ*.

TAB.

TAB. XXXII.

71   The Inside of the *Serratus Minor Anticus*.

A   Its Origine, cut from the *Proceſſus Coracoides* of the *Scapula*.

BBB   Its three fleſhy Digitations, that terminate on the ſecond, third and fourth Ribs, in the manner you ſee the Ends of the fleſhy Fibres here expreſs'd, cut off, ✝ ✝ ✝.

72   The Inſide of the *Serratus Major Anticus*.

AC   That part of it, that ſprings from the *Baſis Scapulæ*, below its Spine: from A to D is that part, that has its Origine above the Spine of the *Scapula*.

B   The upper part of this Muſcle, which is ſeen between the *Cucullaris*, *Scaleni*, *Levator Scapulæ*, and *Clavicularis*, as expreſs'd Tab XXII. at 72.

EF   The Digitations of this Muſcle, cut from the 8th, 7th, 6th, 5th, 4th, and 3d Ribs.

GG   That part of it, which terminated on the firſt and ſecond Ribs.

H   Its Arteries, filled with Wax.

TAB. XXXII.

71

A

B

B

B

71
Serratus minor
Anticus

72

D

A

B

G

C

G

H

F
3

4

5

5

7

E 8
Serratus major
Anticus
72

Fig. I.

Scalenus secundus 75

Scalenus tertius 76

Scalenus primus 74

Splenius I. 22

Intercostales interni 79

Fig. II.
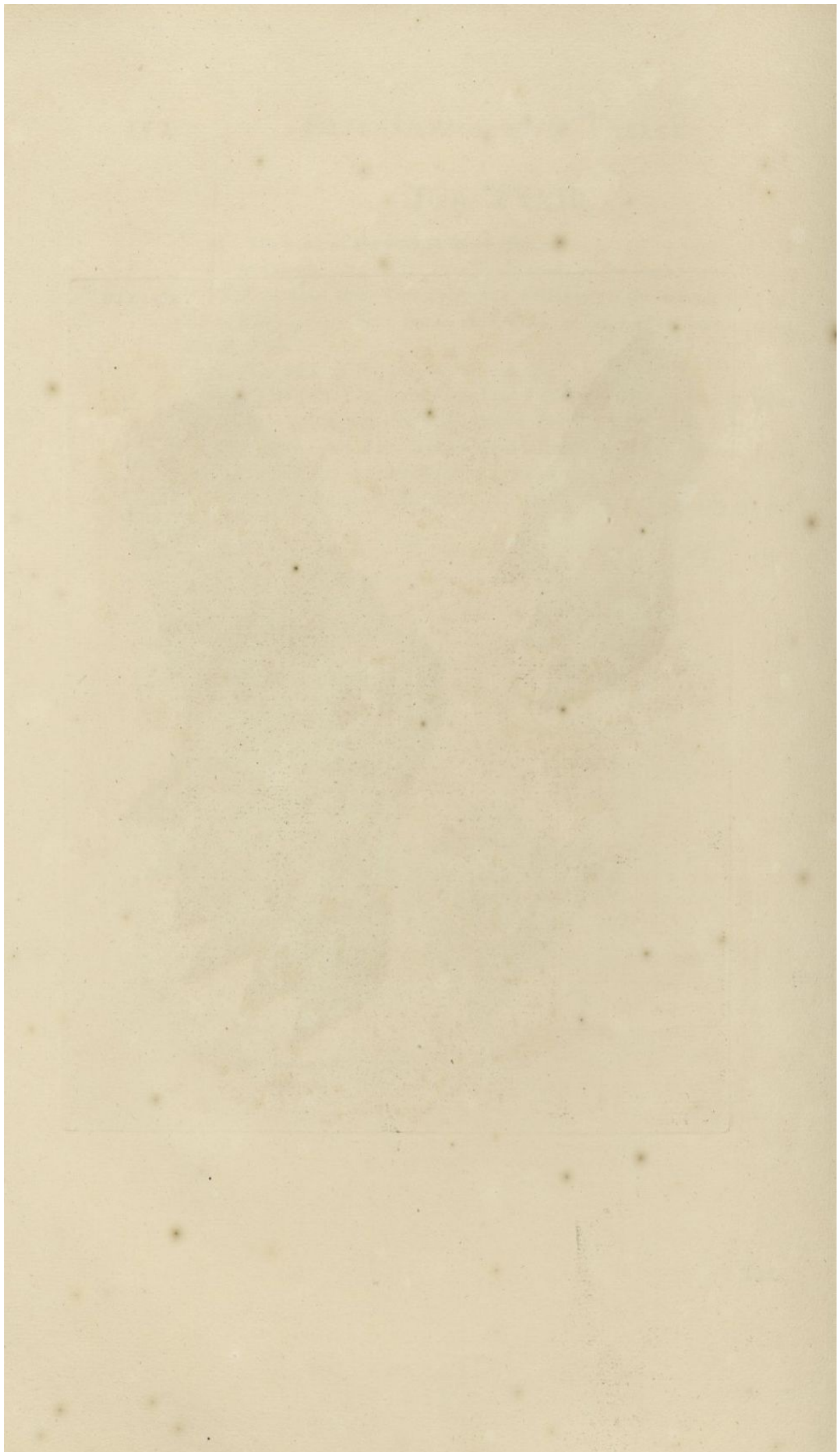
Subclavius 73

TAB. XXXIII.

73 The *Subclavius* diffected.

A The flefhy Part of it, that fprings from the *Clavicula*.

B Its round Tendon, with part of the Cartilage of the firft Rib cut off.

74 The Infide of the *Scalenus Primus*.

A Its flefhy Origine from the fourth, fifth, and fixth tranfverfe Proceffes of the Neck.

B Its Termination, cut from the firft Rib.

75, 76 The Outfides of the *Scalenus Secundus*, and *Tertius*.

A Their flefhy Beginnings from the third, fourth, fifth and fixth tranfverfe Proceffes of the *Vertebræ* of the Neck.

B Their common Tendon in this Subject, cut from the firft Rib.

FIG. I.

The Infide of the Sternum, *with the Cartilaginous Endings of the Ribs, freed from their Bony Parts.*

AA The Cartilaginous Endings of the two upper Ribs, which are conftantly longer than the two next below them, as here exprefs'd.

BB Two Sinus's, where the Extremities of the *Claviculæ* are articulated, by the mediation of two moving Cartilages.

CC Part of the *Par Sternothyroideum*.

DD The Mammary Arteries and Veins.

EE The Infide of the *Os Pectoris*, or *Sternum*.

F The *Cartilago Enfiformis*.

GG The Cartilaginous Endings of the Ribs, cut from their Bony Parts.

77 The *Mufculus Triangularis*, on each Side.

79 The internal Intercoftal Mufcles.

H Part of the Diaphragm.

FIG. II.

A Sketch of the internal Surface of two or three of the lower Ribs, near their Articulations with the Vertebræ *of the Back, as big as the Life ; where a Difpofition of the internal Intercoftal Mufcles, not commonly taken notice of, is reprefented.*

79, 79 The *Intercoftales Interni*.

AA The tendinous Original of divers Slips of the internal Intercoftal Mufcles, fpringing from the inferiour Ribs, and afcending obliquely over the next fuperiour Rib at E, where they become broader and flefhy, being join'd with flefhy Slips from the fubjacent intercoftal Mufcles at C, and terminating in the next Rib above at B.

This Difpofition of the internal Intercoftal Mufcles is continued on all the Ribs, on both fides the *Thorax* in human Bodies, and not in thofe Quadrupeds, that I have hitherto examin'd. The way of difcovering this, is by raifing the *Pleura*, which may eafily be done by your Fingers, after it is divided from the *Mediaftinum*, on the Bodies of the *Vertebræ* of the *Thorax*.

DD Parts of the external Intercoftal Mufcles, bared from the Internal.

R r

TAB.

TAB. XXXIV.

78 The upper Surface of the Diaphragm, next the *Thorax*.

A The Right Side.

B The Left.

C That part of the Diaphragm, which arifes from the *Cartilago Enfiformis*.

DEF Thofe Parts, that arife from the *Vertebræ* of the Loins.

GG From the two laft Ribs.

HH From the Cartilaginous Endings of the Ribs next the *Abdomen*; whence its flefhy Fibres pafs, till they become tendinous, II, where they decuffate each other in various Angles, according to their feveral Directions, from their different Originals at A, B, C, D, E, F, G, H. Nor do they feem to terminate here, but each tendinous Fibre is continued to its oppofite flefhy one, making as it were fo many Digaftrick Mufcles, in which are two confiderable Perforations; the one for

K The *Vena Cava*, the other for

L The *Gula*.

M A Portion of the Trunk of the *Arteria Magna*, in the Fiffure of the two Productions of the Diaphragm, where the *Vena fine pari* and the Thoracick Duct alfo pafs.
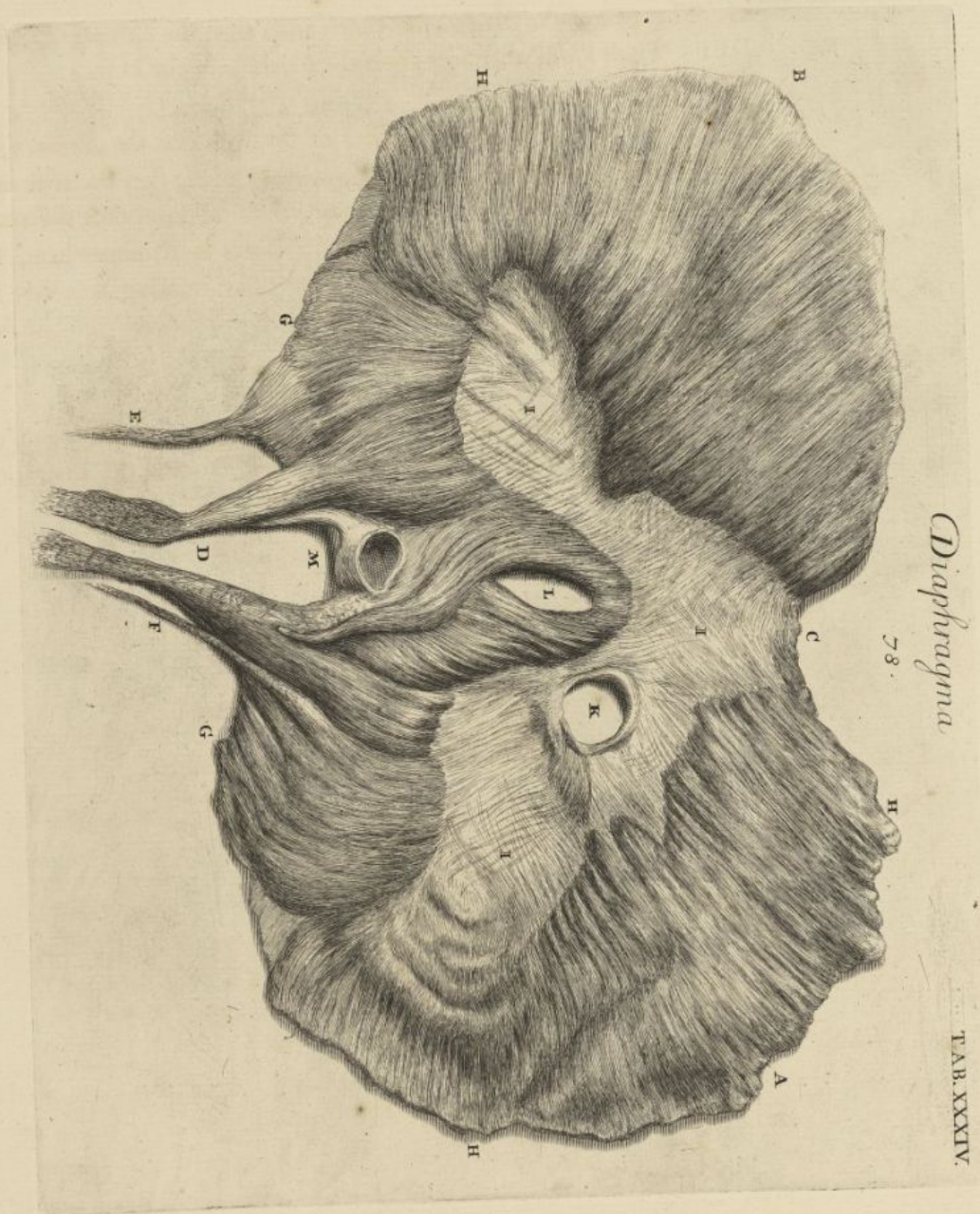
Diaphragma

78.

TAB. XXXIV.
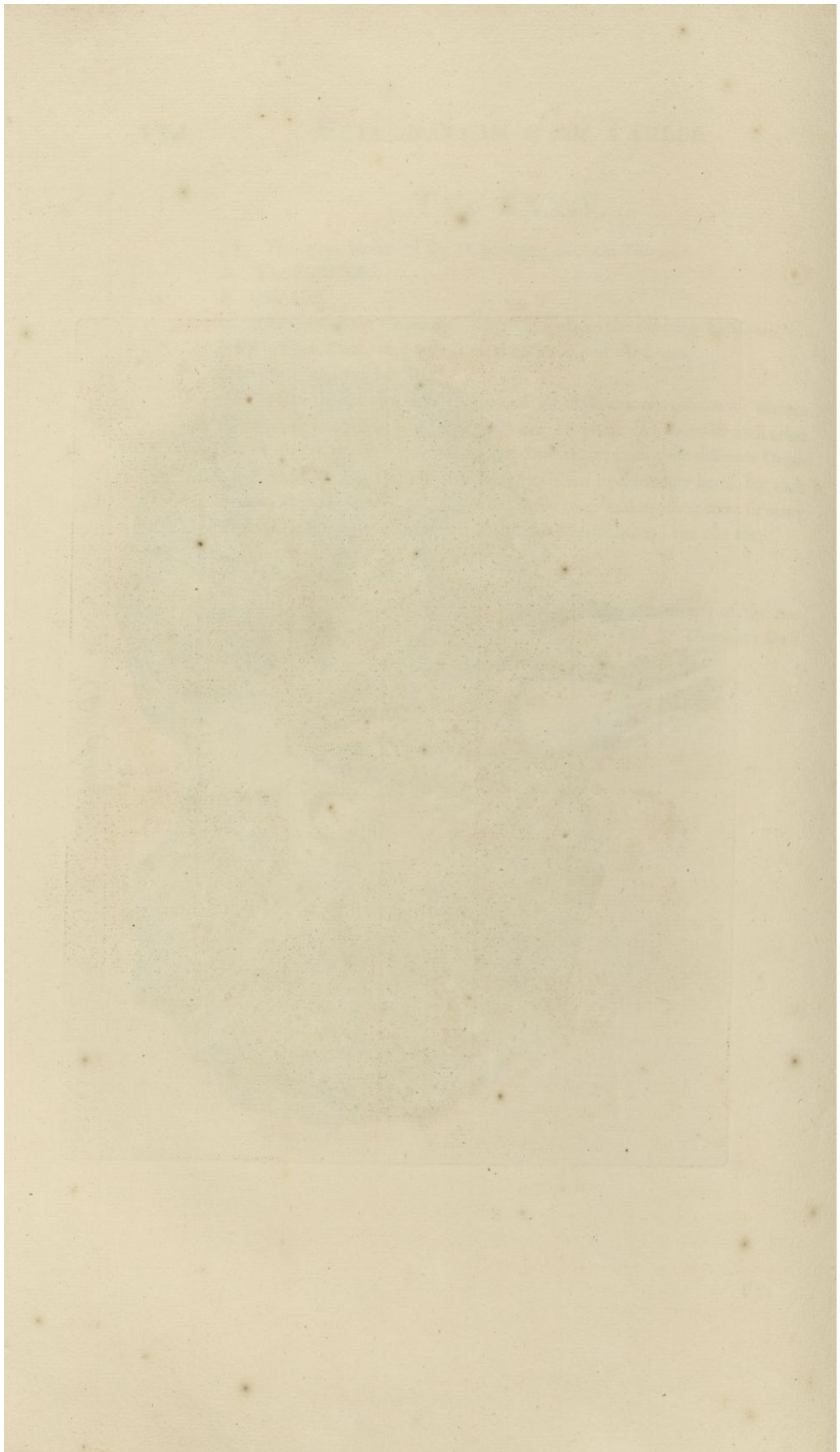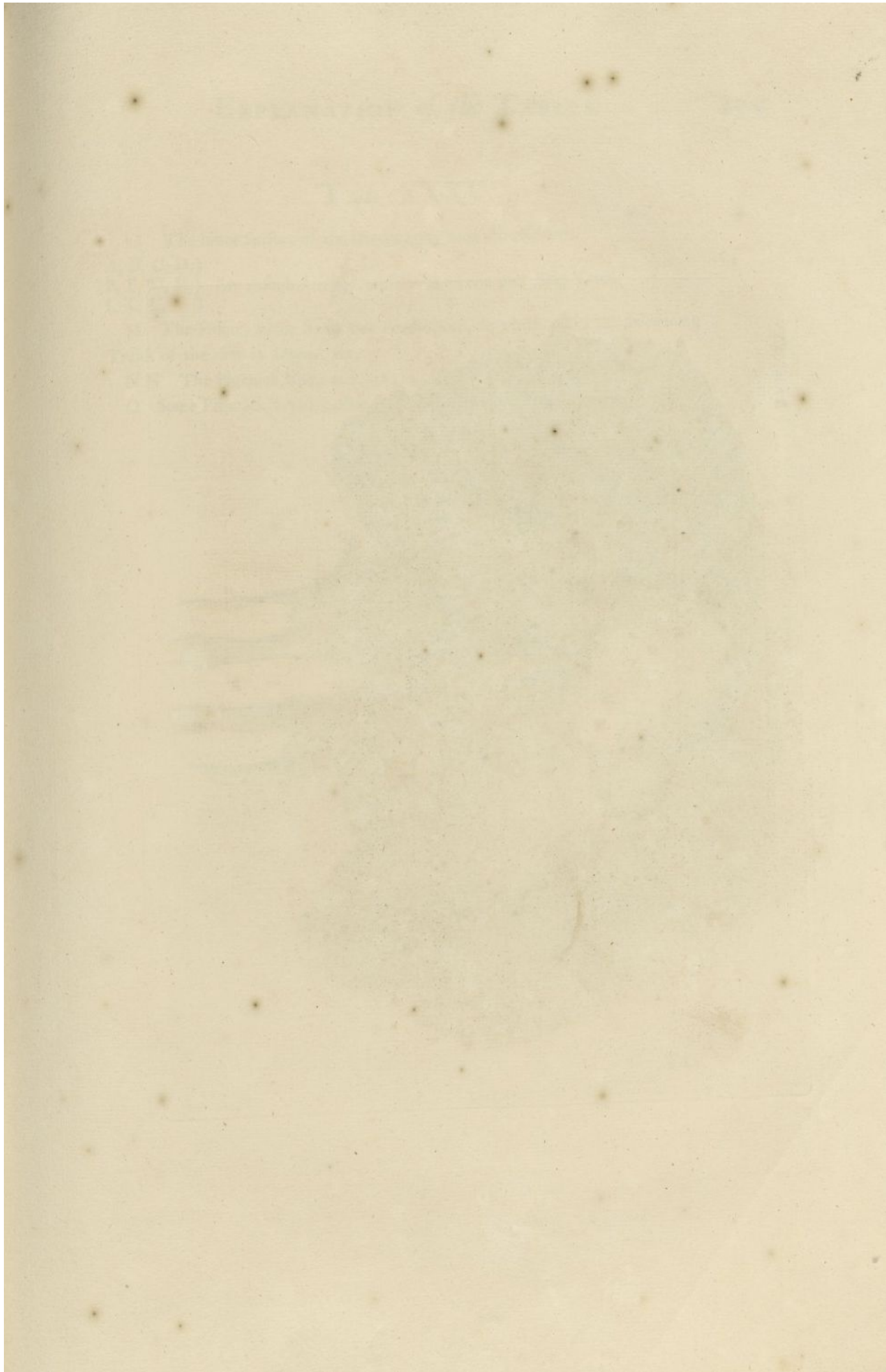
TAB. XXXV.

Diaphragma. 78
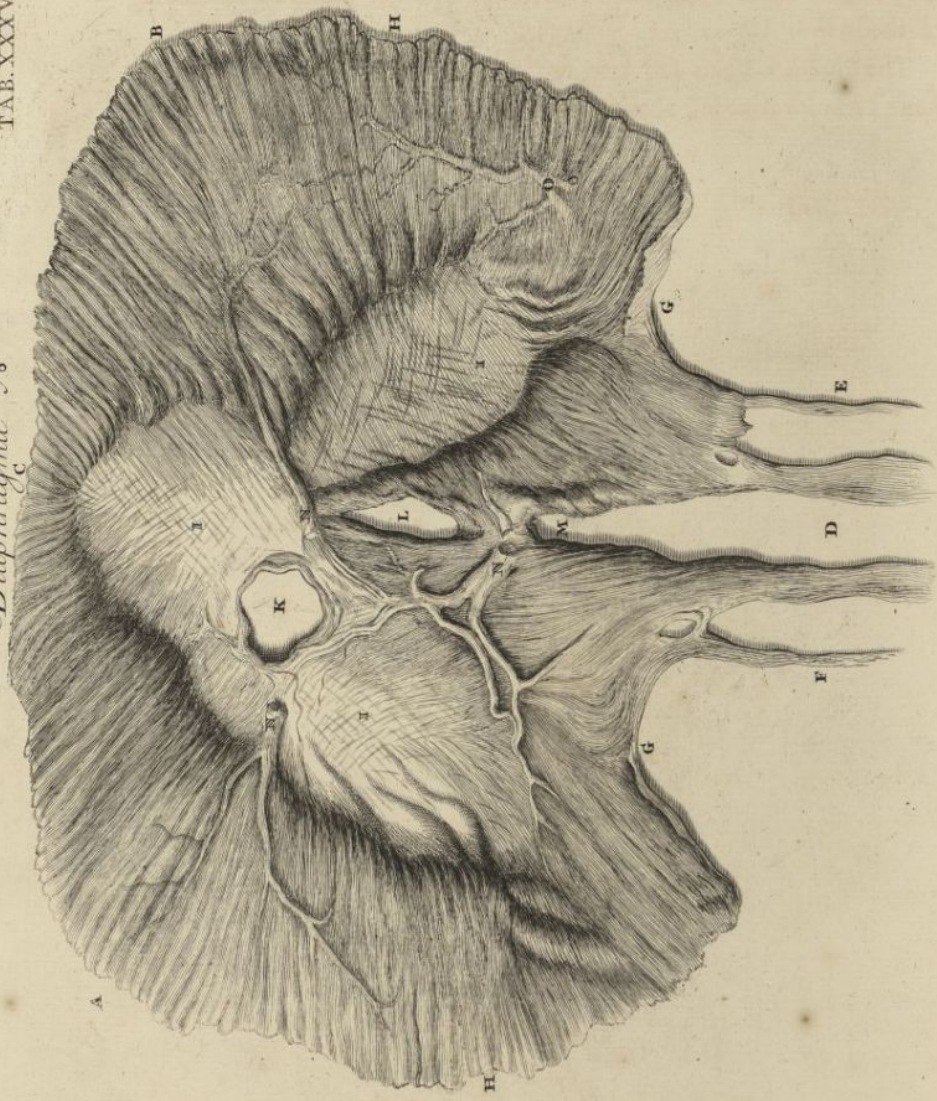
TAB. XXXV.

78 The lower Surface of the Diaphragm, next the *Abdomen.*

A, B, C, D,
E, F, G, H, } Are defcrib'd in the Explication of the preceding Table.
I, K, L,

M The Fiffure, made by its two Productions, in which paffes the defcending Trunk of the *Arteria Magna*, &c.

N N The Phrenick Veins and Arteries, fill'd with Wax.

O Some Phrenick Arteries, that fpring from the Intercoftal Arteries.

TAB.

TAB. XXXVI.

Divers Views of the external, middle, and internal Compages of the Fibres of the Heart.

FIG. I.

The fore part of the Heart, next the Sternum.

A   The inferiour Trunk of the *Vena Cava.*

B   The *Arteria Pulmonalis.*

C, C, C   The *Vena Pulmonalis,* with its Branches tied up.

D   The *Arteria Magna.*

a   The *Ligamentum Arteriosum,* between the Pulmonick Artery and the *Aorta.*

b   The Trunk of the *Arteria Coronalis.*

E   The right Auricle distended, to shew the Series of its Muscular Fibres.

F   The Left Auricle.

G   The oblique descending Progress of the Muscular Fibres of the right Ventricle of the Heart.

H   The oblique ascending Progress of the carnous Fibres of the left Ventricle.

I I   The tendinous Union of both these on the *Septum* of the Heart.

FIG. II.

The back part of the Heart, next the Vertebræ.

A   The lower, or ascending, Trunk of the *Vena Cava.*

a a   The circular Fibres appearing on its inside.

B   A Portion of the upper, or descending, Trunk of the *Cava.*

b   The *Vena Coronaria.*

C   The *Vena Azygos* tied up, where it discharges it self into the *Cava.*

D D   The right Auricle, representing the various Disposition of its Fibres.

E   Part of the Root of the left Auricle *in Situ.*

G   The Muscular Fibres on the bulbous Trunk of the *Vena Pulmonalis.*

F F   Two of its Ramifications from the Lungs, tied up.

H   The Fibres of the right Ventricle.

I   Those of the left Ventricle.

K K   Their tendinous Union, on the *Septum Cordis.*

L   The *Foramen Ovale,* somewhat appearing.

FIG.

Cor Musculus
80

Fig. I.   Fig: II.   TAB. XXXVI.

Fig: VI.

Fig: III.   Fig: IV.

Fig: V.
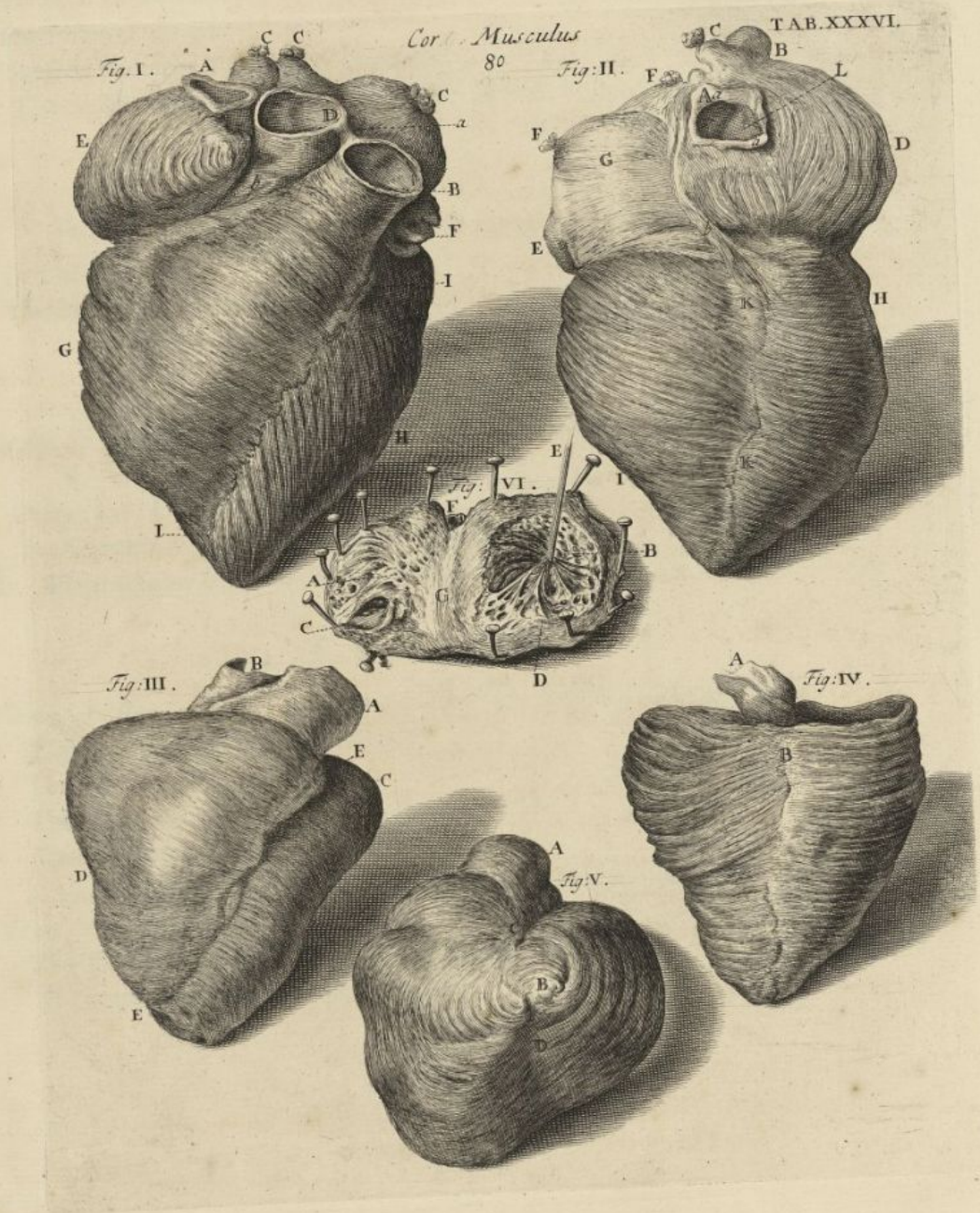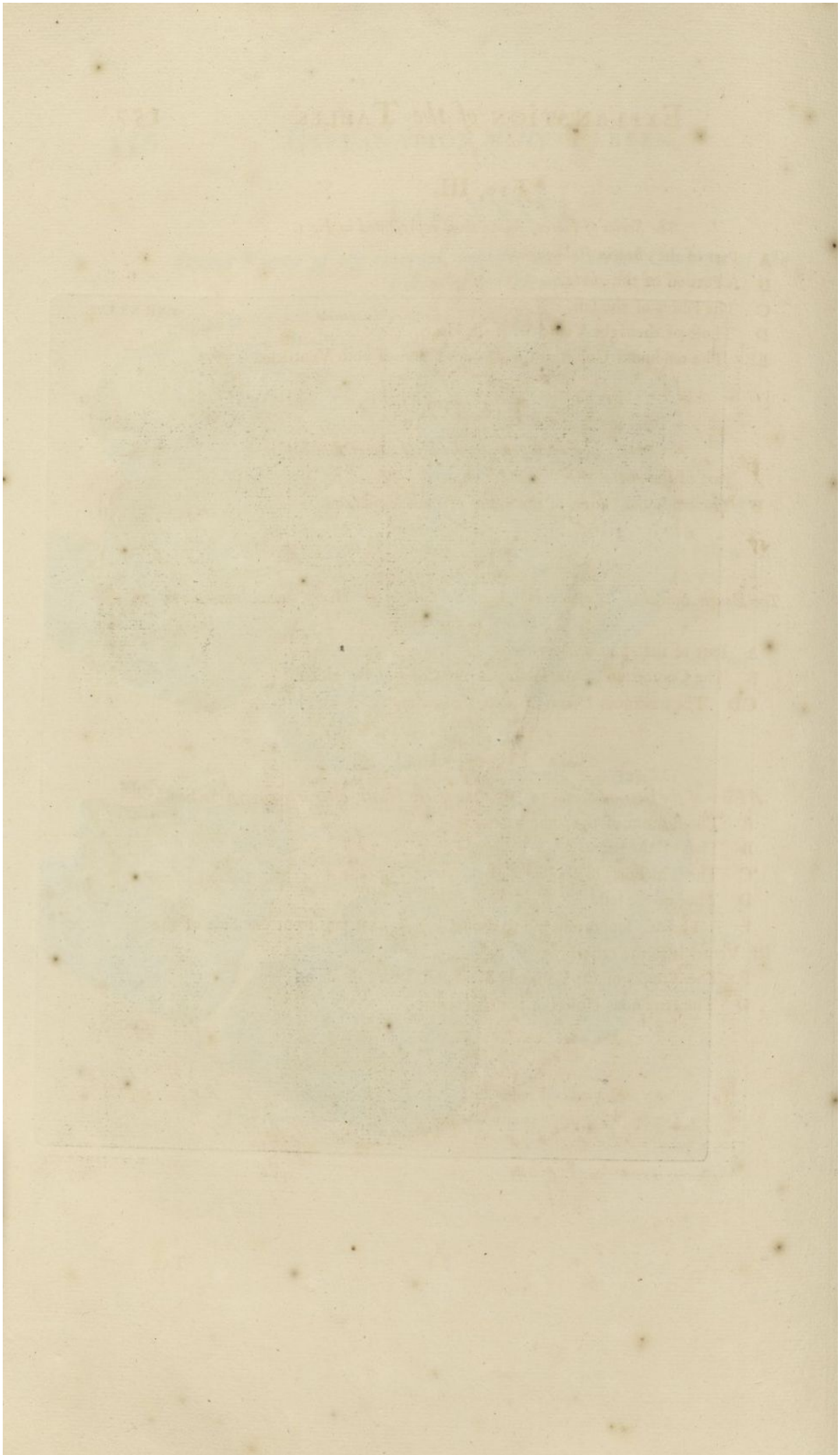
FIG. III.

The Series of Fibres, under those represented in Fig 1.

A   Part of the *Arteria Pulmonalis.*
B   A Portion of the *Aorta.*
C   The Fibres of the left,
D   Those of the right Ventricle of the Heart.
EE   The tendinous Union of the carnous Fibres of both Ventricles.

FIG. IV.

The Fibres, as they appear, under those express'd in Fig. II.

A   Part of the *Aorta.*
B   The tendinous Union of the Fibres of both Ventricles.

FIG. V.

The Double Spiral Order of the Fibres, at the Cone of the Heart, which may partly be seen in Fig. III.

A   Part of the *Arteria Pulmonica.*
B   The Contortion of the Fibres, at the Cone of the Heart.
CD   The tendinous Union of both Ventricles.

FIG. VI.

A View of the internal Surface of the Cone of the Heart, after a transverse Section.

A   The Bottom of the right Ventricle.
B   That of the left.
C   The Thickness of the Sides of the right Ventricle.
D   That of the left.
E   A Thread, supporting the tendinous Fibres, that pass from one Side of the left Ventricle to the other.
F   The Trunks of the Coronary Vein and Artery divided.
G   The tendinous Union of both Ventricles.

S f   TAB.

TAB. XXXVII.

FIG. I.

The right Auricle and Ventricle of the Heart, open'd from the
Vena Cava.

A   The Body of the Heart, with its Blood Veſſels filled with Wax.

a   Its Cone.

BB   The aſcending Trunk of the *Vena Cava* opened.

bb   That part of the right Auricle, that is divided from the aſcending Trunk
of the *Cava.*

C   The deſcending Trunk of the *Cava*, alſo open'd and expanded.

c   The Orifices of Veins, that bring Blood from the Auricles, and Trunks of
Blood Veſſels at the *Baſis* of the Heart.

DD   The Inſide of the right Auricle.

d   A ſmall Semilunar Valve, as it appears in the lower Trunk of the *Vena Cava*,
in this Poſition.   See Fig. II.

EEE   The Sides of the right Ventricle divided.

F   One of the carnous Columns, to which the Tricuſpid Valve is faſten'd.

f   Some fleſhy Fibres paſſing from the inſide of the Ventricle to the Tricuſpid
Valve.

GG   The Tricuſpid Valve, as it appear'd in this Poſition.

H   A Valve pinn'd up, at the Orifice of the Coronary Vein.

II   A bended Probe, paſſing through the *Foramen Ovale*, K, into the *Vena
Pulmonalis*, L, which remain'd open in this Subject, who died conſumptive about
30 Years of Age.

MM   A Black Lead Pencil, ſupporting the Tricuſpid Valve, and paſſing out at
the right Branch of the *Arteria Pulmonalis*, N.

O   The left Branch of the *Arteria Pulmonalis.*

P   Divers carnous Fibres, which ariſing from the *Septum Cordis*, paſs to the
oppoſite Side of the right Ventricle, and draw it cloſe to the *Septum*, when the
Heart is *in Syſtole.*

FIG. II.

A Portion of the lower Trunk of the Vena Cava, *diſſected and diſplay'd, with the*
Parts annex'd, to ſhew the Valve expreſs'd at d, Fig. I.

AA   The Trunk of the *Vena Cava*, cut off immediately above the Liver, at
its paſſing the Perforation of the Diaphragm.

B   A Portion of the Diaphragm.

C, C   Two Pins, with Threads paſſed through the Edge of the Semilunar Valve,
as I call it from its Figure in this and moſt other Subjects, to ſhew the Extent of
this Valve.

EE   Part

TAB. XXXVII.
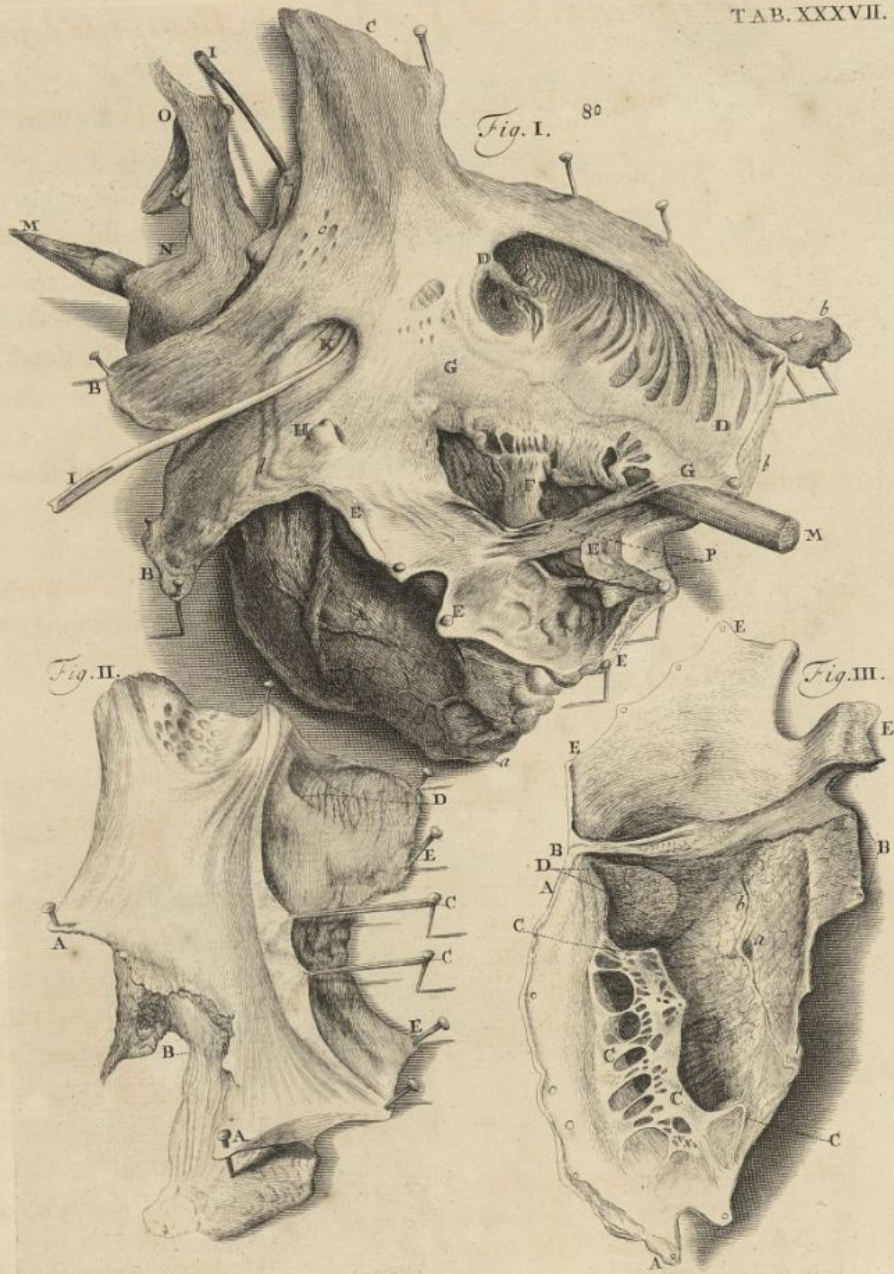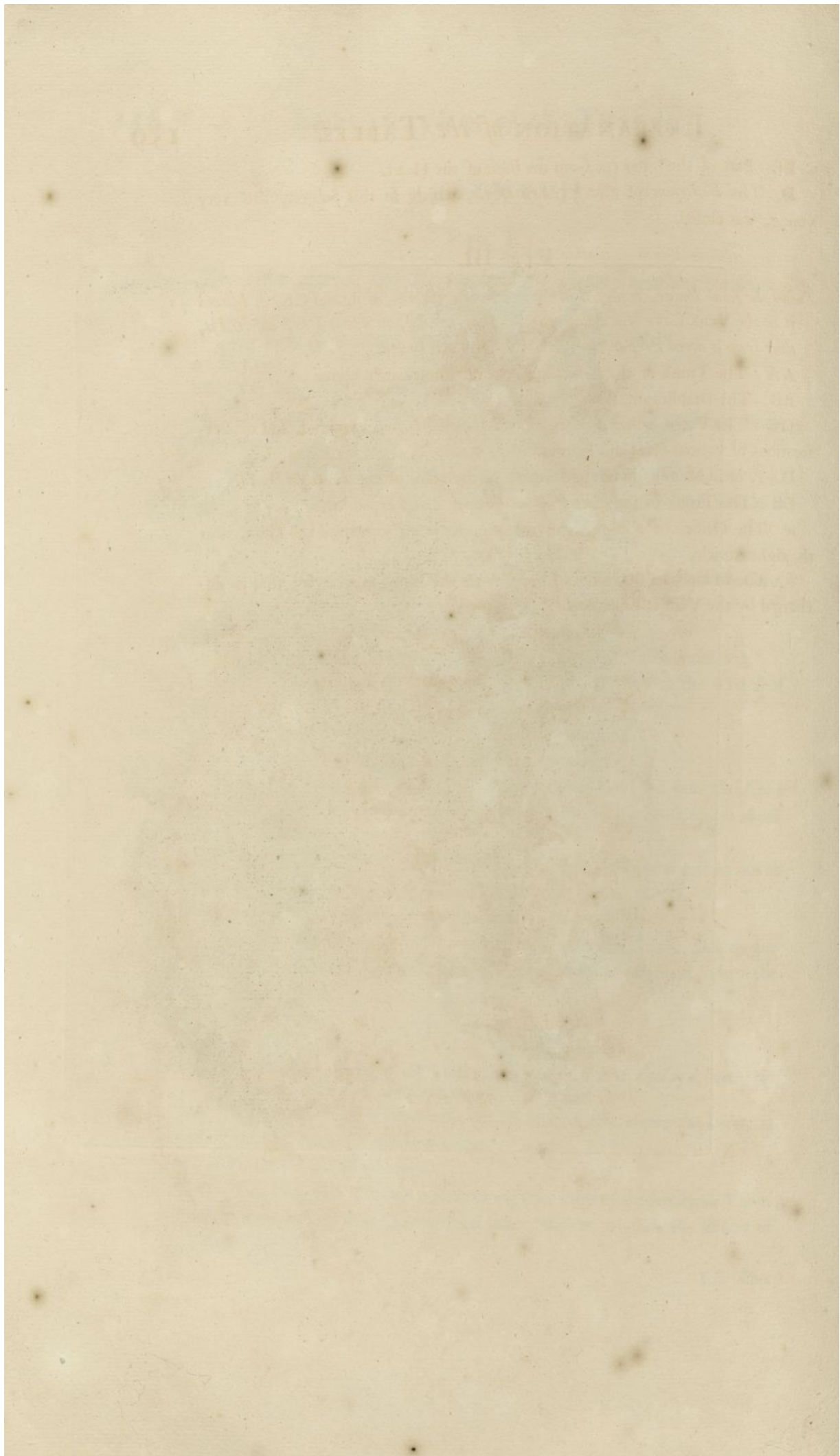
Fig. I.

Fig. II.

Fig. III.

EE Part of the *Cava* cut from the *Basis* of the Heart.

D   The *Vestigium* of the *Foramen Ovale*, which in this Subject, tho' very young, was closed.

FIG. III.

Shews the same Valve, express'd in the two former Figures, at d, and CC, as I found it in the Vena Cava *of a Man near 80 Years of Age, in whom I first observ'd it, done from a dried Preparation, which I have now by me.*

AA The Trunk of the *Vena Cava*, cut off immediately above

BB The Diaphragm.

CC The Valve, which in this Subject appears, as here express'd, full of Perforations of various Sizes and Figures.

D   A lucid Membrane not perforated, in the place of the *Foramen Ovale*.

EE The Trunk of the *Vena Pulmonalis* open'd and expanded.

a The Orifice of a large Vein, that empties it self into the *Vena Cava*, near the right Auricle.

b The Branches of Arteries, from whence the Blood is received, that is discharg'd by the Vein last mention'd.

TAB.

TAB. XXXVIII.

FIG. I.

The same Heart, represented at Fig. I. in the preceding Table, with the right Ventricle open'd from the Arteria Pulmonalis, *both being here pinn'd out and display'd, as big as the Life.*

A   The external Surface of the Heart, near its Cone, with its Blood Veffels (a a a) fill'd with Wax.

BB   The Sides of the right Ventricle, divided and pinn'd out, to fhew its internal Surface, leading into the *Arteria Pulmonalis*.

CC   The Trunk of the Pulmonick Artery open'd, and in like manner expanded.

D, E   Its right, and left Branches, alfo open'd and cut off at their Entrance into the Lungs.

c c c   The three Semilunar Valves, one of which is fupported with a Probe.

d   A large flefhy Column, arifing from the oppofite Side of the right Ventricle, here fupported on the Head of a large Pin, f, to fhew its Tendons paffing to the lower Margin, and fides of the Tricufpid Valve, e.

By means of the feveral *Foramina*, Fiffures, and flefhy Columns, in this Ventricle, its Sides contract the clofer in the *Syftole*, in order to the better Expulfion of its contain'd Blood into the Arteries of the Lungs.

F   The Trunk of the *Aorta* cut off.

G   The Defcending Trunk of the *Vena Cava*.

H   Part of the right Auricle.

FIG. II.

The Mitral Valve of the left Ventricle, diffected and display'd.

a   The upper part of the Valve, freed from its connexion to the *Bafis* of the Heart, at the Orifice of the *Vena Pulmonica*.

bb   Its lower Margin, which hangs down into the Cavity of the left Ventricle, to which fome Tendons, as here exprefs'd, arifing from the carnous Columns, are faft'ned; which Tendons, being equal in length with thofe, that pafs to the middle and upper part of the Valve, at ee, muft admit of the lower Edges of this Valve to fold on each other, whereby the Orifice of this Valve is effectually clofed, when the Heart is *in Syftole*, while the middle and upper part of the Valve, at ee, is drawn down with the *Bafis* of the Heart, towards its Cone.

c cc   The *Columnæ Carneæ*, cut from the Sides of the Ventricle; from which the above-mention'd Tendons arife.

dd   Two of the tranfverfe Tendons, between the carnous Columns.

FIG.

TAB.XXXVIII.

Fig. II.
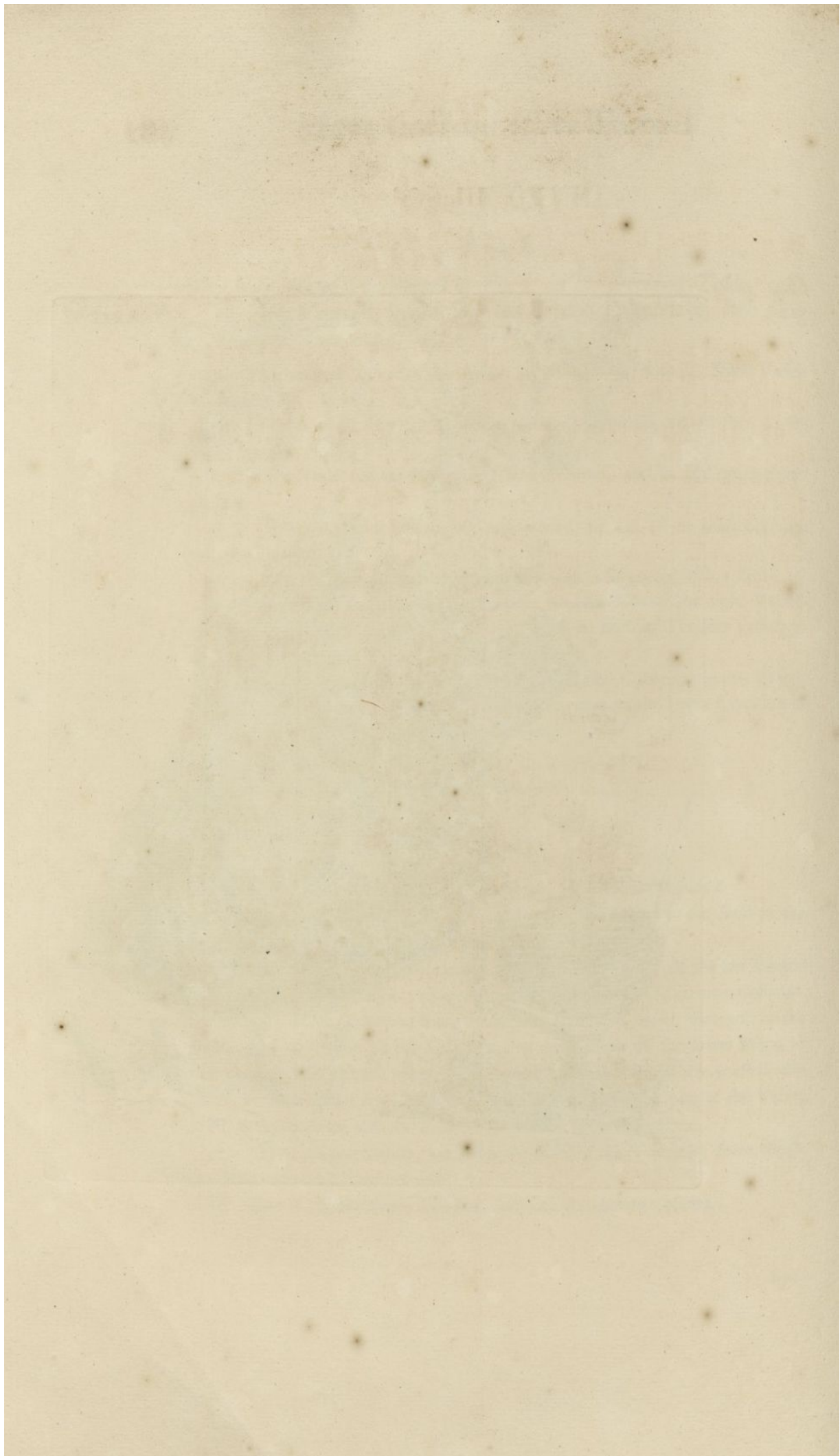
80

Fig: I.

Fig.V.
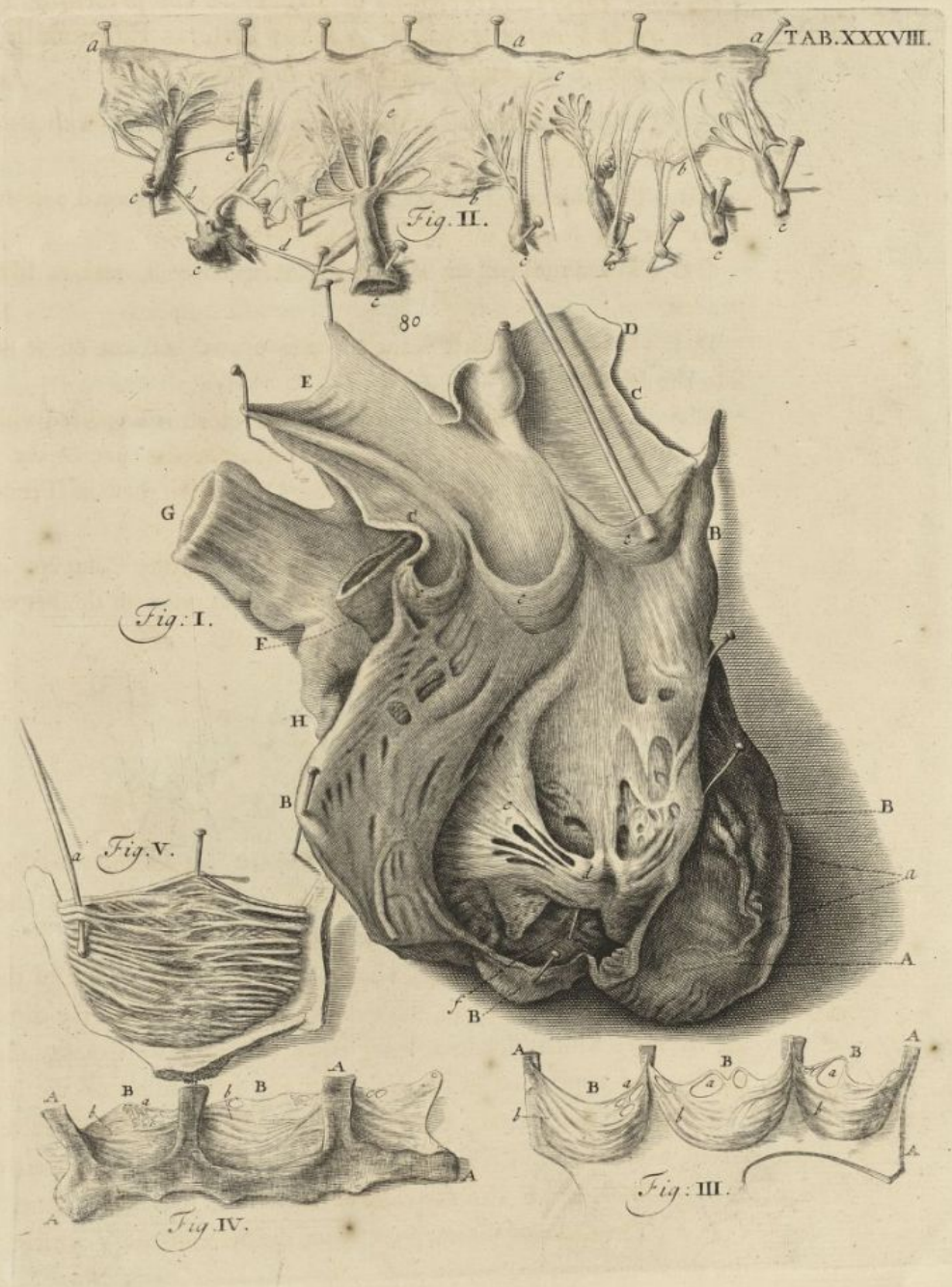
Fig. IV.

Fig: III.

FIG. III.

The internal Surface of the three Semilunar Valves of the Pulmonary Artery, next the Cavity of the right Ventricle of the Heart.

FIG. IV.

The external Surface of the same Valves, next the Trunk of the Pulmonick Artery.

AA   Parts of the Artery left, after the rest are cut away, to shew the Structure of the Valves.

BB   The Valves as I have frequently found them, with Perforations of various Sizes, a a.

bb   The carnous *Fibrillæ* of these Valves, which appear almost as plain, as here express'd, to the naked Eye; but on the external Surface of these Valves in an Ox, *i. e.* next the Trunk of the Artery, you will find these carnous Fibres variously interwoven, and such large muscular Bodies, that you may thrust a Probe underneath them, without wounding the internal Surface of the Valve, as express'd at a. Fig. v.

T t

TAB.

TAB. XXXIX.

FIG. I.

The Left Ventricle of the Heart open'd, with the Trunk of the Vena Pulmonalis, and the Left Auricle.

A   The Cone of the Heart.

BB   The Sides of the Left Ventricle divided, to shew its internal Surface.

a b   The Trunks of the Coronary Veins and Arteries, fill'd with Wax, and cut through, at the *Basis* of the Heart.

CC   The Trunk of the Pulmonick Vein, divided and expanded.

DD   The Left Auricle of the Heart, partly open'd, at e e, to shew its internal Surface.

E   A small Probe, and a Pencil inserted into the Branches of the Pulmonick Vein.

F   Another Pencil supporting the Mitral Valve.

gg   The Muscular Columns, which send Tendons to the Valve.

h   A tendinous Production from each Carnous Column, which not only serves for approaching those Parts nearer to each other in the *Systole*, and straitning the Cavity of the Ventricle, in order to expel the Blood into the *Aorta*; but in the *Diastole* of the Heart it prevents too great a Dilatation of the Sides of the Ventricle, by the influent Blood.

i   The way the Blood passes to the *Aorta*, behind the Mitral Valve.

I   A Probe passing the *Foramen Ovale*, between the Right Auricle and *Vena Pulmonalis*.

K   Part of the *Vena Cava*.

FIG. II.

The external Paries of the Left Ventricle, cut off from the Basis of the Heart, at the Root of the Arteria Magna, to the Cone, according to the length of the Heart.

A   The Beginning of the *Arteria Magna*.

a b   Some of the Trunks of the two Coronary Arteries, freed from the Heart and cut off.

B   The Valves of the *Aorta*, as they appear'd towards the Left Ventricle.

C   The outside of part of the Mitral Valve, with the Tendons deriv'd from the two *Columnæ Carneæ* variously terminating on it, as is expres'd Fig. II. of the preceding Table.

DD   The *Columnæ Carneæ*, deriving their Origine from a Center on the Side of the Left Ventricle of the Heart next its *Septum*, at E, whereby they not only draw the part of the Mitral Valve here expres'd towards the *Septum*, and consequently bring this Side of the Mitral Valve to the other, but by this means make way for the Blood to pass out at the *Aorta*, as may be easily conceiv'd by this Figure.   Besides the

TAB. XXXIX.
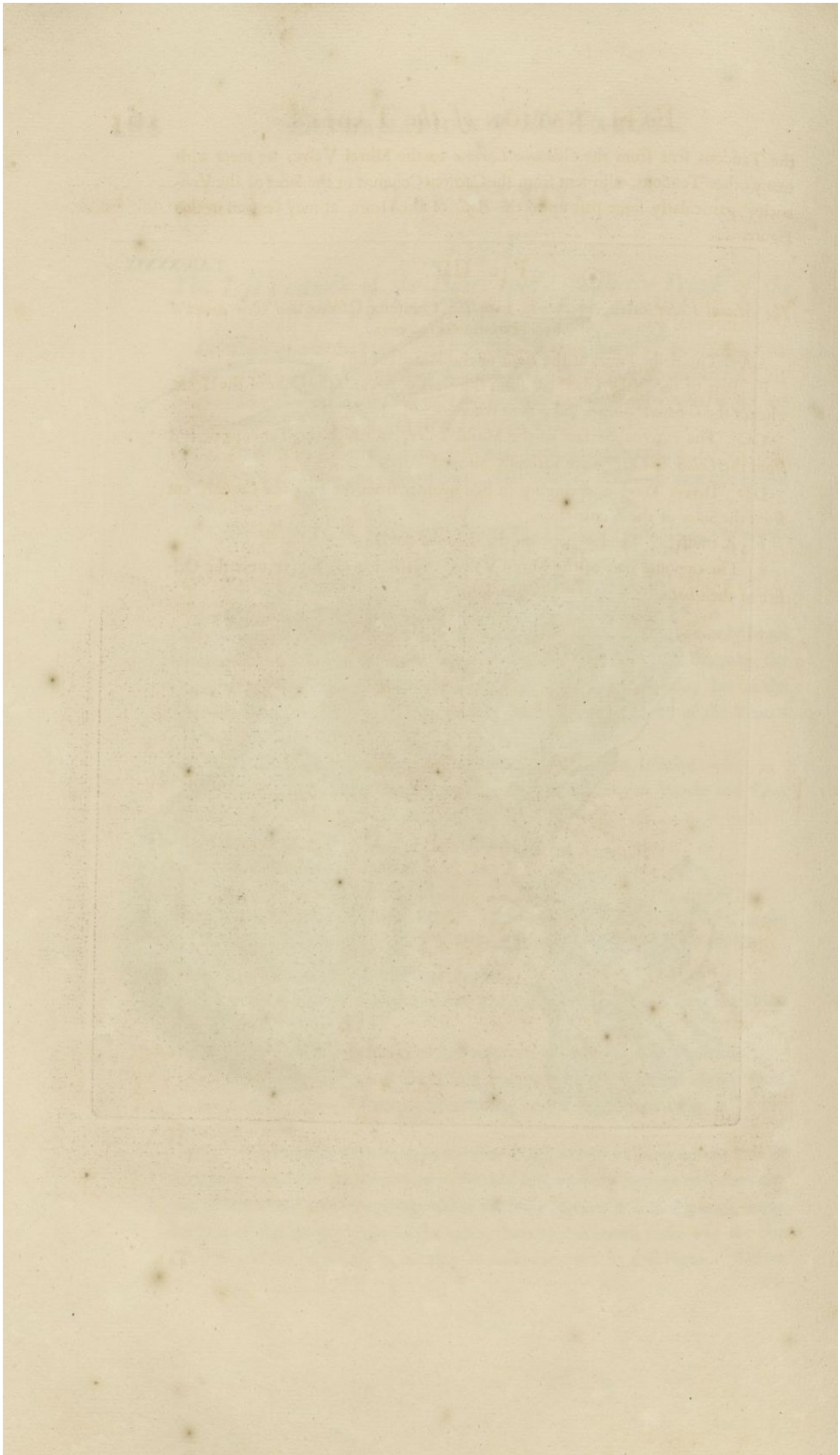
Fig: I.

Fig: II.

Fig: III.

the Tendons fent from the *Columnæ Carneæ* to the Mitral Valve, we meet with many other Tendons, alfo fent from the Carnous Columns to the Sides of the Ventricle; particularly fome pafs up to the *Bafis* of the Heart, as may be feen in this Figure.

Fig. III.

The Mitral Valve taken out entire, with the Columnæ Carneæ *and their annex'd Tendons,* &c.

A A   The flefhy Fibres at the *Bafis* of the Heart cut off.

B   Part of the flefhy Fibres cut from the *Septum*, towards the Cone of the Heart, whence the *Columnæ Carneæ* take their Rife.

C C   The external Surface of the Mitral Valve, to which the Tendons deriv'd from the *Columnæ Carneæ* are varioufly inferted.

D D   Divers Tendons fpringing in like manner from the *Columnæ Carneæ*, cut from the Sides of the Ventricle.

b   A tranfverfe Tendon between the *Columnæ Carneæ*.

i   The oppofite part of the Mitral Valve, exprefs'd at C, Fig. II. next the Orifice of the *Aorta*.

TAB.

TAB. XL.

FIG. I.

The Left Ventricle of the Heart opened, together with the Vena
Pulmonalis *and Trunk of the* Aorta, *to shew in one View the
Position of the Valves, that hinder the Return of the Blood by
the same way it came into the Ventricle, as well as those Valves,
that prevent the return of the Blood, after it is expell'd from
thence by the Systole of the Heart.*

A A   The Sides of the Heart divided, from its Basis, where the *Aorta* and *Vena
Pulmonalis* pass by each other, to

B   The Cone of the Heart.

C, C, D   The large bulbous Trunk of the *Vena Pulmonalis,* open'd and pinn'd
out.

E   The Orifice, that leads into the Left Auricle.

F   The external Surface of the Left Auricle of the Heart.

G G   A Probe supporting the Mitral Valve, whereby the Tendons springing
from the *Carneæ Columnæ* are made very conspicuous, and the use of the Position
of those Organs, mention'd in the Explication of Fig. II. of the preceding Table,
farther illustrated.

g g   The divided Sides of the Mitral Valve.

h h   Divers transverse tendinous and fleshy Fibres, appearing in this Position, in
the Left Ventricle of the Heart.

I   The internal Surface of the Left Ventricle, leading to the *Aorta,* which is
smooth, for the more easy Ascent of the Blood that way to the *Aorta.*

K K   The *Aorta* cut off and expanded.

L   An Ear Scoop, supporting one of the Semilunar Valves of the *Aorta.*

l, l   The other two Semilunar Valves, as they appear in this Position.

M   The Trunk of the *Arteria Pulmonalis,* cut off.

FIG. II.

Is drawn from the same Heart express'd Fig. I. *in the preceding Table, after dividing
the* Vena Pulmonalis, *through the middle, (as 'tis there represented) together with
the* Arteria Aorta.

A A   The *Aorta* cut off near the *Basis* of the Heart, and slit open and display'd.

B, B   The bulbous Trunk of the *Vena Pulmonalis* divided through, with part
of the *Aorta* annex'd to it, and pinn'd aside, to shew

a a a The

TAB. XL.

Fig: 1.

Fig: III.

Fig: V.

Fig: II.

Fig: IV.

Fig: VI.
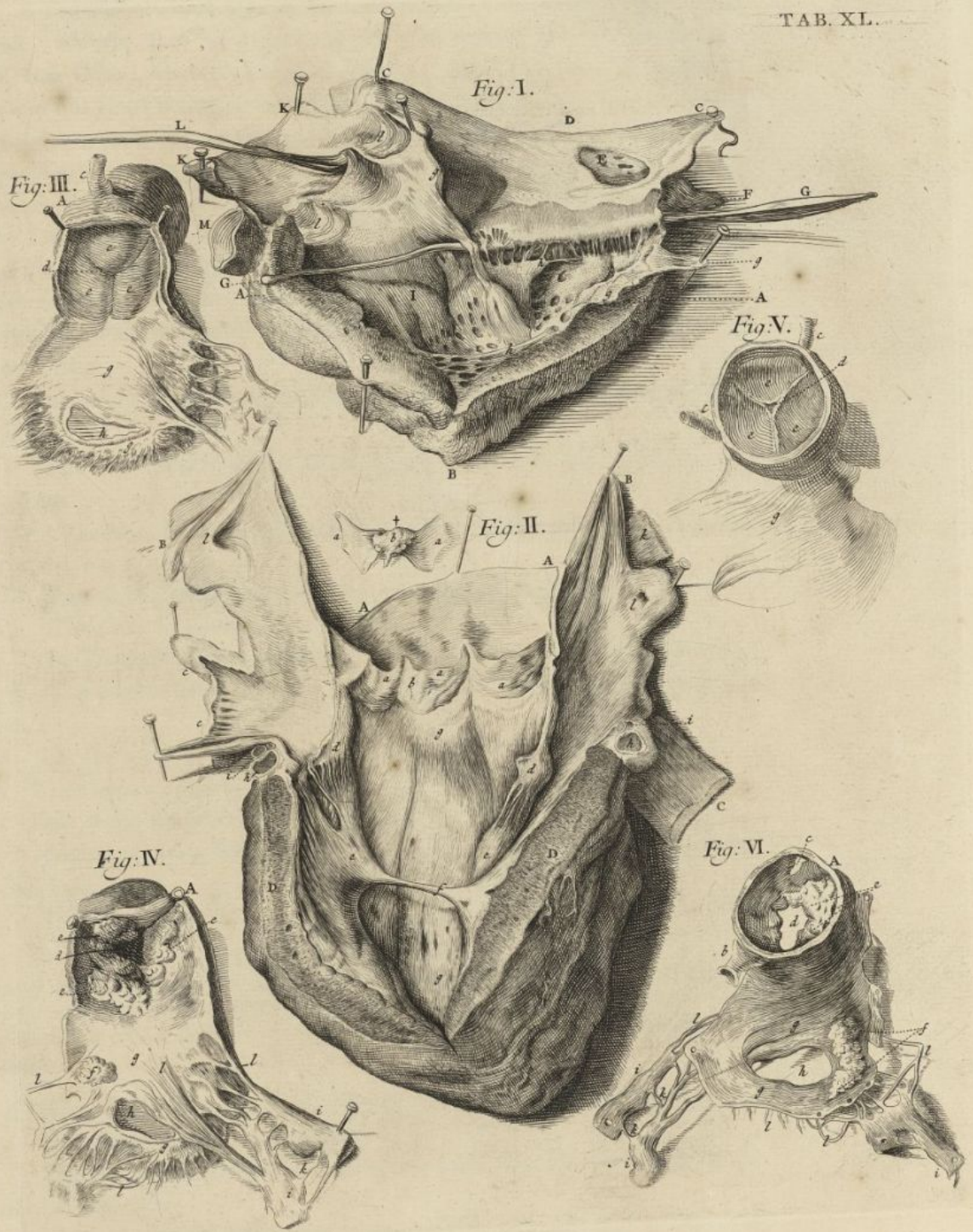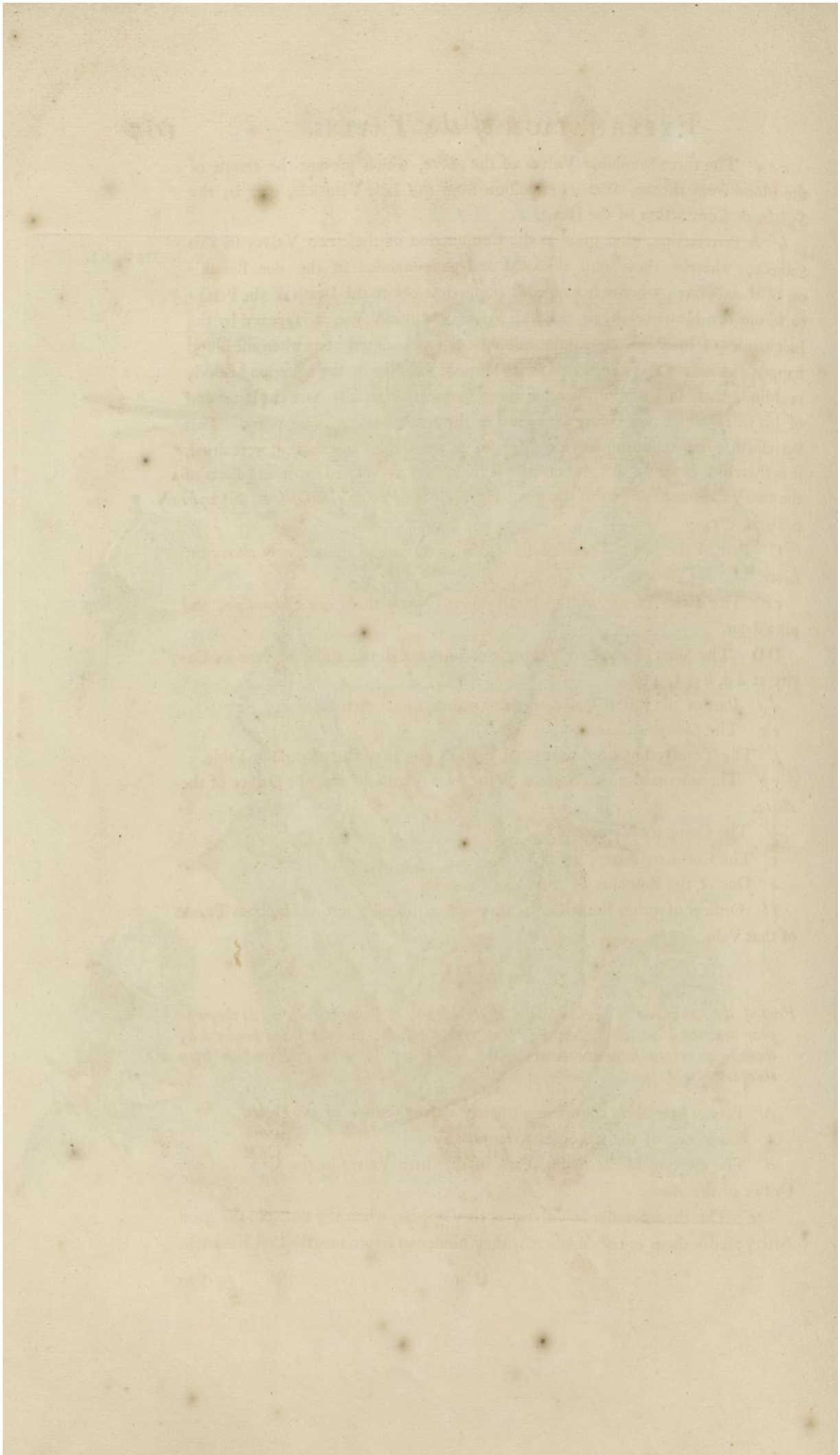
a a a The three Semilunar Valves of the *Aorta*, which prevent the return of the Blood from thence, after its Expulsion from the Left Ventricle, g g, by the *Systole*, or Contraction of the Heart.

b A Petrefaction, that grew at the Conjunction of these two Valves in this Subject, whereby they were thickned and incommoded in the due Execution of their Office; whence it happened (some time before the Death of the Person to whom this Heart belong'd) that the *Systole* was interrupted, as appear'd by the Inequalities of his Pulse, sometimes missing one Stroke in ten; but when the Blood happen'd to be any ways quicken'd in its Motion, whether by any agitation of Body or Mind, these Interruptions became more frequent, especially near the latter end of his Life, which was before he arriv'd to the Age of thirty three Years. This Petrefaction not appearing to view so plain, as when the Parts about it were dried, it is therefore express'd at †, where the same Letters are placed on it and Parts of the two Valves annex'd, as in the great Figure. See *Philos. Transactions*, N° 299. p. 1970, &c.

C Part of the lower Trunk of the *Vena Cava*, cut off immediately above the Liver.

c c The Left Auricle of the Heart open'd from the *Vena Pulmonalis*, and pinn'd out.

DD The Sides of the Left Ventricle divided and drawn aside, to shew its Cavity at d d, e e, f, g g.

d d Part of the Mitral Valve, divided and drawn to each Side.

e e The *Columnæ Carneæ*.

f The Transverse Chord mention'd at h, in Fig. 1. of the preceding Table.

g g The internal smooth Surface of the Left Ventricle near the Orifice of the Aorta.

h The Coronary Vein, and

i The Coronary Artery divided.

k One of the Branches of the *Vena Pulmonalis*.

l l Orifices of other Branches, as they appear opening into the bulbous Trunk of that Vein.

Fig. III.

Part of the Aorta *cut off next the* Basis *of the Heart, to shew its Valves, as they appear next the Ventricle, when the Heart is in* Diastole, *and the Blood hinder'd by them in its return from the* Aorta *to the Left Ventricle, after its Expulsion from thence.*

A Part of the *Aorta* cut off immediately above the *Basis* of the Heart.

c Part of one of the Coronary Arteries.

d The meeting of the middle Parts of the three Valves in the Center of the Orifice of the *Aorta*.

e e e The three Semilunar Valves, as they appear, when the Blood in the great Artery presses them together, whereby they hinder its return into the Left Ventricle.

U u   *g g* Part

g g   Part of the Mitral Valve.

b   Its Orifice, by which the Blood flows from the *Vena Pulmonalis* into the Left Ventricle of the Heart.

FIG. IV.

A Portion of the Aorta, *with the Parts annex'd, in the same Position, as was repre-sented in the preceding Figure, taken from a morbid Body, in which the use of the Semilunar Valves was entirely defeated by a large Petrefaction, that grew upon them.*

A   The Trunk of the *Aorta,* cut from the *Basis* of the Heart.

d   A large triangular Aperture, which always remain'd open by reason of

e, e, e   The Petrefaction of the three Semilunar Valves.

f   A Petrefaction of the *Valvula Mitralis.*

g, g   The Mitral Valve, which was very much stiffned in this Subject.

b   Its Orifice, as above-mention'd.

i, i, i   Carnons Columns taken out and display'd, to shew the Tendons arising from them, and terminating variously, as express'd at l, l, on the Mitral Valve.

k k   Divers transverse Tendons, that help to approach the fleshy Columns to each other in the *Systole.*

FIG. V. VI.

Shew the same Parts of the Aorta, *with its Valves viewed from the great Artery to-wards the Heart.*

N. B. The same Letters of Reference, with those of the two preceding Fi-gures, serve to both, except Fig. VI.

b   The Trunk of one of the Coronary Arteries.

c   The Aperture of the other Coronary Artery, the Trunk of which happen'd to be cut off in the Dissection from the Heart.

TAB. XLI.
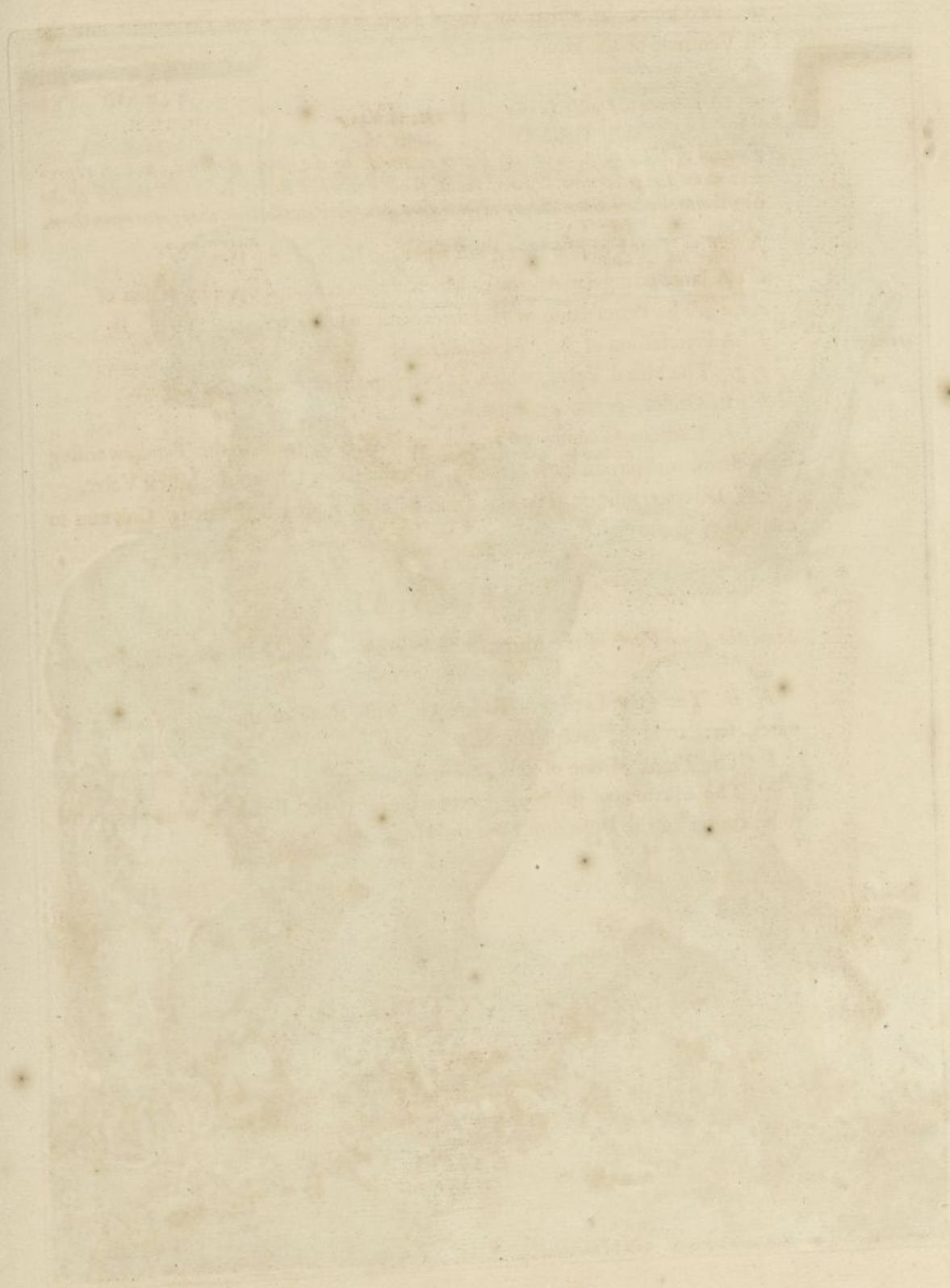
A . Os Occipitale .
a a. Ligamentum Colli .
B . Vertebrarum Dorsi Spinæ .
C . & c. Costæ .
D . Clavicula .
E . Spina Scapulæ .
e . ejus Basis .
F . Olecranon five Ulnæ Appendix superior .
G . _____ inferior .
H . Ossis Humeri Protuberantia interna .
I . Ossis Ilij spina .
K . Os Coccygis .

TAB. XLI.

The Parts here reprefented, being fufficiently explain'd by the Re-
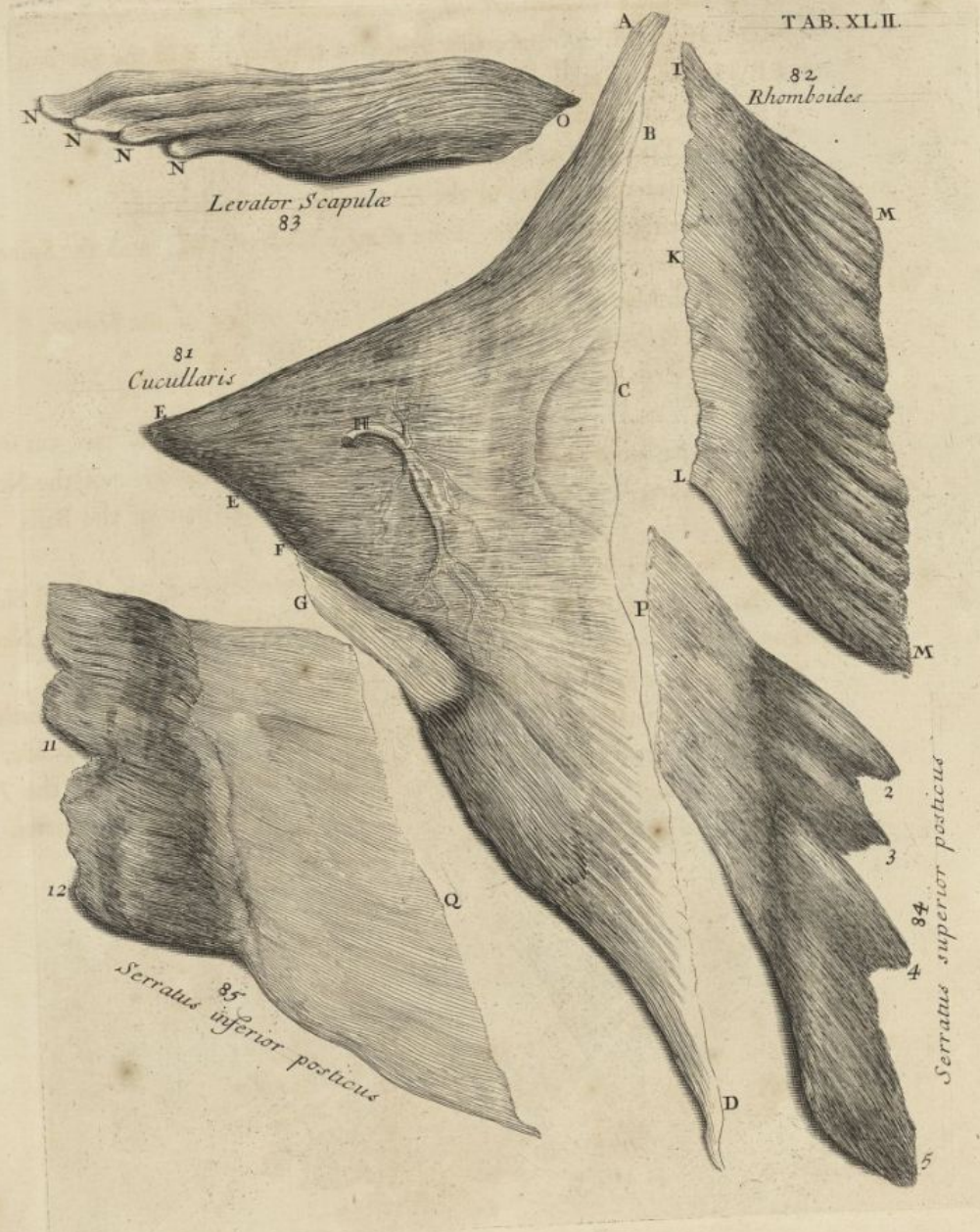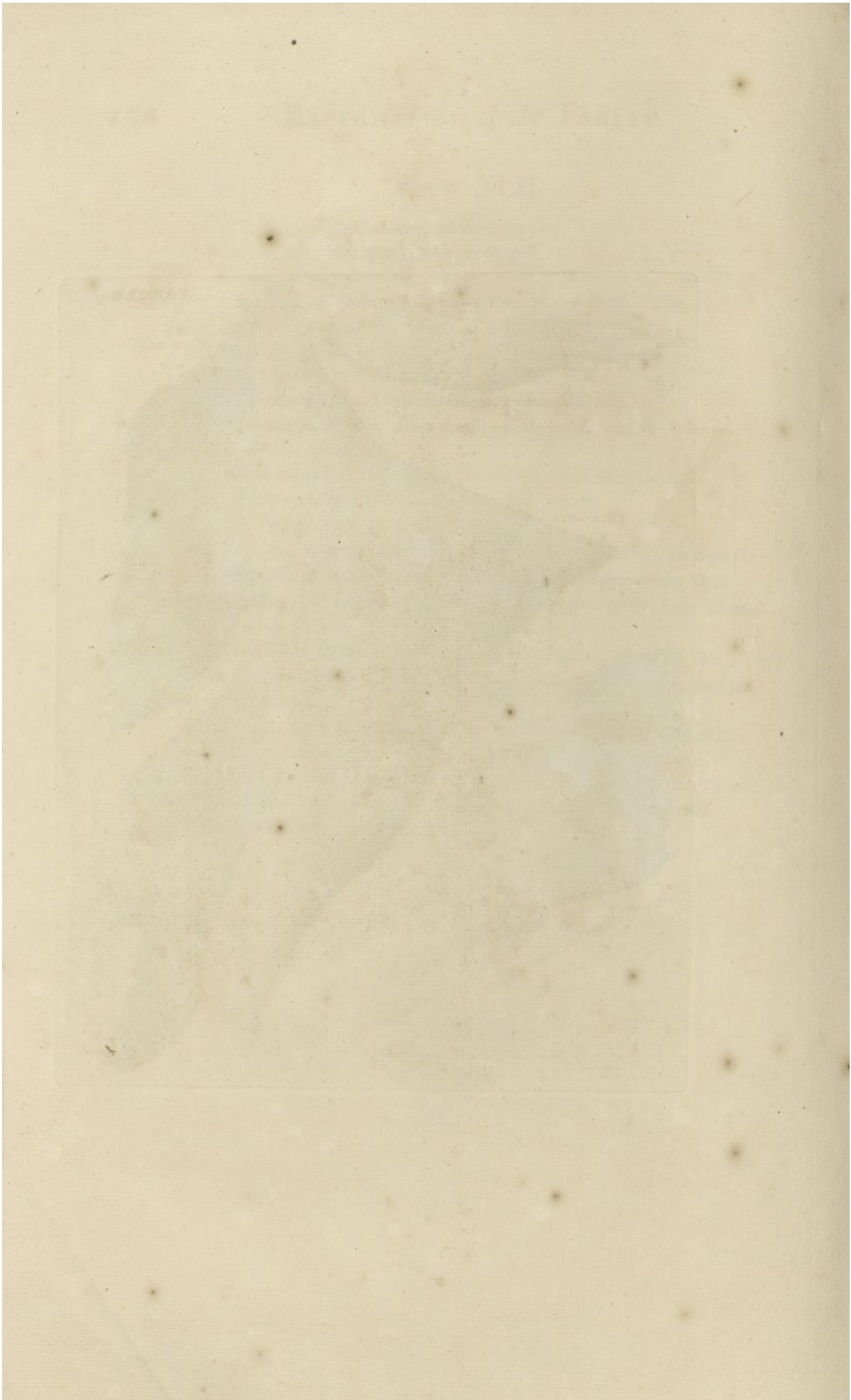*ferences engrav'd on the Plate, and the general Table of the*
Mufcles, we fhall add no other Defcription.

TAB.

TAB. XLII.

81   The Infide of the *Cucullaris*, of the right Side.

A   That part of it, that fprings from the *Occiput*,

B   From the *Ligamentum Colli*,

CD   From the eight fuperiour Spines of the *Vertebræ* of the *Thorax*.

EE   Its flefhy Termination cut from the *Clavicula*.

FG   Its flefhy and tendinous ending in the Spine of the *Scapula*.

H   The Trunks of its Blood Veffels.

82   The internal Surface of the *Rhomboides*, of the left Side.

IK   Its tendinous Origine, from the *Ligamentum Colli*, and the Spine of the lowermoft *Vertebra* of the Neck.

KL   From the four fuperiour Spines of the *Vertebræ* of the *Thorax*.

MM   Its flefhy Termination, cut from the *Bafis Scapulæ*.

83   The *Levator Scapulæ*, of the right Side.

NNNN   Its four partly tendinous, and partly flefhy Originations, cut from the tranfverfe Proceffes of the firft, fecond, third and fourth *Vertebræ* of the Neck.

O   Its Ending, cut from the fuperiour Angle, and part of the Bafis, of the *Scapula*.

84   The internal Surface of the *Serratus Superior Pofticus*, of the left Side.

P   Its tendinous Origine, cut from the Spines of the *Vertebræ* of the Neck and *Thorax*.

2, 3, 4, 5   Its flefhy Terminations on the fecond, third, fourth, and fifth Ribs.

85   The external Surface of the *Serratus Inferior Pofticus*, of the left Side.

Q   Its tendinous Part, freed from the Spines of the *Vertebræ* of the *Thorax* and Loins, as well as from the *Dorfi Latiffimus*, to which it firmly adheres.

11, 12   Its flefhy Terminations, freed from the lower Ribs.

TAB.

TAB. XLII.

82
Rhomboides

Levator Scapulæ
83

81
Cucullaris

Serratus superior posticus
84

85
Serratus inferior posticus

Splenius
E 88

89
Complexus

90
Rectus major

TAB. XLIII.

Recti minores
91

Obliquus superior
92

Recti interni
minores
96

Obliquus
inferior
93

Mastoideus
94

Partentium Falloppy

Rectus internus major
95

Rectus internus
minor
96

Rectus lateralis
97

TAB. XLIII.

88 The external Surface of the *Splenius*, of the right Side.

AB Its lower part, which appears diſtinct in ſome Subjects, and may be truly reckon'd a Muſcle of the Neck, ariſing from the Spines of the *Vertebræ* of the *Thorax.*

BC That part of this Muſcle, that ſprings from the Spines of the *Vertebræ* of the Neck.

DD The two Tendons of its lower part, which terminate in the tranſverſe Proceſſes of the firſt and ſecond *Vertebræ* of the Neck.

EE Cut from its Implantation on the *Occiput.*

89 The exteriour Face of the *Complexus* of the ſame Side.

FF Springs from the ſix ſuperiour tranſverſe Proceſſes of the *Vertebræ* of the *Thorax.*

GG Are its partly tendinous and partly fleſhy Originations, from the ſix inferiour tranſverſe Proceſſes of the *Vertebræ* of the Neck.

HH That part, which terminates on the *Os Occipitis.*

90 The *Rectus Major*, of the right Side.

A Its narrow Original, cut from one part of the double Spine of the ſecond *Vertebra* of the Neck.

B Its broad end, implanted on the *Os Occipitis.*

91 The *Recti Minores*, cut from their Inſertions at the *Occiput*, and left at their Origine, at the back part of the firſt *Vertebra* of the Neck.

A The firſt *Vertebra* of the Neck.

bb Its two Proceſſes, that are articulated with thoſe of the *Occiput.*

cc Its tranſverſe Proceſſes, whence the *Recti Laterales* ariſe.

92 The *Obliquus Superior*, cut from the *Occiput*, and left at its Origine from the back part of the tranſverſe Proceſs of the firſt *Vertebra* of the Neck.

93 The *Obliquus Inferior.*

A Its Origine, from the Spine of the ſecond *Vertebra* of the Neck.

B Its Termination, at the tranſverſe Proceſs of the firſt *Vertebra.*

94 The outſide of the right *Maſtoideus.*

A That part of it that ſprings tendinous from the *Sternum.*

BB From the *Clavicula.*

C Its broad tendinous Ending, cut from the back part of the *Proceſſus Mammillaris*, and the adjoining part of the *Os Occipitis.*

95 The external Surface of the *Rectus Internus Major*, of the left Side.

AB That part of it which ariſes from the *Vertebræ* of the Neck.

C A part of this Muſcle, that in this Subject was inſerted into the tranſverſe Proceſs of the firſt *Vertebra* of the Neck.

D That part of it, that was cut from the anteriour *Appendix* of the *Os Occipitis.*
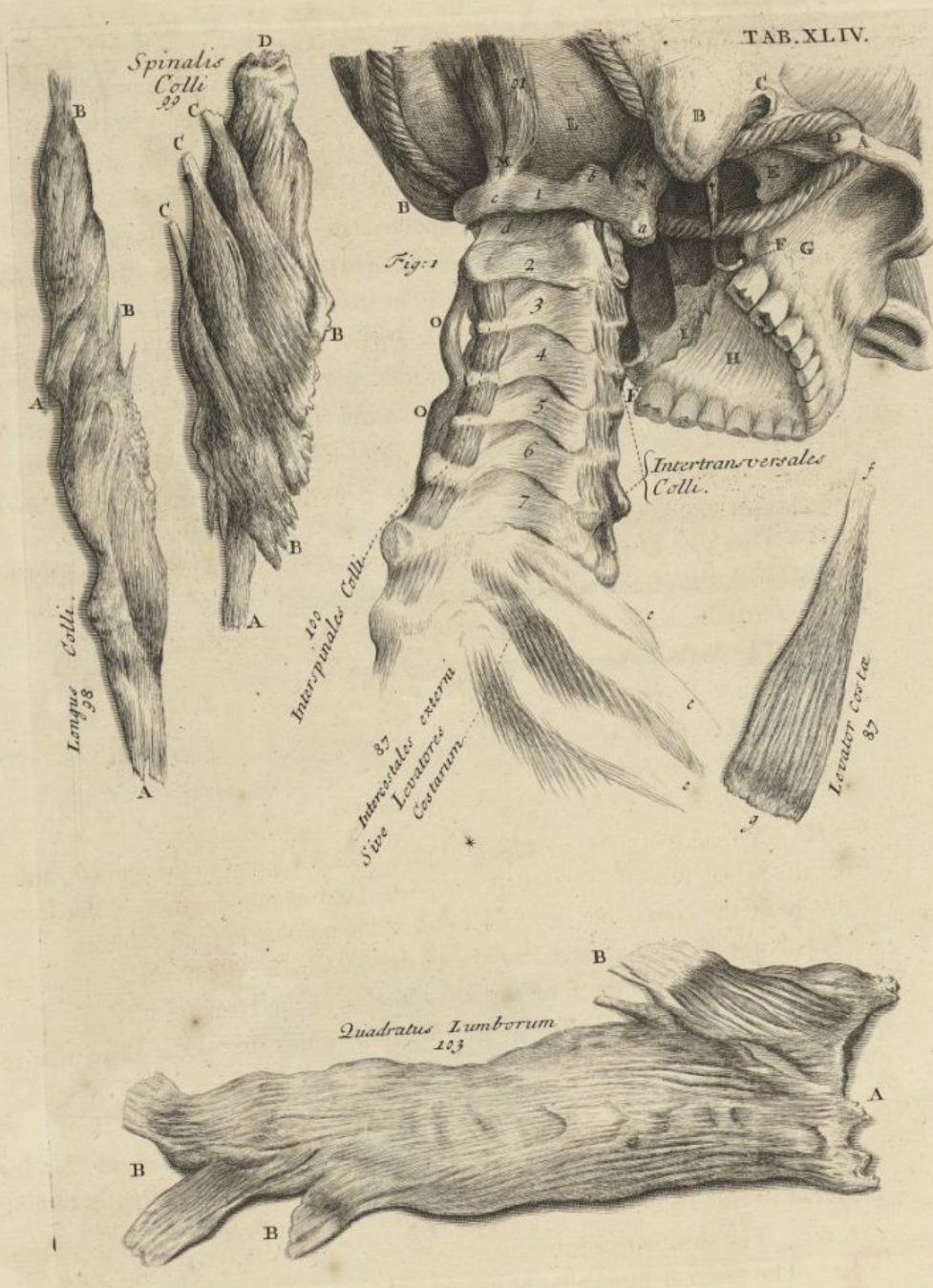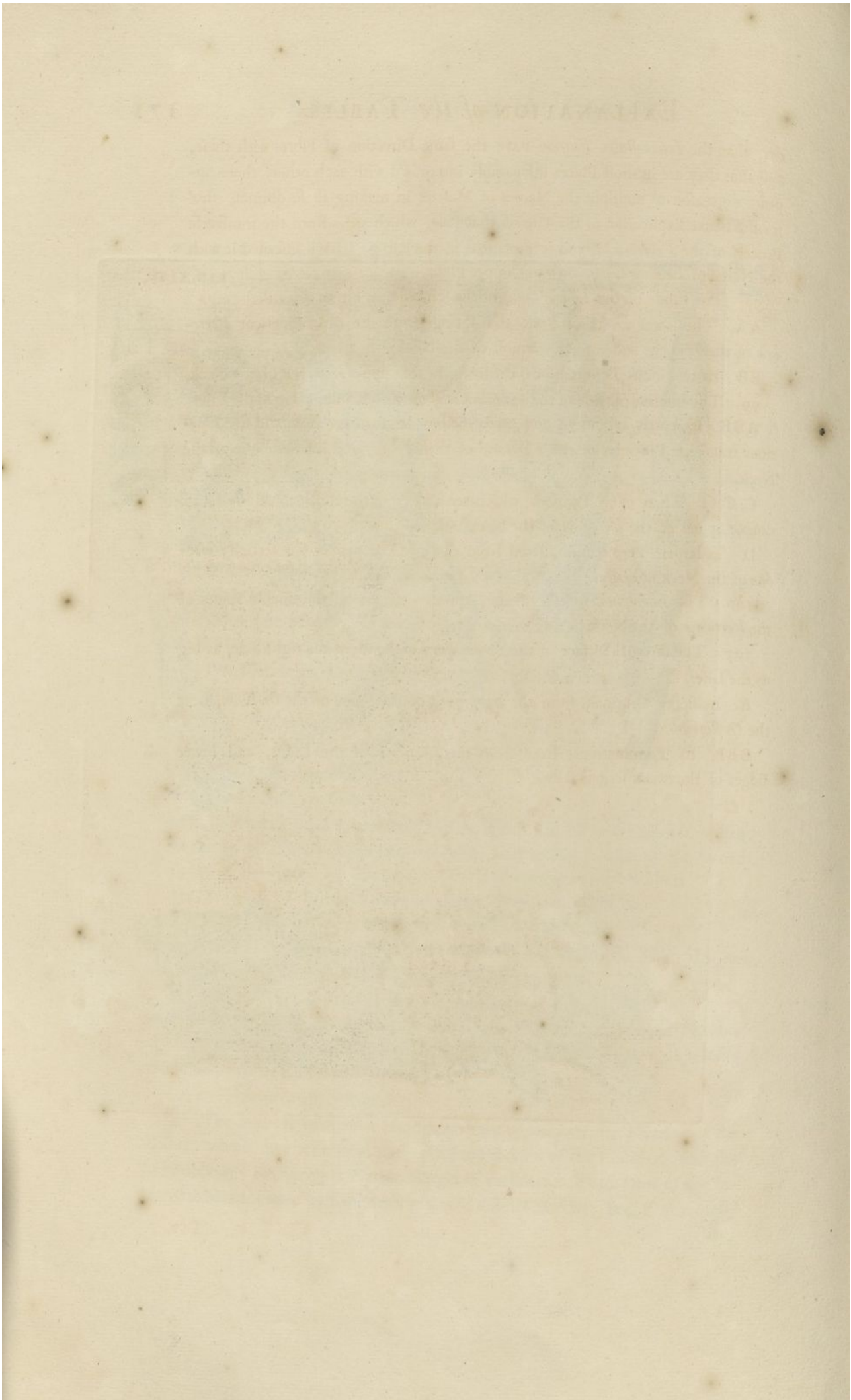
96 The *Rectus Internus Minor.*

97 The *Rectus Lateralis.*

X x

TAB. XLIV.

FIG. I.

The back Parts of the Vertebræ of the Neck, as they appear'd in a late Subject, with the Muscles and Parts annex'd, as big as the Life.

A   The *Os Jugale.*

B   The *Processus Mastoides.*

C   The *Meatus Auditorius,* as it appears, after the *Auricula* is cut off.

D   The shallow Cavity, that receives the Head of the *Processus Condyloides* of the lower Jaw-bone.

E   The external Surface of the *Ala Vespertilionis* of the *Os Sphenoides,* where the *Musculus Pterygoideus Internus* does arise.

F   The *Processus Pterygoides,* on which the Tendon of the *Pterygostaphylinus* passes.

G   The fourth Bone of the upper Jaw, where it makes the external *Paries* of the *Antrum Maxillæ Superioris.*

H   That part of the same Bone, which makes the roof of the Mouth, here cover'd with the glandulous Membrane of the Palate.

I   The Glands, as they appear'd, where the *Uvula* was cut off.

K   The *Septum Narium,* towards the *Fauces.*

L   The *Os Occipitale.*

91 M   The *Recti Minores.*

N   The *Rectus Lateralis.*

✢   The *Processus Styloides.*

OO   A round, slender, and long Muscle, which I found in this Subject, arising from the Spinal Proces of the sixth *Vertebra,* and ending in that of the second *Vertebra* of the Neck; but this I have observ'd is wanting in most Subjects.

1, 2, 3, 4, 5, 6, 7   The back Parts of all the *Vertebræ* of the Neck.

a   The transverse Proces of the first *Vertebra* of the Neck.

b   A rising in the back Part of this *Vertebra,* which makes the *Sinus,* that receives the oblong Proces of the *Os Occipitale* on that side.

c   The back Part of this *Vertebra,* without any Spinal Proces.

d   A strong, large, but loose Ligament, between the first and second *Vertebræ* of the Neck, so framed to give way to the Motion of the first *Vertebra,* in turning the Head to either Side.

e, e, e   The three upper Ribs.

87   The external Intercostal Muscles, as they appear near the *Vertebræ* of the *Thorax,* where they arise from the transverse Processes of the *Vertebræ,* and descend obliquely to the upper Part or Margin of each Rib. These Parts of the Intercostal Muscles have by some been reckon'd distinct Muscles; but, if you consider,

der,

TAB. XLIV.

Spinalis Colli. 99

Fig: 1.

Intertransversales Colli.

Interspinales Colli. 102

Levator Costæ. 87

Longus Colli. 98

Intercostales externi Sive Levatores Costarum. 87

Quadratus Lumborum. 103

der, that the *Intercostales Externi* have the same Direction of Fibres with these, and that they are in most Places inseparably intermix'd with each other, there appears no reason to multiply the Names of Muscles in making these distinct, tho' for the better Explication of the Use of that Part, which arises from the transverse Process of the *Vertebra*, f, and is implanted in the Rib g, I have inscrib'd it with the Name of *Levator Costæ*, on the Copper Plate.

98 The Inside of the *Longus Colli*, of the left Side, as big as the Life.

A A The lower tendinous Part, that springs from the three superiour *Vertebræ* of the *Thorax*, and three lowermost of the Neck.

BB Its tendinous Terminations, cut from the four upper *Vertebræ* of the Neck.

99 The internal Surface of the *Spinalis Colli*, of the left Side, as big as the Life.

ABB Its partly tendinous and partly fleshy Originations from the five superiour transverse Processes of the *Vertebræ* of the *Thorax*, and inferiour one of the Neck.

C, C, C Three of its Tendons, which terminated in the third, fourth and fifth double Spines of the *Vertebræ* of the Neck.

D Its largest Termination, freed from the inferiour part of the second *Vertebra* of the Neck laterally.

100 The *Interspinales Colli*, as they appear between all the double Spines of the *Vertebræ* of the Neck.

103 The internal Surface of the *Quadratus Lumborum* of the right Side, as big as the Life.

A Its fleshy Original, from the back part of the Spine of the *Os Ilium*, next the *Os Sacrum*.

BBB Its Terminations, freed from the *Vertebræ* of the Loins, and lower Edges of the two inferiour Ribs.

TAB. XLV.

FIG. I. II.

The exteriour and interiour Surfaces of the Longiffimus Dorfi, Sacro-lumbalis, Sacer, Semi-Spinatus, *and* Tranfverfalis Colli, *diffected from an emaciated Body.*

A   The Origine of the *Sacrolumbalis*, and *Dorfi Longiffimus*, in common, from the upper part of the *Os Sacrum*, and back part of the Spine of the *Os Ilium*, a a.

b, b, b   Divers Terminations of them, on the tranfverfe Proceffes of the *Vertebræ* of the Loins.

B, B   Their tendinous outfide, on the Region of the Loins, from which the Tendons of the *Dorfi Latiffimus*, and *Serratus Inferior Pofticus*, may be eafily feparated.

C, C, C   Some Tendons of the *Longiffimus Dorfi*, that terminate on the back part of the Ribs.

D, D   Two tendinous Slips, fpringing from the *Longiffimus Dorfi*, which terminate on the tranfverfe Procefs of the firft *Vertebra* of the *Thorax*.

E   That part of it, that was inferted into the lower tranfverfe Proceffes of the *Vertebræ* of the Neck.

F   Another Production of this Mufcle, which, with its Partner on the other Side, is by *Falloppius* called *Par tertium Capitis*, and is implanted on the *Os Occipitis*, behind the *Proceffus Maftoides*.

G, G, G   The external Parts of the *Sacrolumbalis*, with its tendinous Productions, arifing flefhy from the lower Ribs * *, and afcending obliquely to their Terminations on the upper Ribs.

H, H, H, *h, h*   Two or three, of many other Productions of this Mufcle, which, alfo fpringing from the lower Ribs, afcend obliquely upwards and inwards, decuffating the former at acute Angles, as they pafs to their Terminations on the fuperiour Ribs. *Vid.* Fig. II. ✢ ✢ ✢.

101   The exteriour and interiour Surfaces of the *Tranfverfalis Colli*, continued with the upper part of the *Semifpinatus*.

I   Two Productions of this Mufcle, the flendereft and longeft of which is implanted on the *Occiput*, with the Production of the *Dorfi Longiffimus*, at F.   The other fhort one is alfo inferted into the *Os Occipitale*, near the Maftoide Procefs.
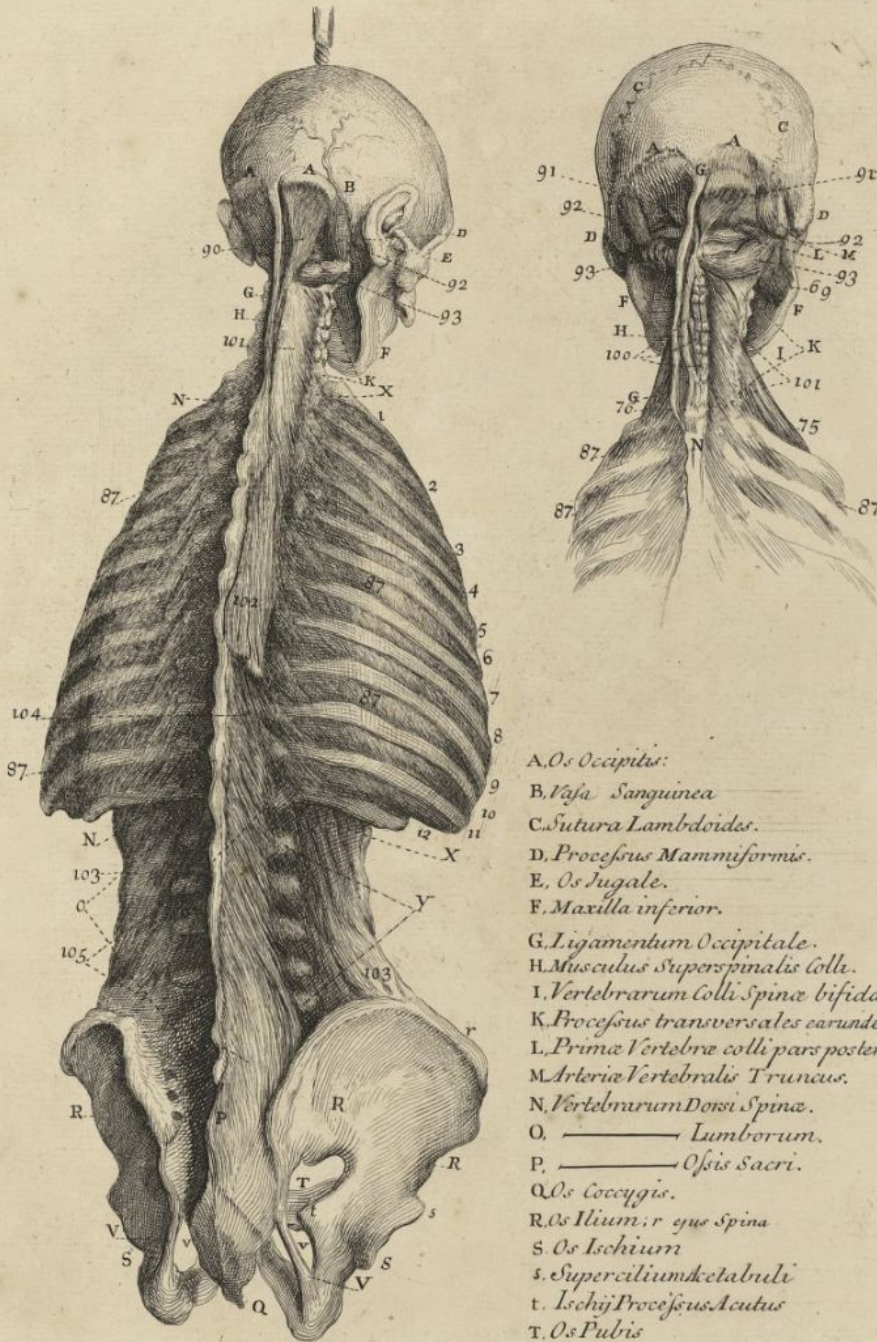
102   The Body of the *Dorfi Longiffimus*.

K, K   Some flefhy Fibres, fpringing from the tendinous outfide of the *Longiffimus Dorfi*, which afcending obliquely join with thofe that lie underneath, and fpring from the *Vertebræ Dorfi*, exprefs'd at c, c, c, Fig. II. and are afterwards inferted into the Spines of the *Vertebræ*, d d d, which makes up

104 The

TAB. XLVI.
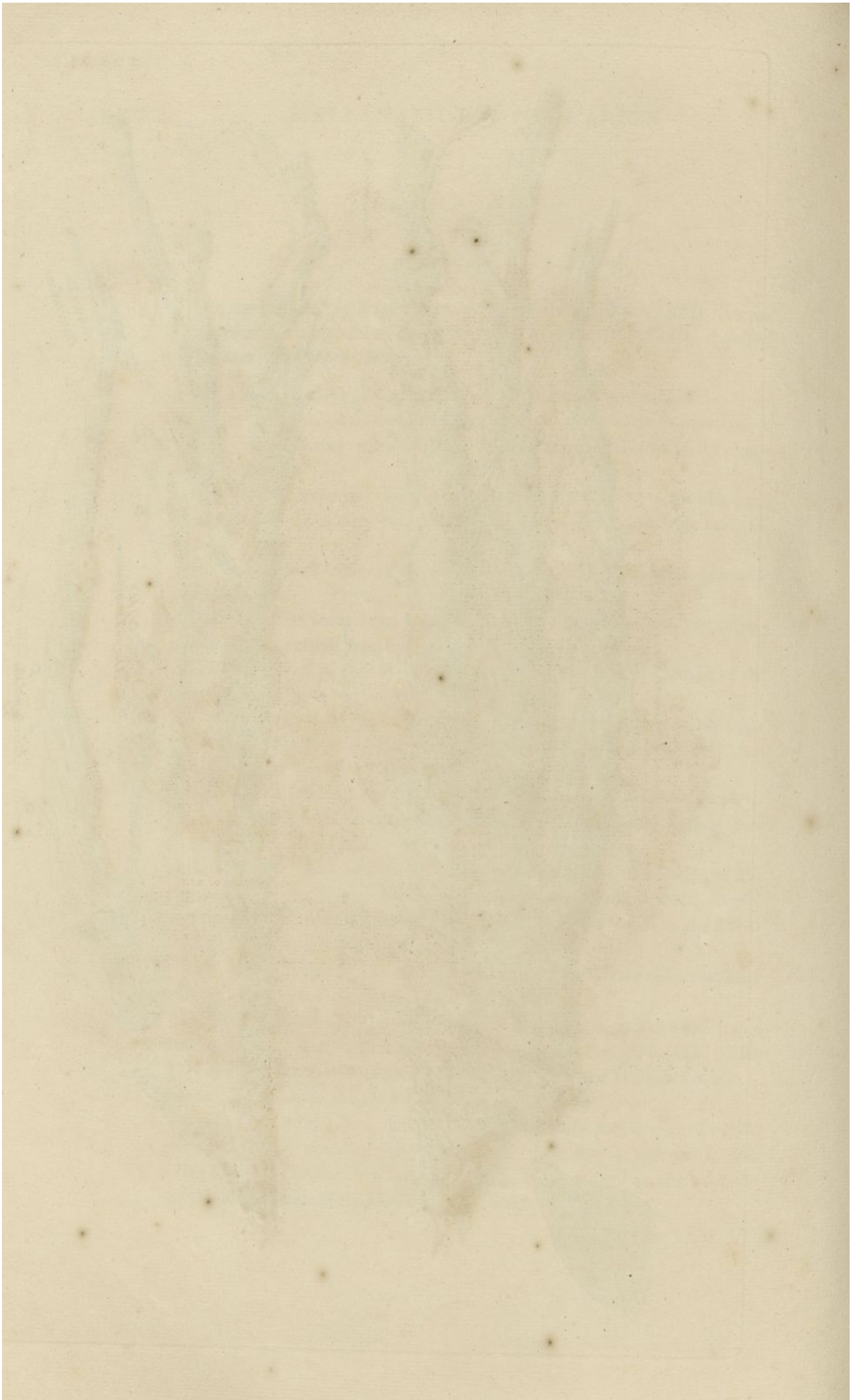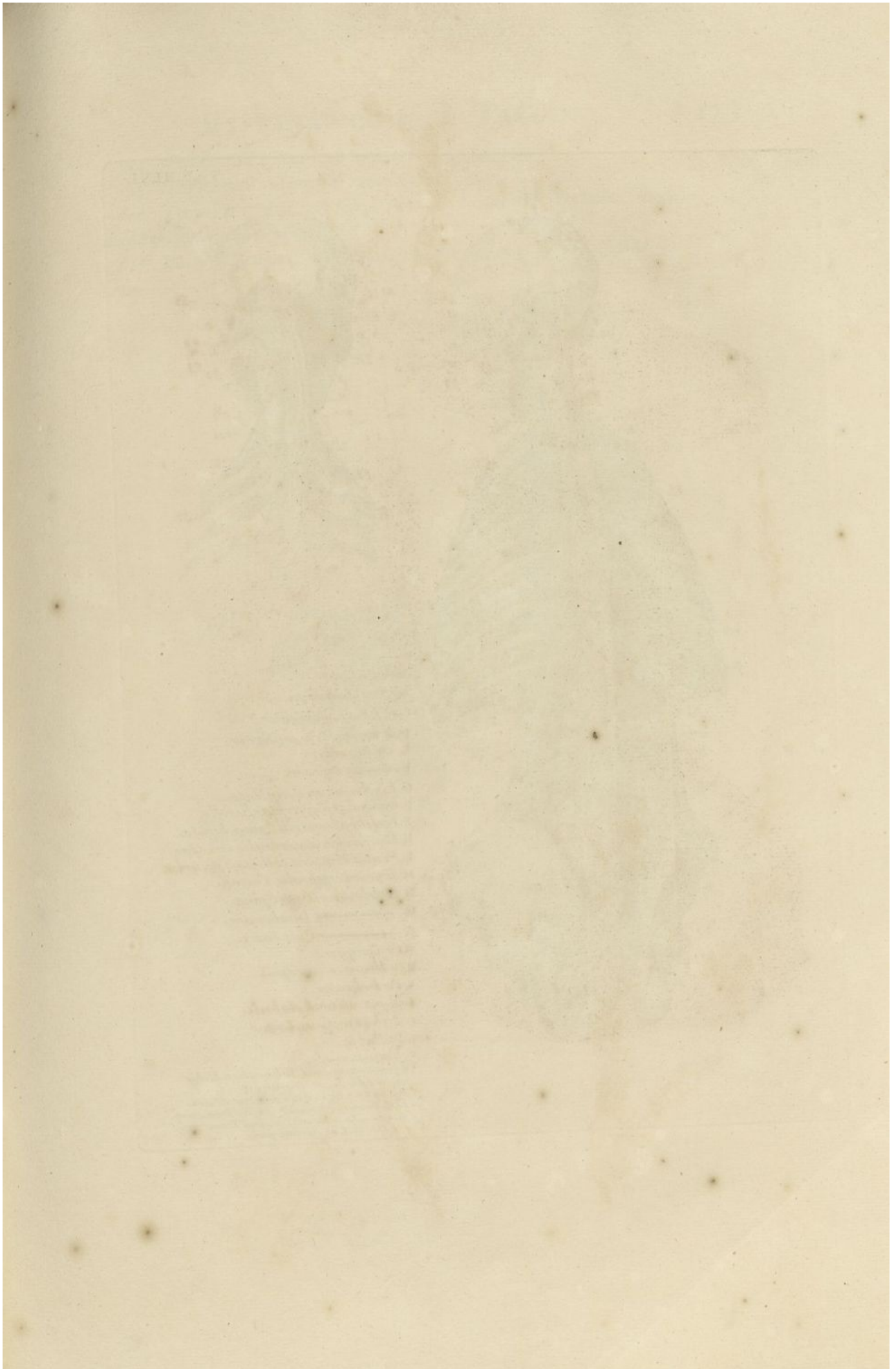
A. *Os Occipitis.*

B. *Vasa Sanguinea.*

C. *Sutura Lambdoides.*

D. *Processus Mammiformis.*

E. *Os Jugale.*

F. *Maxilla inferior.*

G. *Ligamentum Occipitale.*

H. *Musculus Superspinalis Colli.*

I. *Vertebrarum Colli Spinæ bifidæ.*

K. *Processus transversales earundem.*

L. *Primæ Vertebræ colli pars posterior.*

M. *Arteriæ Vertebralis Truncus.*

N. *Vertebrarum Dorsi Spinæ.*

O. ——————— *Lumborum.*

P. ——————— *Ossis Sacri.*

Q. *Os Coccygis.*

R. *Os Ilium; r ejus Spina.*

S. *Os Ischium.*

s. *Supercilium Acetabuli.*

t. *Ischij Processus Acutus.*

T. *Os Pubis.*

v. *Foramen ejus.*

V. *Ligamentum quod Tuberculum Ischij*
cum Osse Sacro conjungit.
1.2.3.4.5.6.7.8.9.10.11.12. Costæ duodecim.

X. *Vertebrarum Thoracis Processus Transversi.*

y. ——————— *Lumborum Processus Transversi.*
102 Dorsi Longissimi pars.

104 The external and internal Surfaces of the *Semispinatus*.

105 The external and internal Surfaces of the *Sacer*.

e e e Those Parts of it that spring from the *Vertebræ* of the Loins, which ascend obliquely, and compose

f f f Divers Digitations, that terminate in the Spines of the *Vertebræ* of the Loins.

Y y

TAB.

TAB. XLVI.

Is sufficiently explain'd by the References engrav'd on the Plate.

✿✿✿✿✿✿✿✿✿✿✿✿✿✿✿✿✿✿✿✿✿ ✿✿✿✿✿✿✿✿✿✿✿✿✿✿✿✿✿✿✿✿✿✿✿✿

TAB. XLVII.

107   The internal Surface of the *Pectoralis*, of the right Side.

A B Its fleshy Origination. Here it may be observ'd, that the Fibres of the lower Part, B, ascend and decussate those of its upper Part, A, in its broad Tendon, C, inserted into the *Os Humeri.*

D   A Production of the Tendon of the *Pectoralis*, which ascends and joins the Ligament of the Articulation of the *Os Humeri* with the *Scapula.*

108   The internal Surface of the *Deltoides*, of the right Side.

B C Its tendinous Origine from the *Spina Scapulæ.*

A Its fleshy one from the *Clavicula.*

D Part of the *Periosteum*, into which it is inserted on the *Os Humeri.*

109   The internal Surface of the *Supraspinatus.*

A A Its fleshy Original from the *Scapula.*

B Its tendinous Termination on the *Os Humeri.*

110   The Inside of the *Infraspinatus.*

A A Its fleshy Original from the *Scapula.*

B Its tendinous Termination on the *Os Humeri.*

C C Its Arteries fill'd with Wax.

111   The outside of the *Rotundus Minor.*
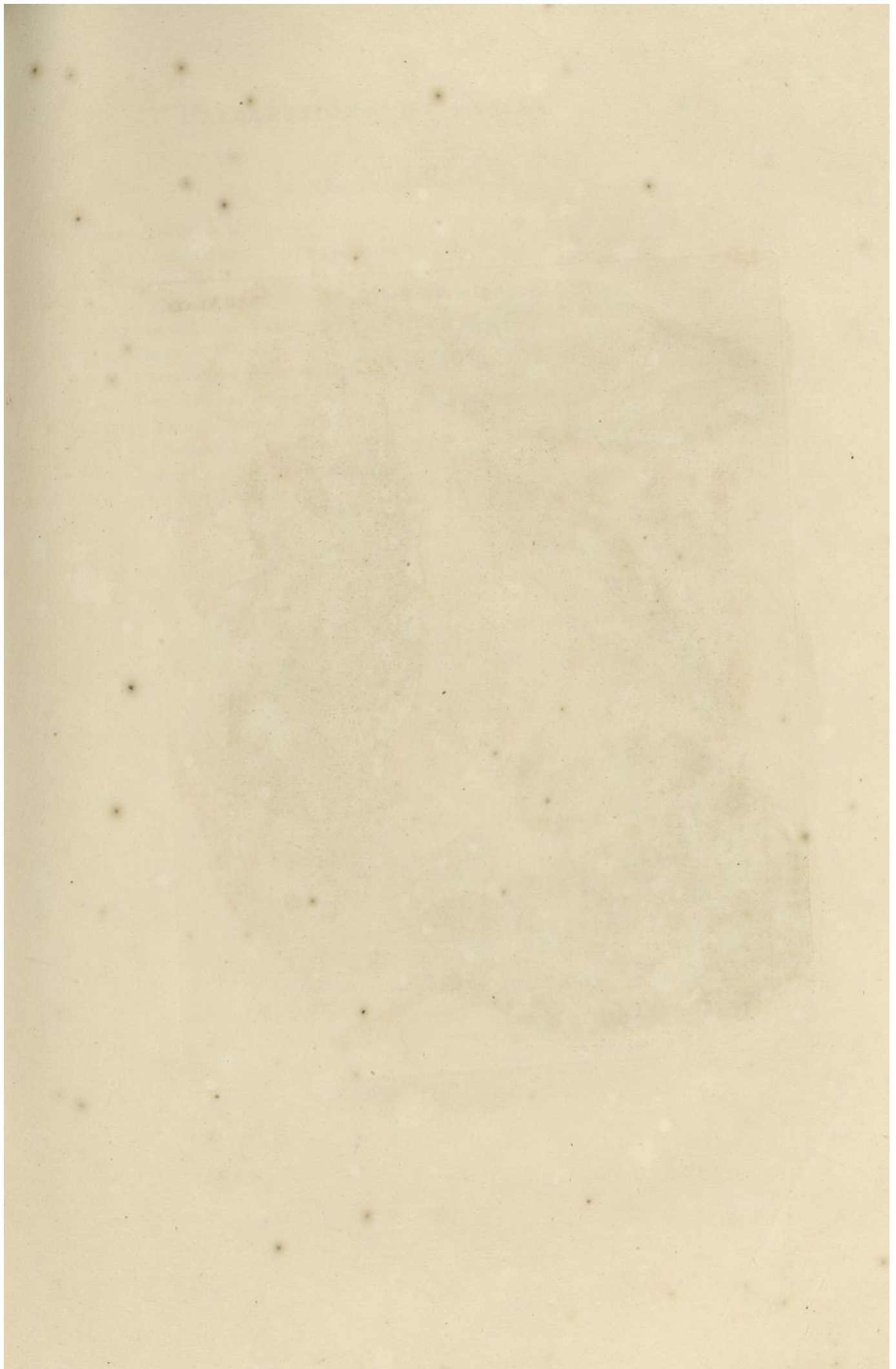
A Its Original from the *Scapula.*
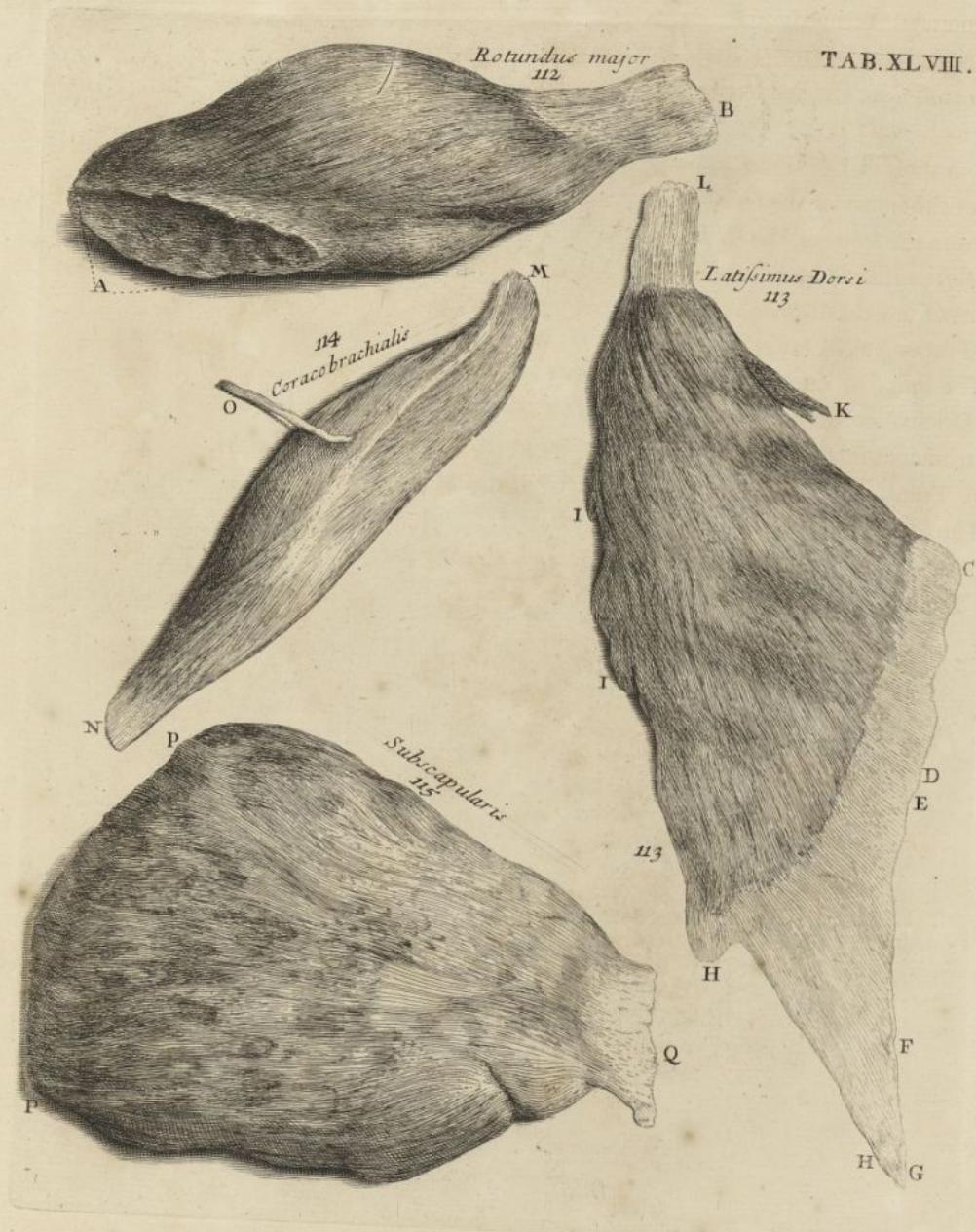
B Its Termination on the *Os Humeri.*

The lower Figure in this Table shews the Disposition of the Fibres, as they appear, when the *Infraspinatus* is divided according to its Length, very much resembling the Plume of a third or fourth Goose-Quill.

TAB.

TAB. XLVII.

107
Pectoralis

D

C

109
Supraspinatus

B

A

A

107

B

110
Infraspinatus

B

C

C

c

A

108
Deltoides

A

B

C

A

A

111
Rotundus minor

B

D

A

108

Infraspinatus secundum longitudinem Difsectus

Rotundus major
112

TAB. XLVIII.

B

L

Latissimus Dorsi
113

M

114
Coracobrachialis

O

K

I

C

I

N   P

Subscapularis
115

D
E

113

H

P

Q

F

H   G
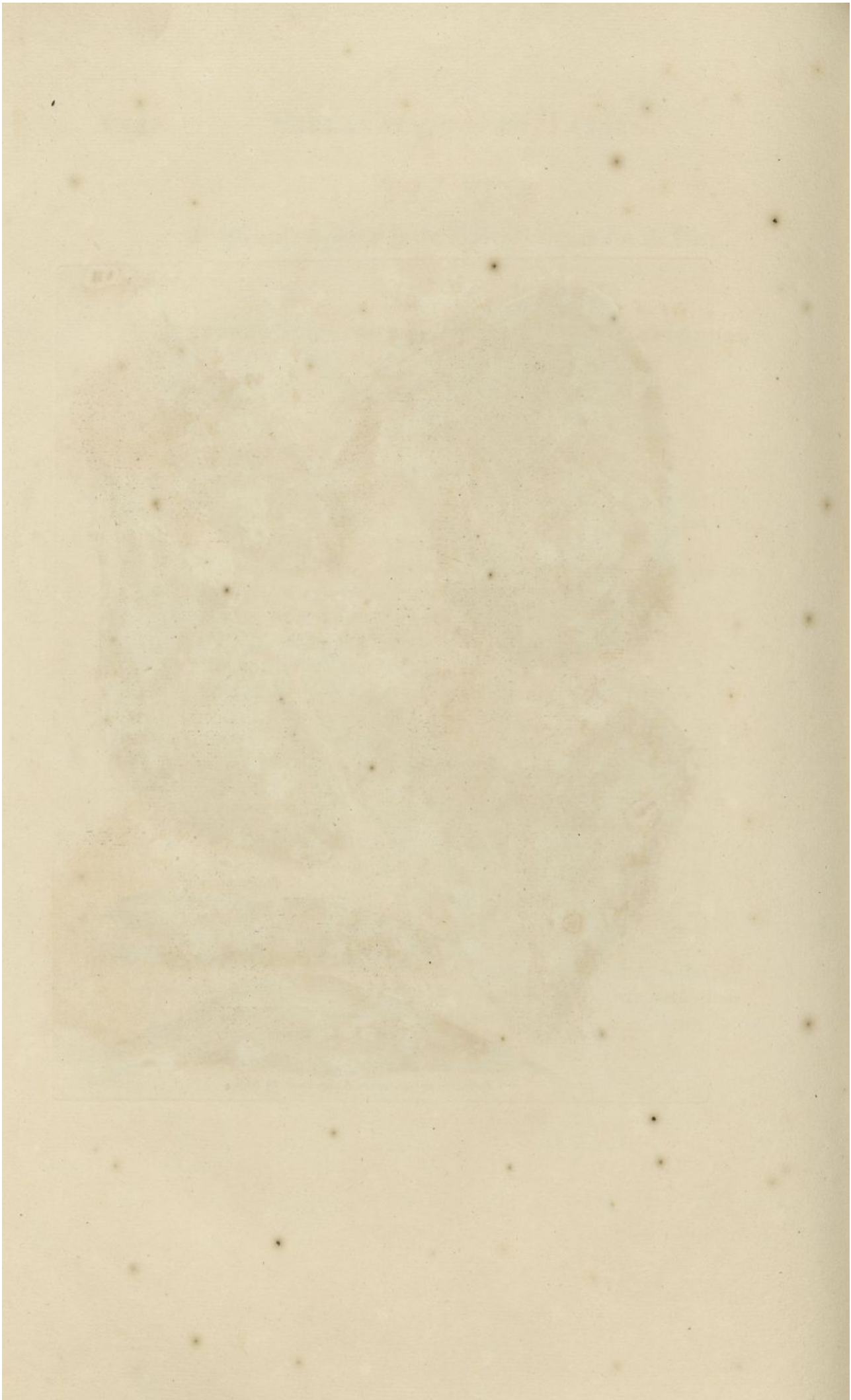
TAB. XLVIII.

112 The Infide of the *Rotundus Major*.

A Its flefhy Original.

B Its tendinous Termination.

113 The internal Surface of the *Latiffimus Dorfi* of the right Side.

CD Its tendinous Origination from the feven inferiour Spines of the *Vertebræ* of the *Thorax*.

EF From thofe of the Loins.

G From the Spines of the *Os Sacrum*.

HH From the Spine of the *Os Ilium*.

II Its *Fafciculi* of flefhy Fibres from the Ribs.

K Others from the *Scapula*.

L Its Tendon, at its Infertion into the *Os Humeri*.

114 The Infide of the *Coracobrachialis*, as big as the Life.

M Its Origination from the Extremity of the *Proceffus Coracoides Scapulæ*.

N Its tendinous Infertion into the middle of the internal Part of the *Os Humeri*.

O The Trunk of the Nerve, that paffes through this Mufcle.

115 The internal Surface of the *Subfcapularis*.

PP Its flefhy Origination, freed from the internal concave Part of the *Scapula*.

Q Its Tendon, cut from the *Os Humeri*.

TAB.

TAB. XLIX.

O The *Clavicula*.

a The Blood Veffels and Nerves of the Arm.

b The annular Ligament of the *Carpus*.

c The fuperiour Branch of the Artery, paffing between the Tendons of the *Supinator Radii Longus*, and *Flexor Carpi Radialis*, which makes the Pulfe in the Wrift.

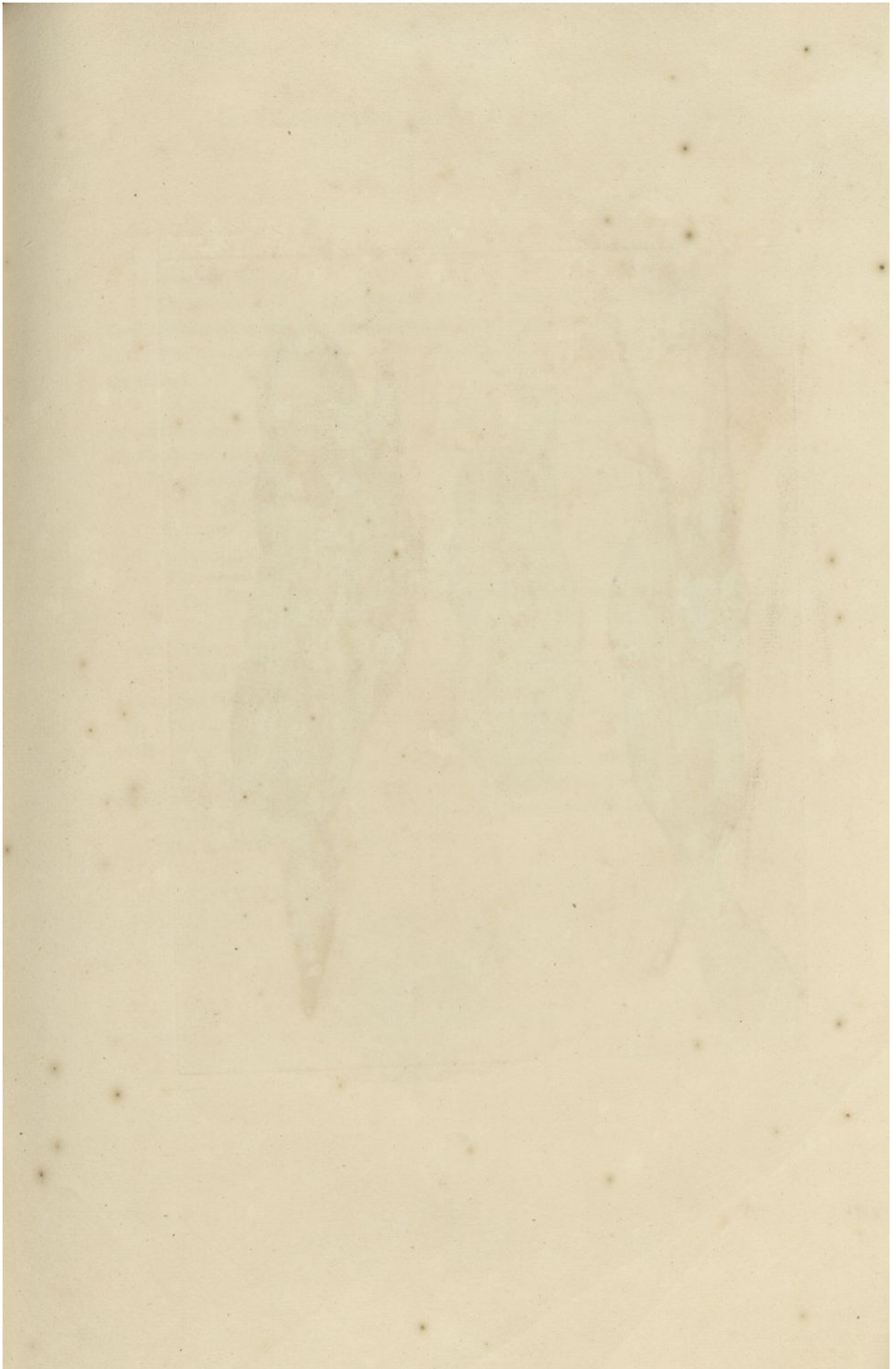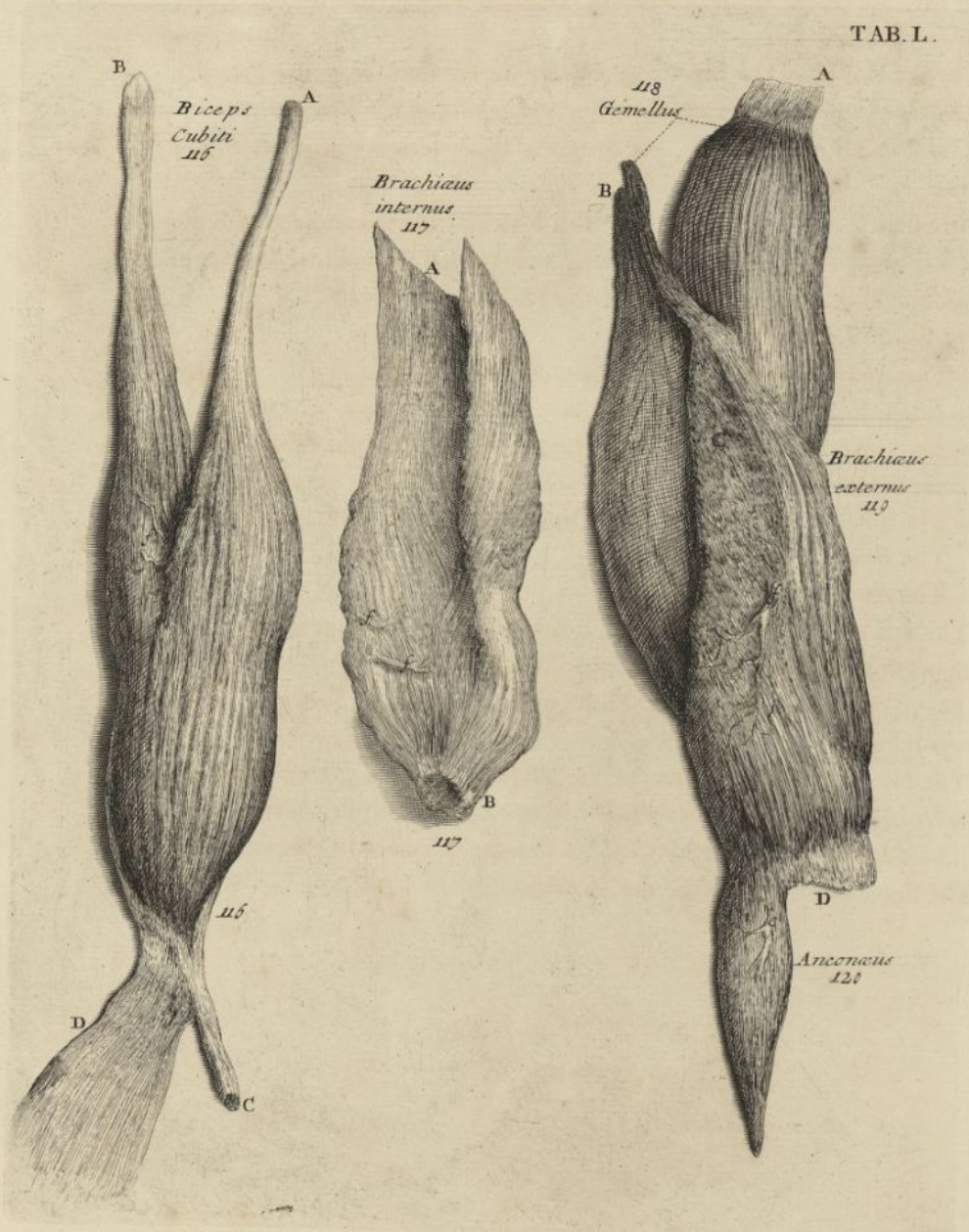*d* The tendinous Expanfion of the *Biceps*.

TAB.

TAB. L.

B

Biceps
Cubiti
116

A

Brachiæus
internus
117

A

118
Gemellus

A

B

Brachiæus
externus
119

B

117

116

D

C

D

Anconæus
120
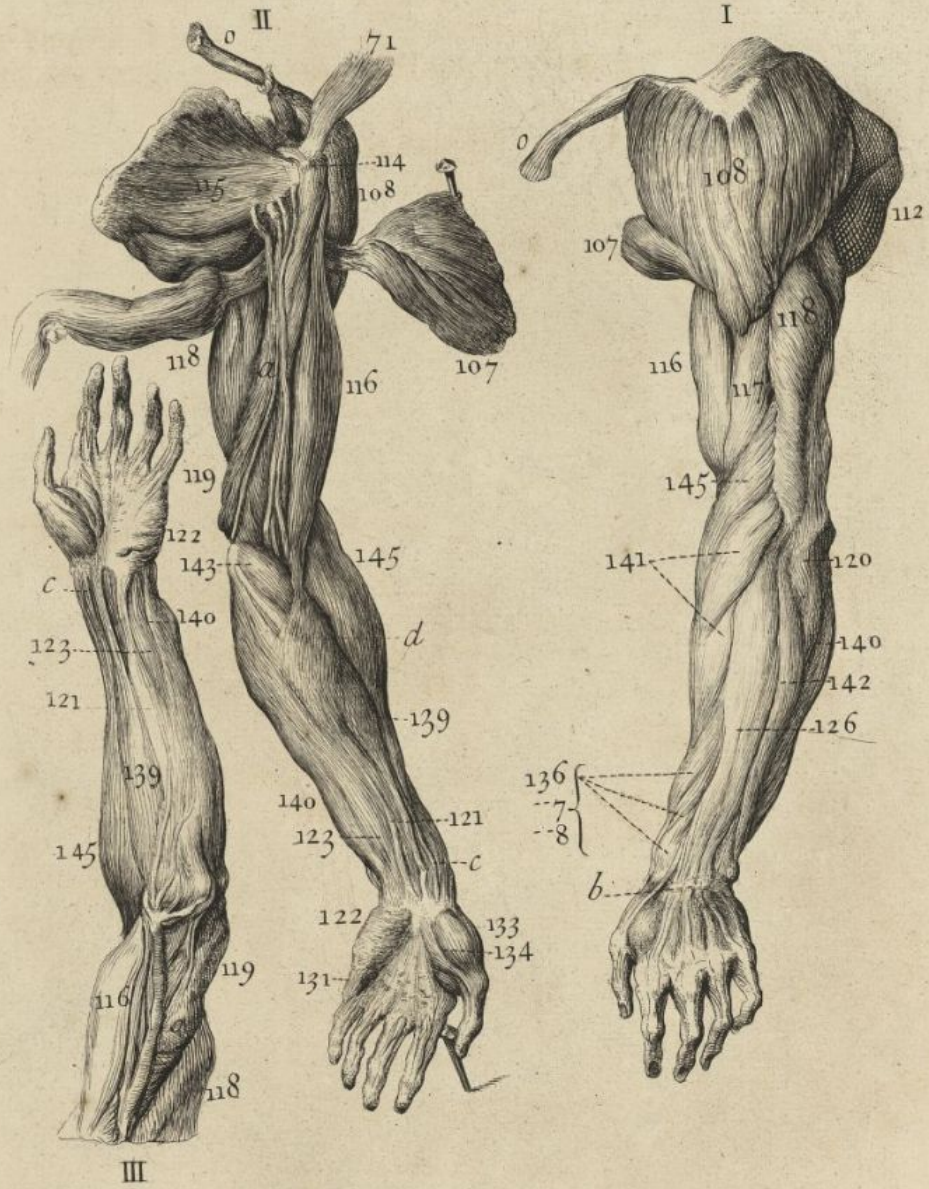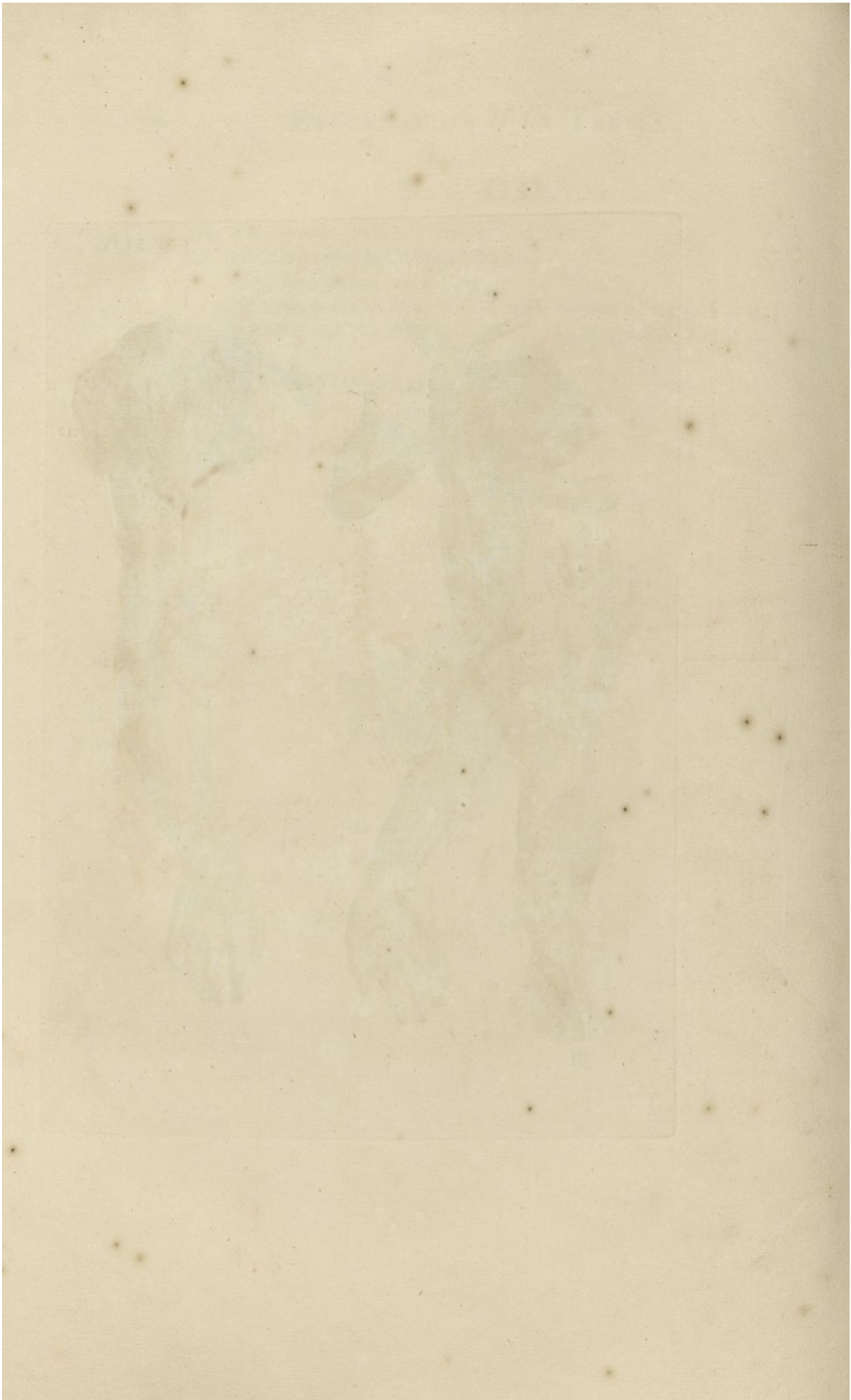
TAB. L.

116   The infide of the *Biceps Cubiti* of the right Arm.

A   Its external Head, which is a round Tendon fpringing from the upper part of the *Acetabulum Scapulæ*.

B   The internal Head, or beginning, of the *Biceps*, freed from the *Proceffus Coracoides Scapulæ* and the *Mufculus Coracobrachialis*, to which it adheres.

C   The Tendon of the *Biceps*, cut from the Tubercle near the upper end of the *Radius*.

D   An other membranous Tendon of this Mufcle, that is expanded with the *Membrana Communis Mufculorum*, and ftrictly embraces all the external Mufcles of the *Carpus* and Fingers, therefore call'd *Fafcia Tendinofa*.

f   The Blood Veffels on its infide.

117   The infide of the *Brachiæus Internus* of the right Arm.

A   Its internal concave Surface, as it arifes from the *Os Humeri*.

B   Its lower part, cut from its Infertion into the fore part of the *Ulna*.

f f   Some Blood Veffels, creeping on the infide of this Mufcle next the Bone.

118   The infide of the *Gemellus* of the right Arm, together with

119   The *Brachiæus Externus*.

120   The *Anconæus*.

A   The firft Head or Beginning of the *Gemellus*, which fprings with a tendinous Origine from the inferiour *Cofta* of the *Scapula*.

B   The fecond Head of the fame Mufcle, from the upper and back part of the *Os Humeri*.

C   The internal concave Surface of the *Brachiæus Externus*, where it fprang from the *Os Humeri*, with the Arteries, f, as they appear'd fill'd with Wax.

D   The Tendon of thefe Mufcles inferted into the *Olecranon* or Elbow.
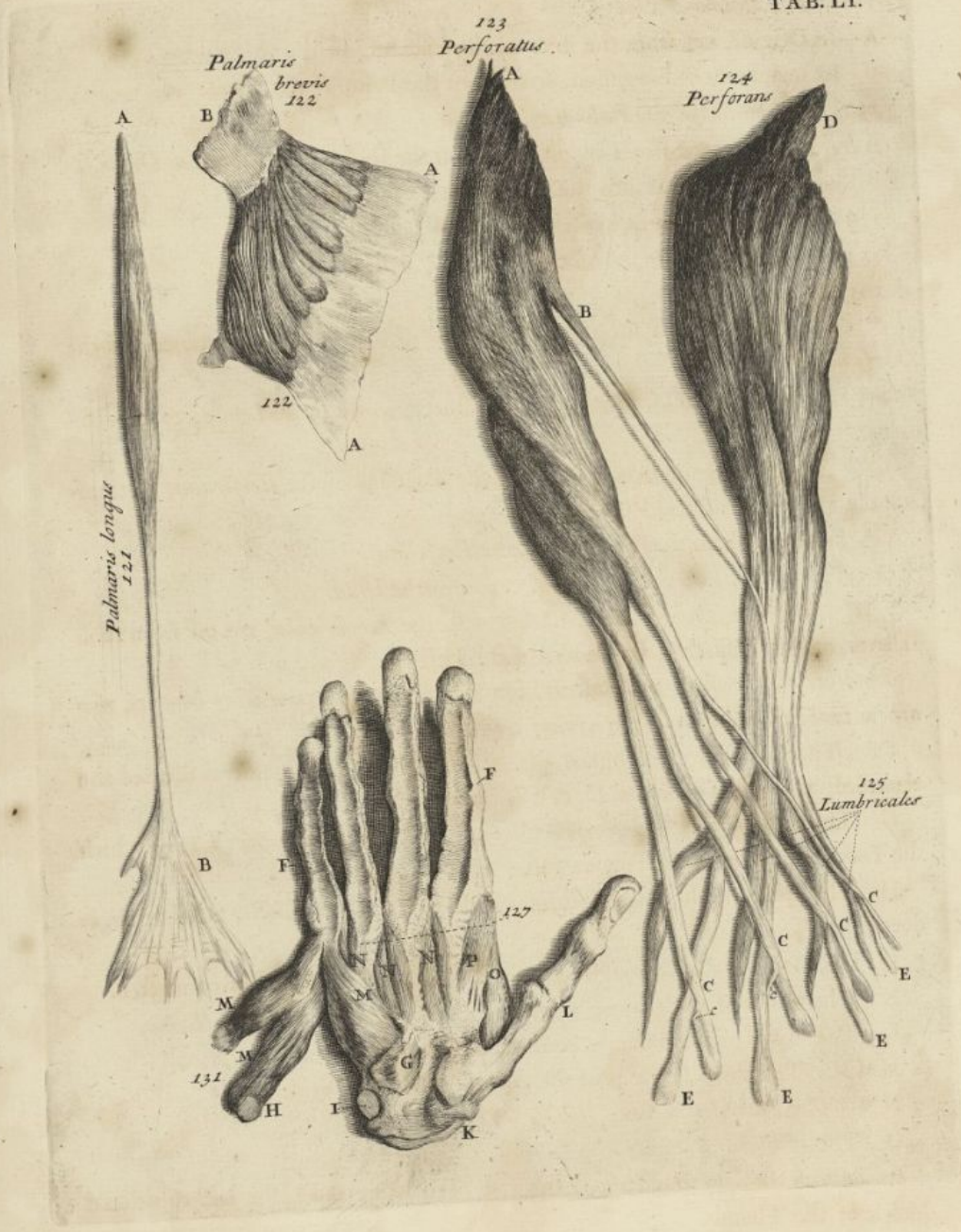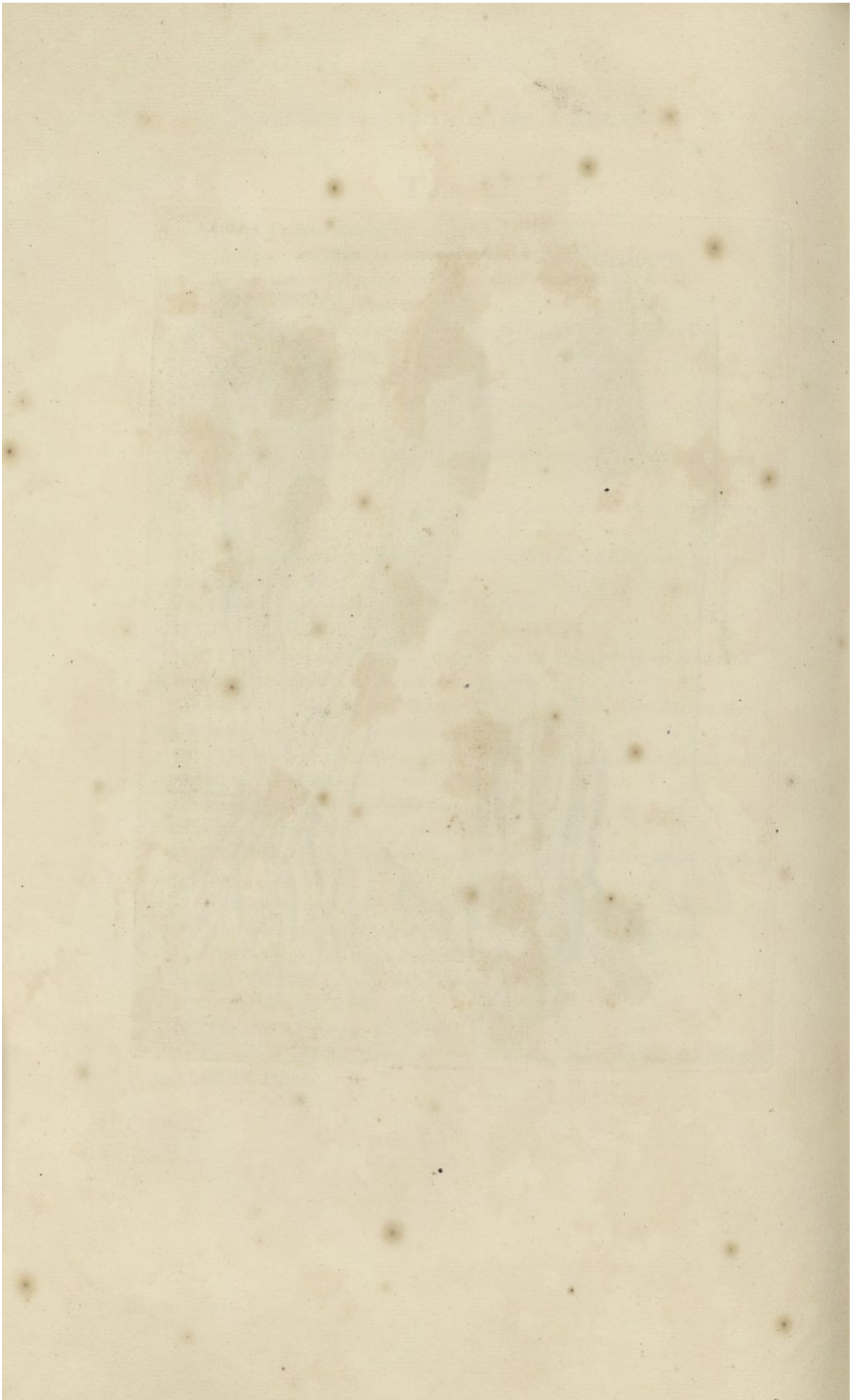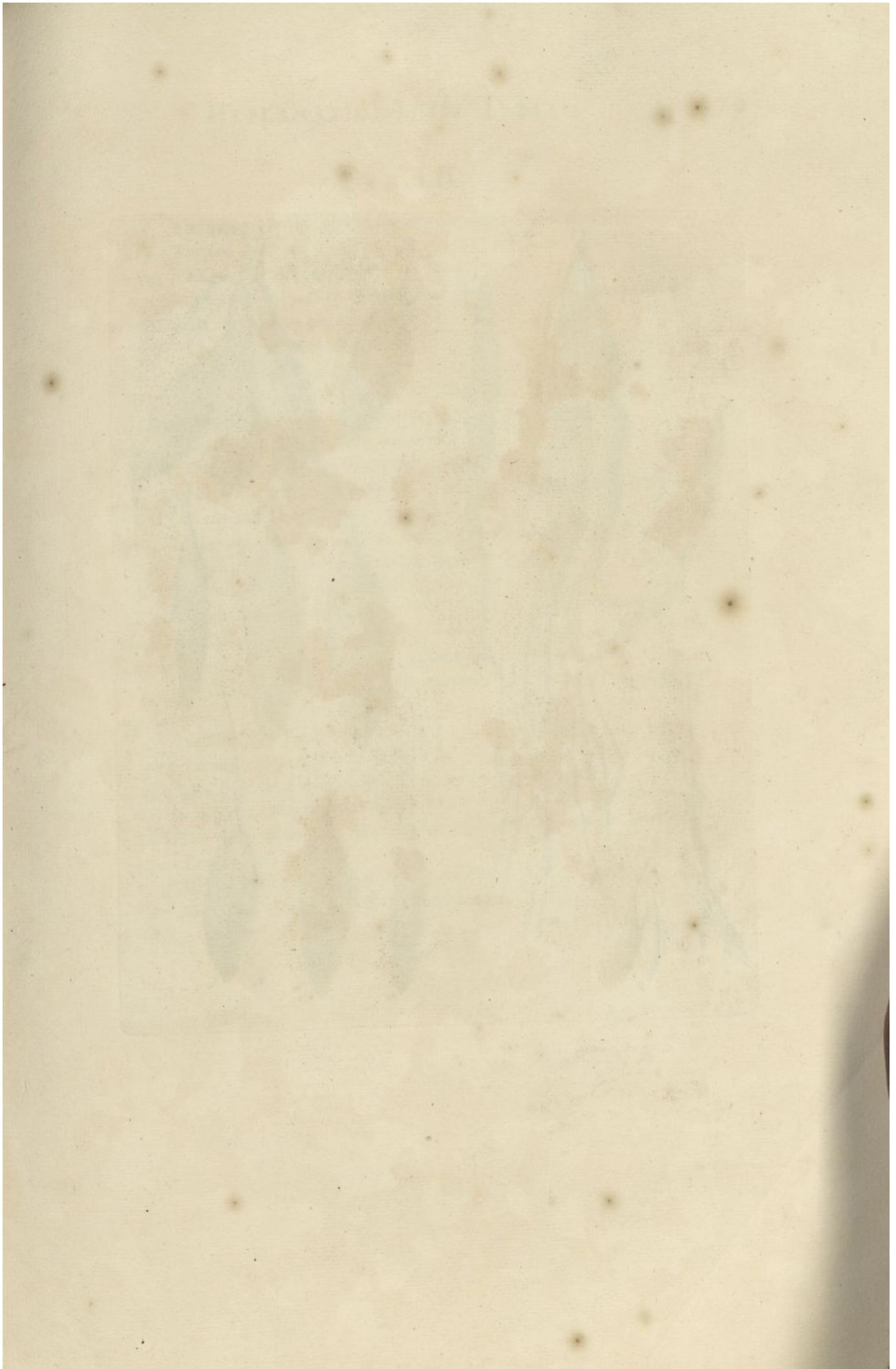
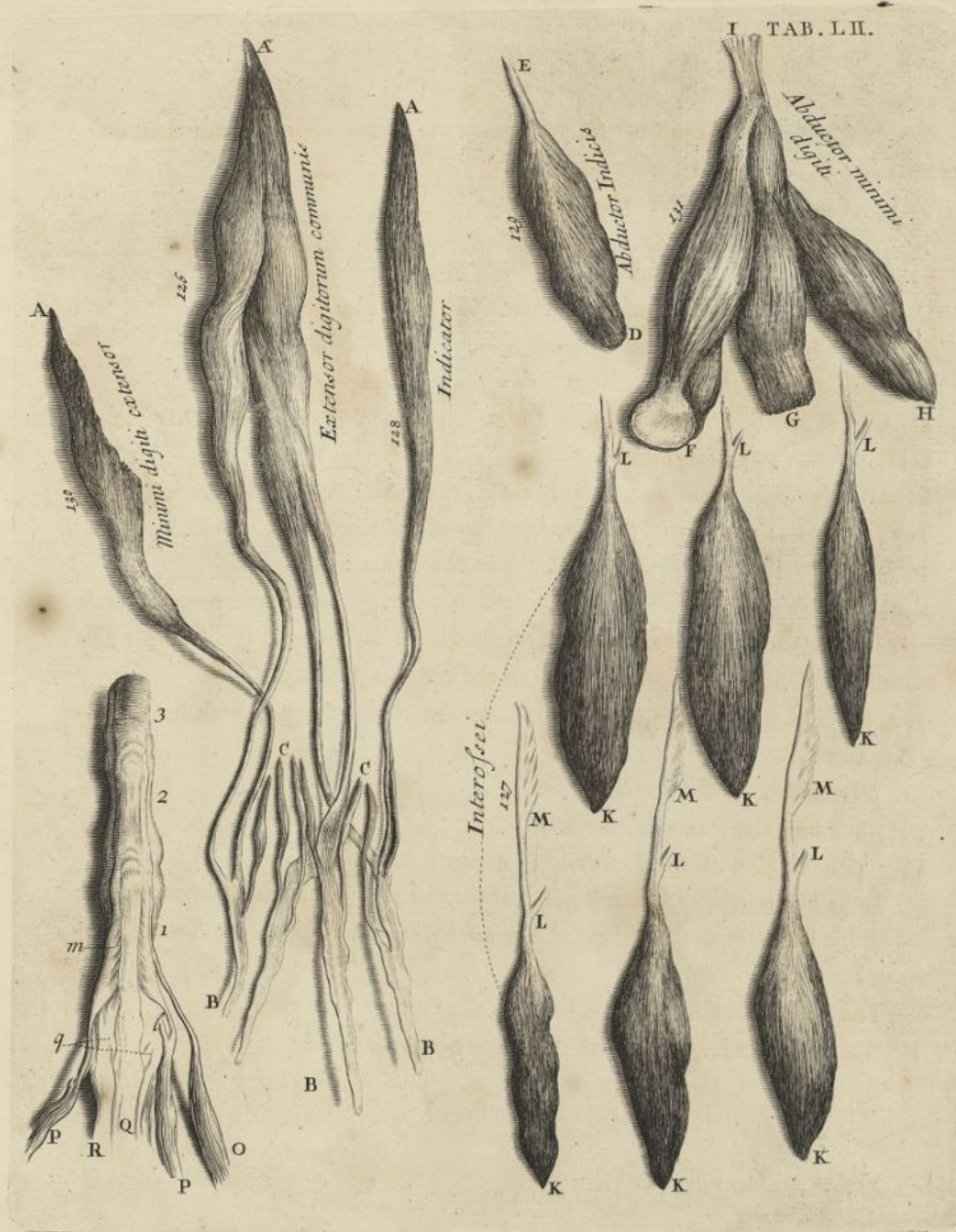e   The Branch of an Artery on the *Anconæus*.

TAB. LI.

121 The *Palmaris Longus.*

A Its Origine, cut from the internal Protuberance of the *Os Humeri.*

B Its membranous Expansion, freed from the Palm of the Hand.

122 The inside of the *Palmaris Brevis.*

A A Its Membrane like Tendon, cut from the *Os Metacarpi Minimi Digiti.*

B Its Tendon inserted into the eighth Bone of the *Carpus.*

123 The internal Surface of the *Perforatus,* and

124 The external Surface of the *Perforans,* with

125 The *Lumbricales,* of the right Hand.

A The beginning of the *Perforatus,* from the internal Extuberance of the *Os Humeri.*

B Part of this Muscle, which, in this Subject, sent a small Tendon to the *Perforans.*

C C The Perforations, or Fissures, in the Tendons of the *Perforatus,* to transmit those of the *Perforans.*

c c Filaments from the Tendons of the *Perforatus.*

D The Original of the *Perforans,* cut from the *Ulna.*

E E E The Tendons of these Muscles, with the *Lumbricales,* cut off from their Insertions at the respective Internodes of the Fingers.

The other Figure shews the Musculi Interossei in Situ *with some other Muscles, that appear in the Palm, after the preceding are removed.*

F F The Bones of the Fingers, with their Semicircular Ligaments divided and expanded, after the Tendons C C, c, E E, are taken off.

G The *Ligamentum Transversale Carpi* divided and turn'd out; under which the Tendons leading to the Fingers pass.

H The Bone of the *Carpus,* from which part of the *Abductor Minimi Digiti* does arise.

I That Bone of the *Carpus,* to which the last mention'd Bone is connected.

K The Bones of the *Carpus,* where they are articulated with the *Radius.*

L The Bones of the Thumb, connected by their Ligaments.

M M M The three Portions of the *Abductor Minimi Digiti.*

N N The *Interossei in Situ.*

O The *Adductor Pollicis.*

P Part of the *Abductor Indicis,* the rest of it lying under the last mention'd Muscle of the Thumb.

TAB.

TAB. LI.

Palmaris
brevis
122

123
Perforatus.

124
Perforans

Palmaris longus
121

125
Lumbricales

TAB. LII.

126   The internal Surface of the *Extenfor Digitorum Communis*.

128   The *Indicator*, and

130   The *Entenfor Minimi Digiti*.

AAA   Their feveral diftinct Originations, which are varioufly united in different Subjects, before they come to

BBB   Their Infertions into the Fingers.

CC   The *Lumbricales*.

129   The *Abductor Indicis*, as big as the Life.

D   Its flefhy Origine from the *Os Metacarpi* of the fore Finger.

E   Its tendinous Ending with the *Indicator*.

131   The *Abductor Minimi Digiti*, as big as the Life.

F   One of the Bones of the *Carpus*, from which it takes one of its Origines.

GH   Its two other Beginnings.

I   The Termination of this Mufcle, cut from the firft Bone of the little Finger.

127   The fix *Interoffei* of the Hand, as big as the Life.

KK   Their flefhy Originations freed from the Metacarpal Bones.

LM   Their long Tendons, which fend Slips to the firft Internode of each Finger, L. M, their other Parts, which join with the Tendons of the *Extenfor Digitorum Longus*, in the manner exprefs'd in the following Figure.

1, 2, 3   The firft, fecond, and third Internodes of the Finger, with its extending Tendons.

O   Part of one of the *Lumbricales*.

PP   Parts of the *Interoffei*, on both fides.

Q   The Tendon of the *Extenfor Digitorum Longus*.

q   Its two Slips, that are inferted into the upper part of the firft *Internodium*.

m   The Fibres of the Tendons of the *Interoffei*, joining with the *Extenfor Digitorum Longus*.

l   The Slip fent off to the firft Joint of the Finger.

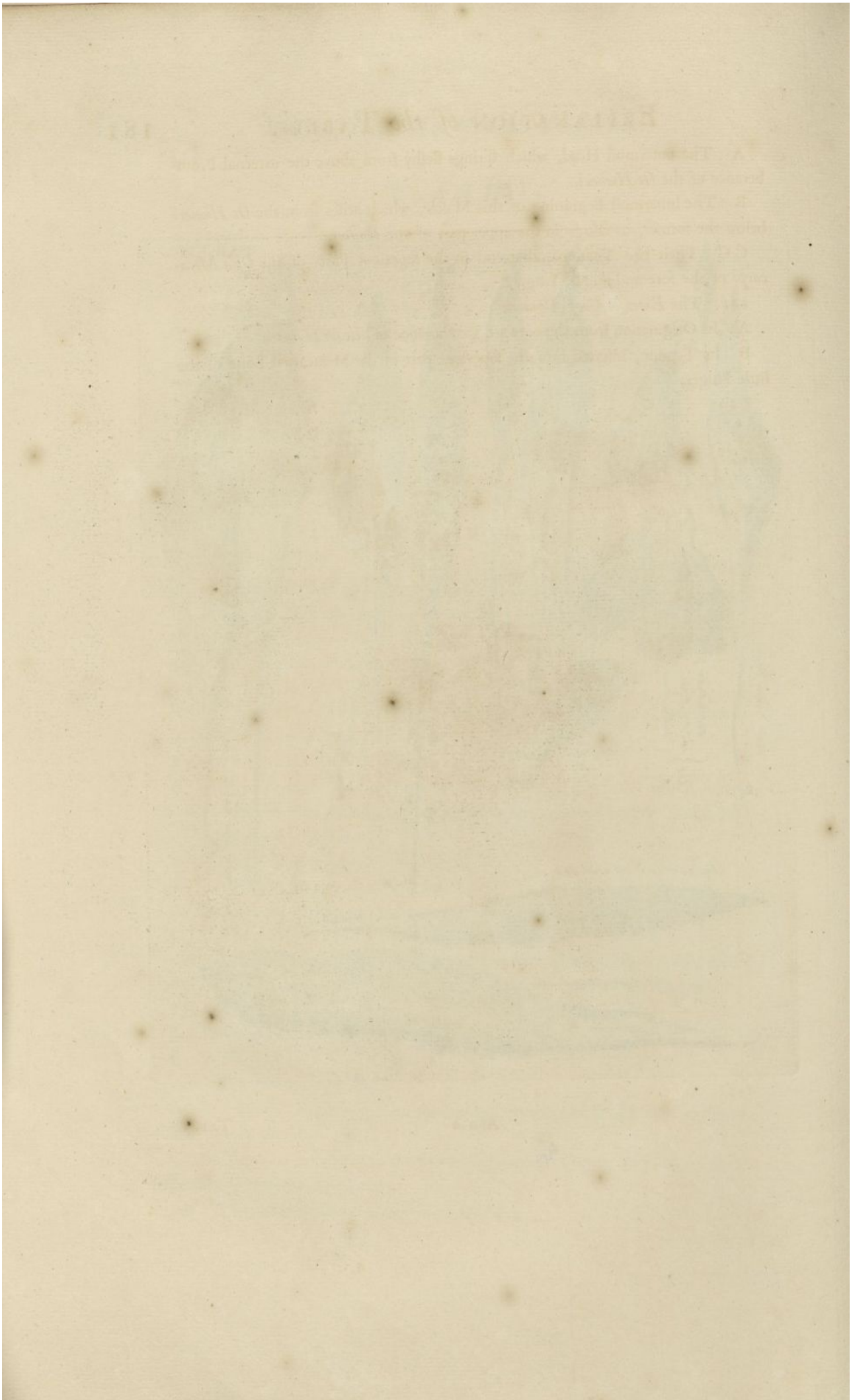R   Part of one of the Bones of the *Metacarpus*.

TAB.

TAB. LIII.

132 *Flexor Pollicis Longus.*

A   One of the Beginnings of this Muscle, (which is not commonly found) from the internal Protuberance of the *Os Humeri.*

a   Its second Beginning from the *Radius.*

B   Its Tendon, ending in the superiour part of the third Bone of the Thumb.

133   The *Abductor Pollicis.*

A   Its fleshy Origination from the *Os Carpi,* to which the Thumb is articulated, and the *Ligamentum Transversale Carpi.*

B   Its tendinous Ending at the superiour and external part of the second Bone of the Thumb laterally.

C   A Tendon we commonly meet with, sent to this Muscle from the *Extensor Primi Internodii Pollicis.*

134   The *Flexor Primi & Secundi Ossis Pollicis,* as big as the Life.

AAA   Its three fleshy Beginnings, from the *Ligamentum Transversale Carpi,* Bones of the *Carpus,* and *Os Metacarpi* of the middle Finger.

B   Its Tendon, inserted into the first and second Bone of the Thumb.

CC   Two *Ossa Sesamoidea* in its Tendon.

135   The *Adductor Pollicis,* as big as the Life.

A   Its fleshy Origination from the *Os Metacarpi Indicis.*

B   Its Tendon, inserted into the superiour part of the first Bone of the Thumb.

136   The *Extensor Primi Ossis Pollicis.*

A   Its Origination from the *Ulna.*

B   Its two Tendons, as they appear'd in this Subject, one of which sent a Slip, C, to the *Abductor Pollicis,* before they were both inserted into the lower part of the first Bone of the Thumb.

137   The *Extensor Secundi Ossis Pollicis.*

A   Its fleshy Origine from the *Radius.*

B   Its Tendon, ending in the lower part of the second Bone of the Thumb.

138   The *Extensor Tertii Ossis Pollicis.*

AA   Its broad, partly tendinous, but chiefly fleshy, Origination from the *Ulna.*

B   Its Tendon, cut from the lower part of the third Bone of the Thumb.

139   The *Flexor Carpi Radialis.*

A   Its Origination.

B   Its Insertion.

140   The *Flexor Carpi Ulnaris.*

A   Its tendinous Beginning from the internal Extuberance of the Shoulder Bone.

BB   From the *Ulna.*

C   Its Tendon, inserted into the fourth Bone of the *Carpus,* and the *Os Meta-carpi* that sustains the little Finger.

141   The inside of the *Extensor Carpi Radialis.*

A The

TAB. LIII.

134

a

A

B

135
Adductor   Pollicis
A

C
B
C

A

A

A

Flexor Pollicis longus

B

{ 134 } Flexor brevis
five 1ma & 2da Ossis
Pollicis Flexor

A
A

Abductor
133

B

Pollicis

Extensor 1ma Ossis Pollicis 136
A
B

Extensor 2da Ossis Pollicis 137
A
B

A

A

Extensor 3tia Ossis Pollicis 138
B

Flexor Carpi Radialis 139
A
B

Extensor Carpi Radialis 141
A
B
C
C

Extensor Carpi Ulnaris 142
A
B

Flexor Carpi Ulnaris 140
B
A
C

A   The outermost Head, which springs fleshy from above the external Protuberance of the *Os Humeri*.

B   The innermost Beginning of this Muscle, which arises from the *Os Humeri* below the former, as also from the upper part of the *Radius*.

C C   Their two Tendons, that end in the superiour Parts of the *Offa Metacarpi* of the fore and middle Fingers.

142   The *Extensor Carpi Ulnaris*.

A   Its Origination from the outward Extuberance of the *Os Humeri*.

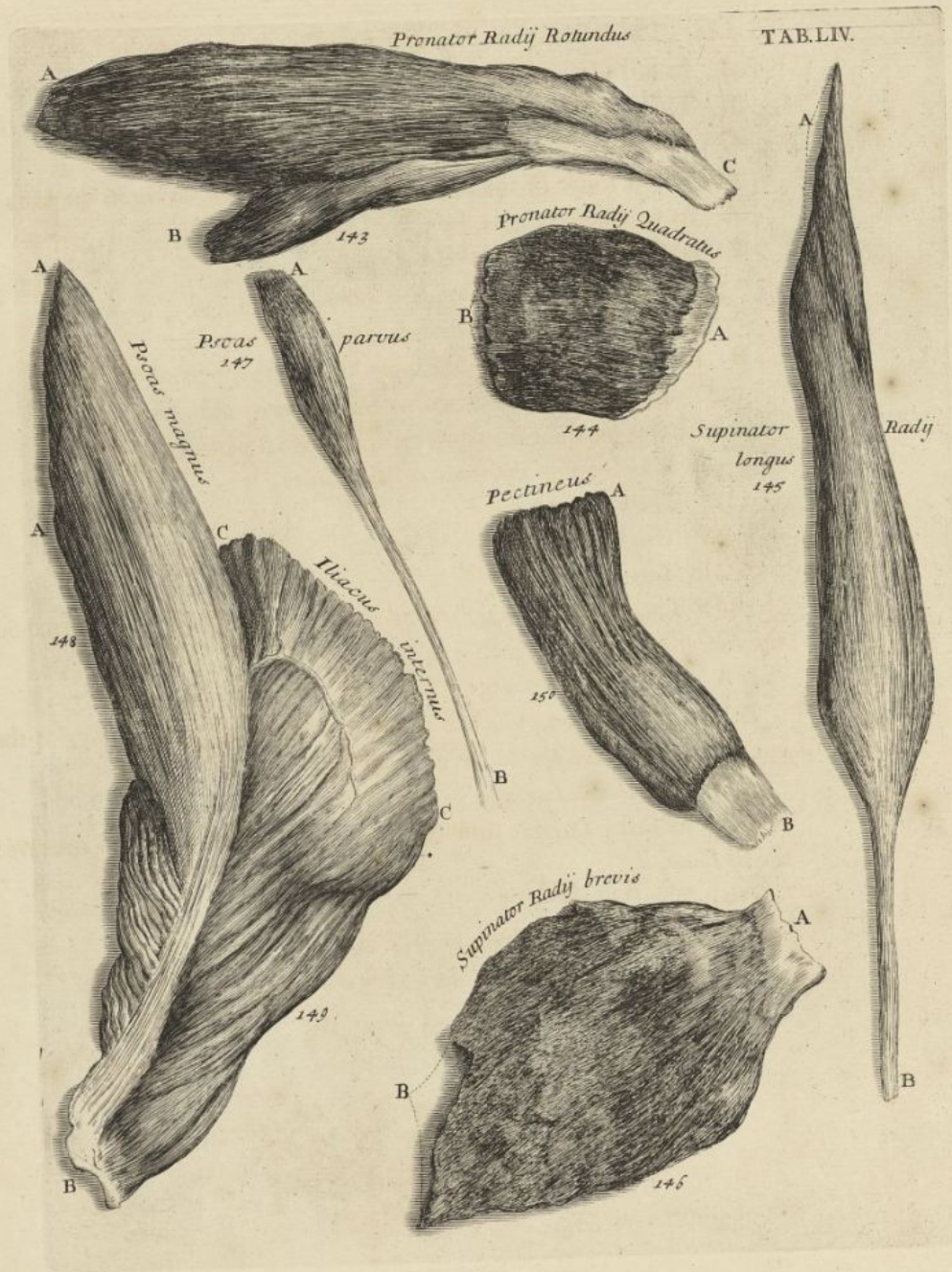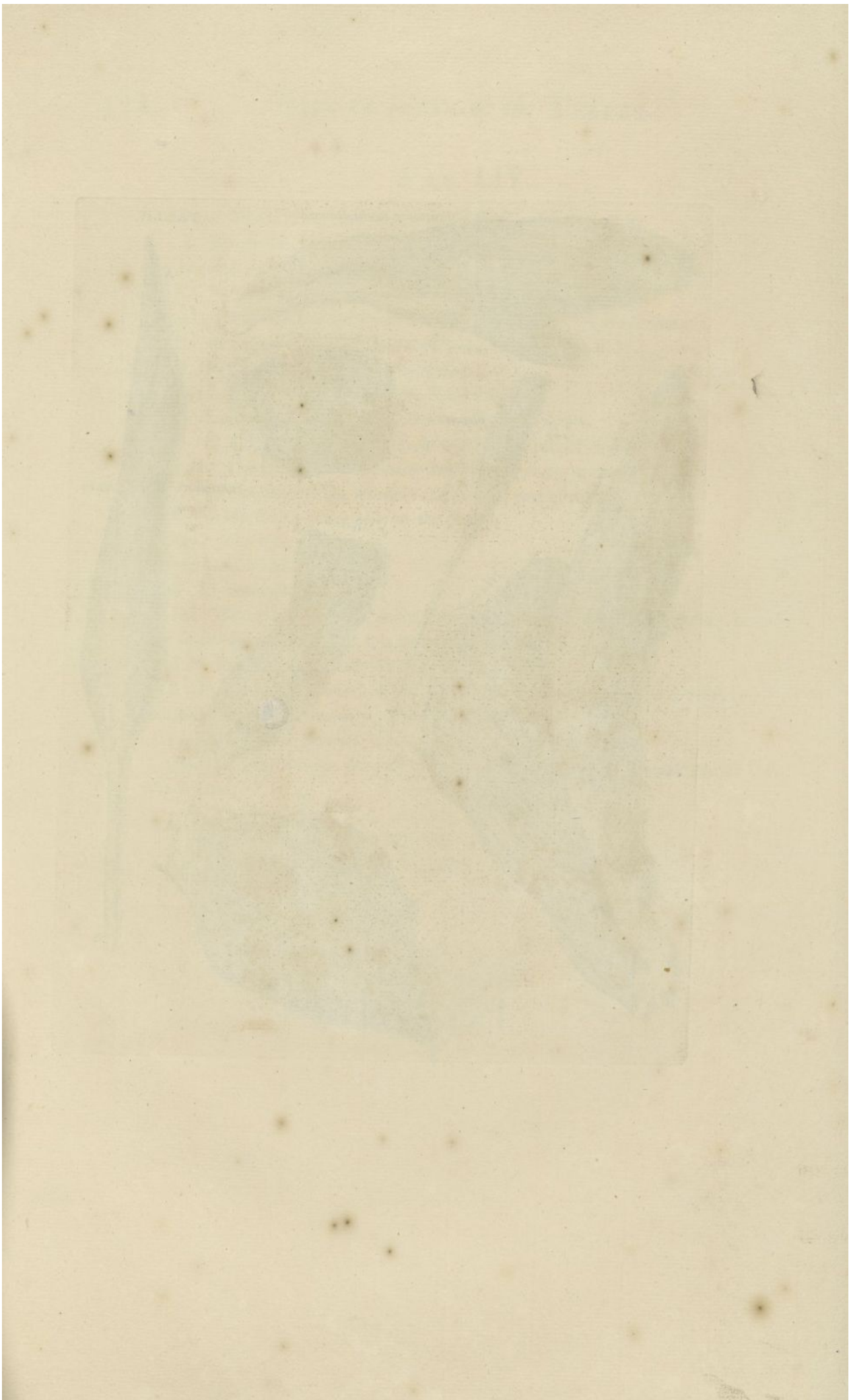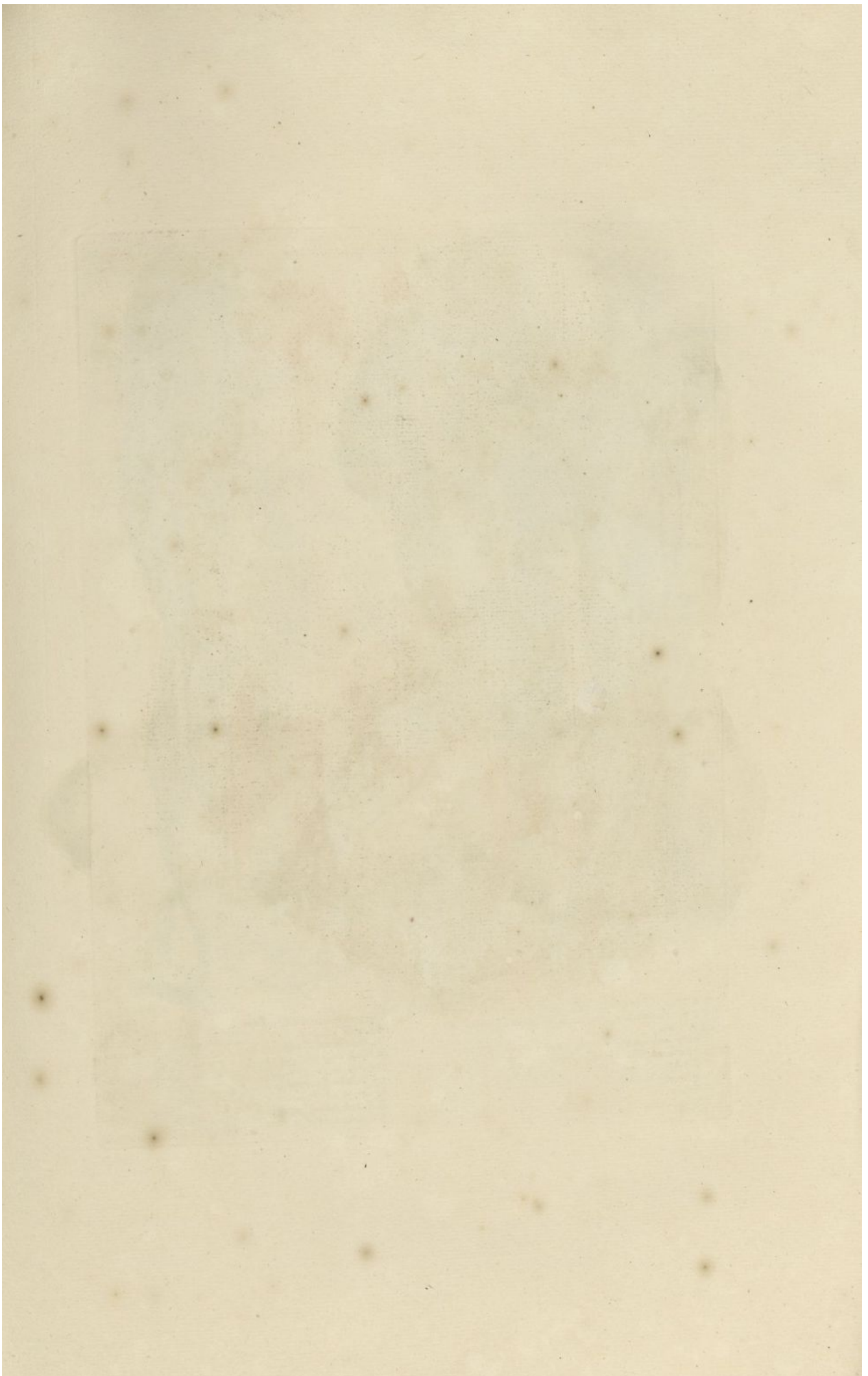B   Its Tendon, inserted into the superiour part of the Metacarpal Bone of the little Finger.
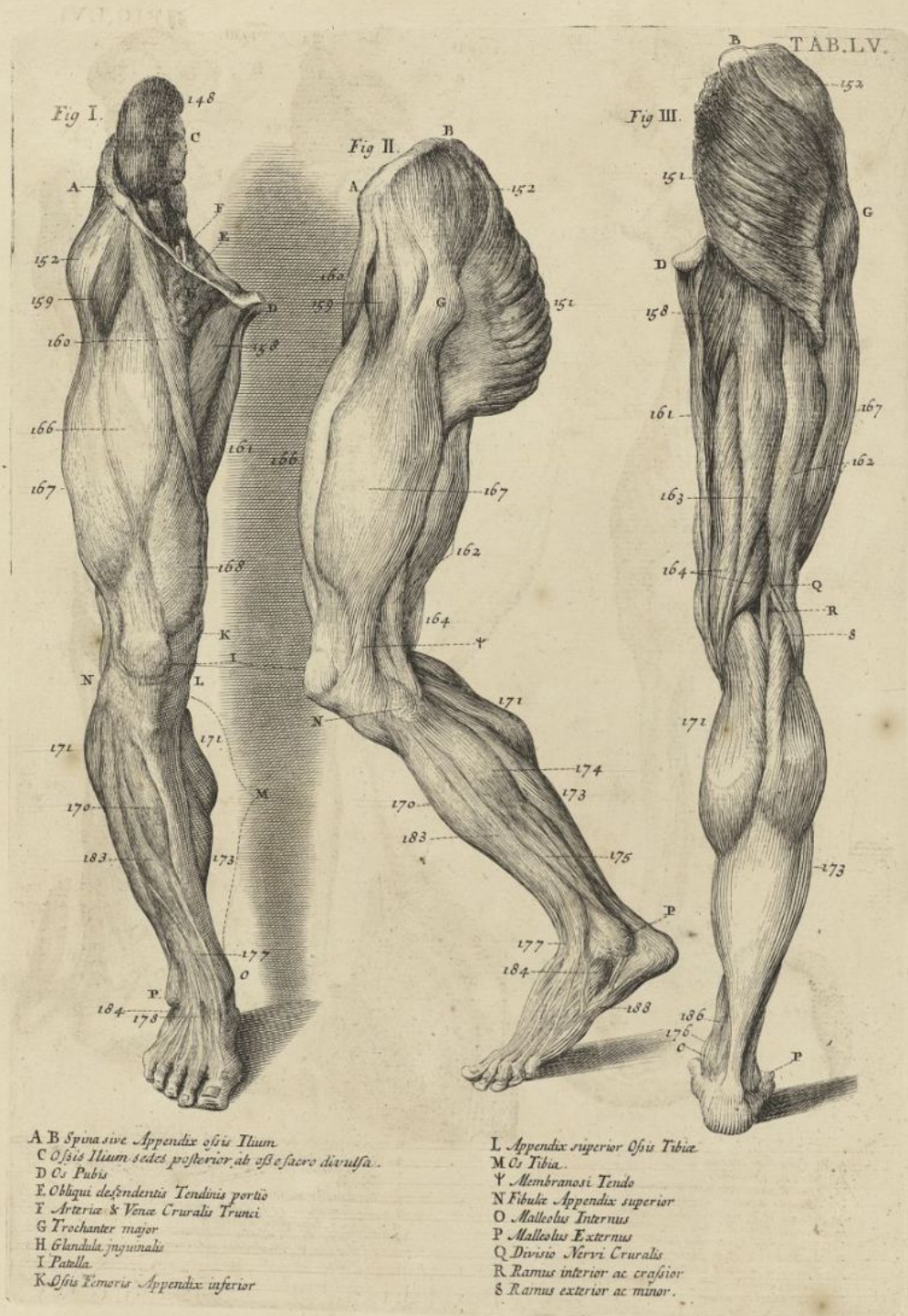
TAB. LIV.

143   The Infide of the *Pronator Radii Teres*, as big as the Life.

A   Its firft Original from the internal Extuberance of the *Os Humeri*.

B   The fecond from the *Ulna*.

C   Its tendinous Infertion freed from the *Radius*.

144   The Infide of the *Pronator Radii Quadratus*, as big as the Life.

A   Its tendinous Origine from the *Ulna*.

B   Its flefhy Termination on the *Radius*.

145   The Infide of the *Supinator Radii Longus*.

A   Its broad flefhy Origination from the *Os Humeri*.

B   Its Tendon, ending in the lower and internal part of the *Radius*.

146   The Infide of the *Supinator Radii Brevis*, as big as the Life.

A   Its Origine from the fuperiour and external part of the *Ulna*.

B   Its Infertion into the Body of the *Radius*.

147   The *Pfoas Parvus*.

A   Its Origination.

B   Its Termination.

148   The external Surface of the *Pfoas Magnus*, with the internal Surface of the *Iliacus Internus*, to which it is infeparably joined.

A A   Its Original from the *Vertebræ* of the Loins.

B   Its Termination, which is partly tendinous and partly flefhy, at the inferiour part of the leffer *Trochanter* of the Thigh-bone.

149   The *Iliacus Internus*.

C C   Its flefhy Origine from above half the fuperiour internal concave Part of the *Os Ilium*.

150   The *Pectineus*.

A   Its flefhy Original from the *Os Pubis*.

B   Its tendinous Ending on the *Os Femoris*.

Pronator Radij Rotundus

TAB.LIV.

143

Pronator Radij Quadratus

144

Psoas
147

parvus

Psoas magnus

148

Iliacus internus

149

Supinator
longus
145

Radij

Pectineus

150

Supinator Radij brevis

146

TAB.LV.

Fig I.

Fig II.

Fig III.

A B *Spina sive Appendix ossis Ilium.*
C *Ossis Ilium sedes posterior ab osse sacro divulsa.*
D *Os Pubis.*
E *Obliqui descendentis Tendinis portio.*
F *Arteriæ & Venæ Cruralis Trunci.*
G *Trochanter major.*
H *Glandula inguinalis.*
I *Patella.*
K *Ossis Femoris Appendix inferior.*

L *Appendix superior Ossis Tibiæ.*
M *Os Tibia.*
Y *Membranosi Tendo.*
N *Fibulæ Appendix superior.*
O *Malleolus Internus.*
P *Malleolus Externus.*
Q *Divisio Nervi Cruralis.*
R *Ramus interior ac crassior.*
S *Ramus exterior ac minor.*

FIG.LVI.

Fig.I.   Fig.II.   Fig.III.

A.B. *Ossis Ilij Spina.*
a. *Nervus Cruralis.*
b. *ejus Ramus interior & major.*
c. *Ramus minor.*
d. *Arteria & Vena Cruralis Truncus.*
e. *Arteria Vena Nervig. Truncus.*
C. *Ossis Ilij Sinus inæqualis Ossi Sacro liberatus.*
D. *Os Pubis E.ejus Foramen.*
F. *Processus acutus Coxendicis.*
G. *Sinus Coxendicis pro Mus.b Pyriformis transitu.*
g. *Appendix Coxendicis.*

H. *Ligamentum latum apertum ad exhibendum h.*
h. *Ossis Femoris Caput.*
i. *Ligamentum Ossi Sacro dissectum.*
I. *Patella.*
K. *Trochanter major.*
L.L. *Os Femoris. l.ejus Linea Aspera.*
M.M. *Capita Appendicis inferioris.*
N. *Os Tibia. O. Malleolus internus.*
P. *p. Fibula P. Malleolus externus.*
Q. *Os Calcis.*
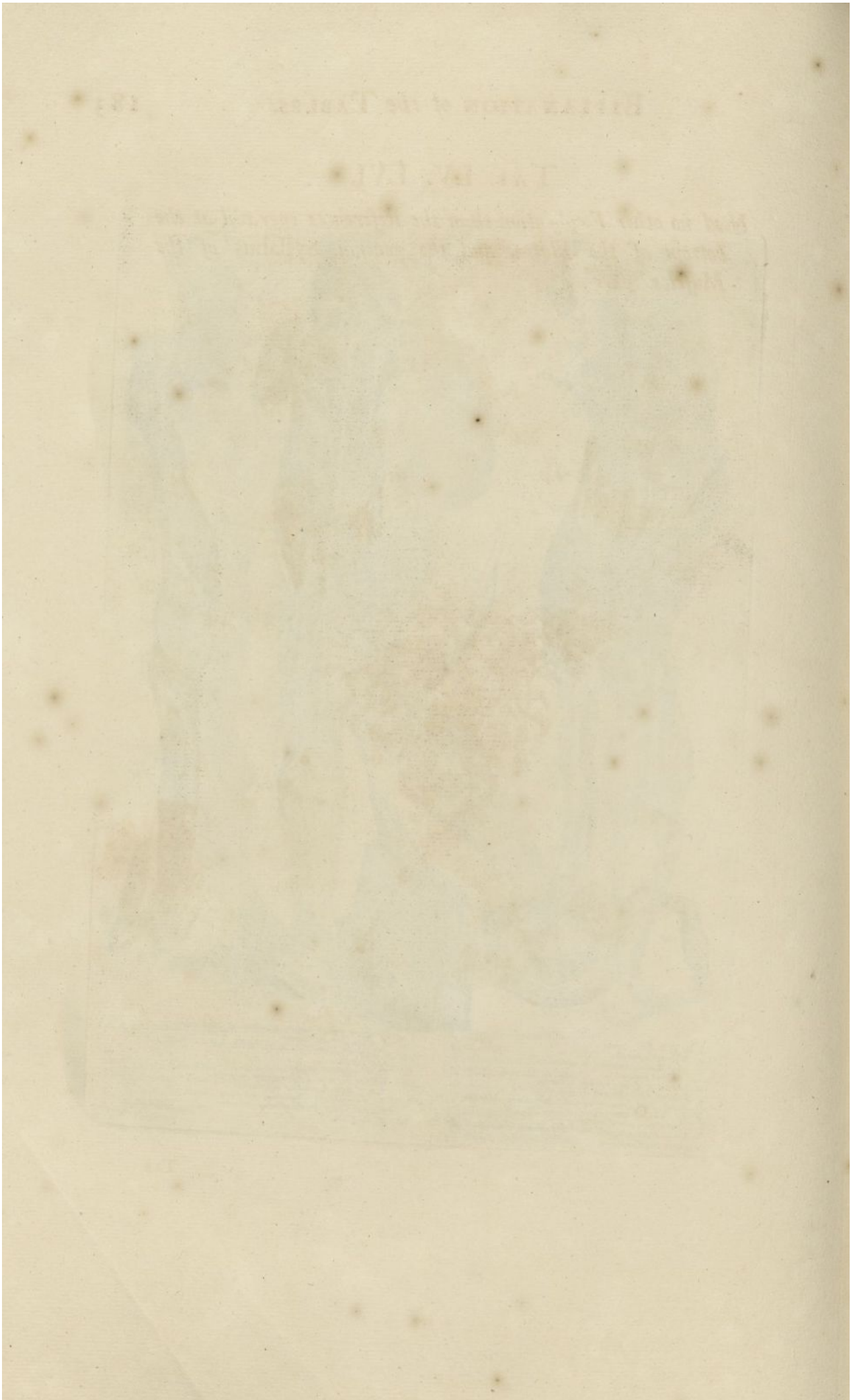
TAB. LV. LVI.

Need no other Explication than the References engrav'd at the bottom of the Plates, and the general Syllabus of the Muscles.

TAB.

TAB. LVII.

151   The Infide of the *Glutæus Magnus* of the left Side, together with its lateral Tendon, which is joined with the Tendon of the *Mufculus Membranofus.*

AA   Its tendinous Origine from the Spine of the *Os Ilium.*

BB   The flefhy Origine of this Mufcle, from the Spine of the *Os Ilium, Os Sacrum* and *Os Coccygis.*

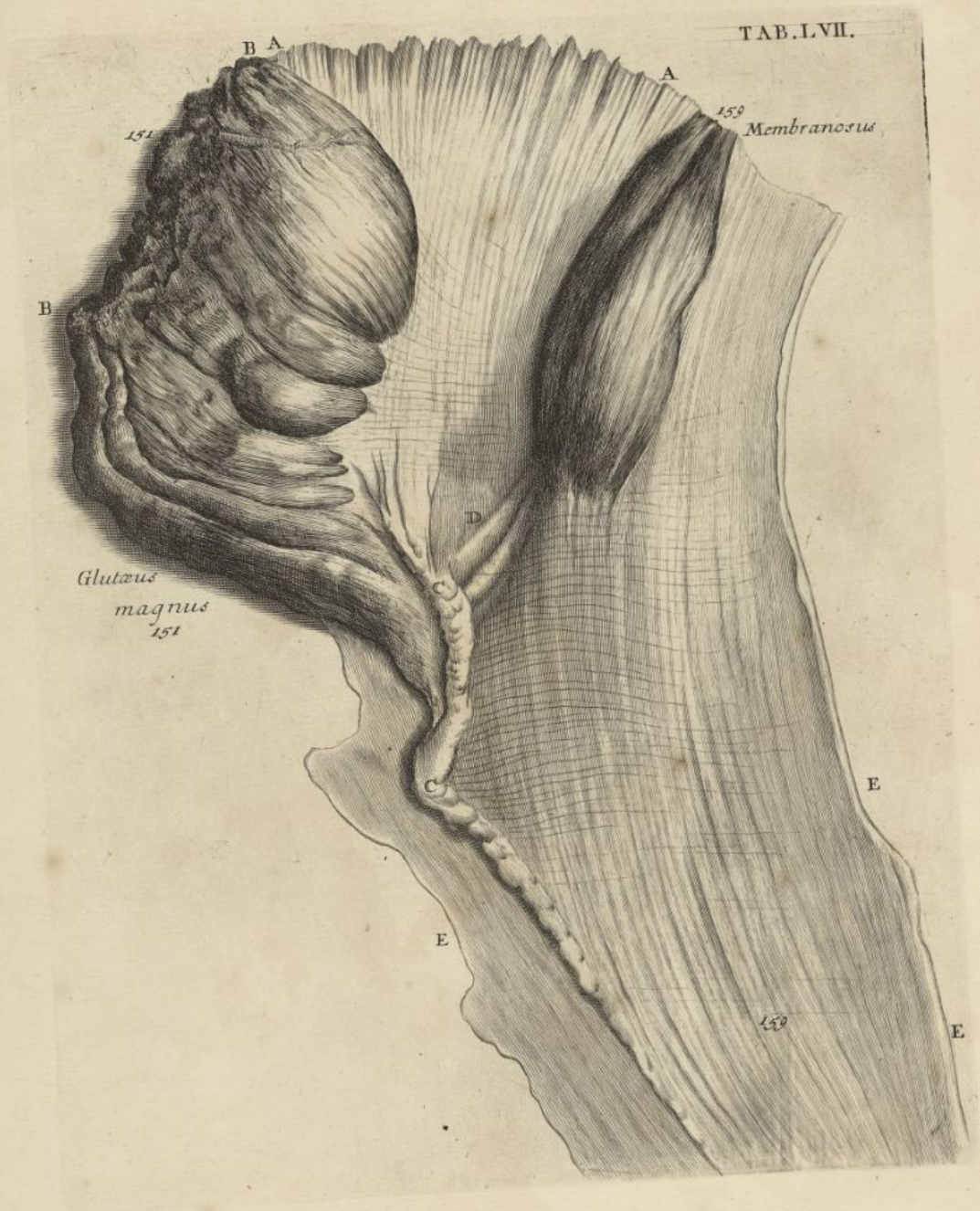CC   The great tendinous Termination of this Mufcle, cut from the *Linea Afpera* of the *Os Femoris.*

D   The other broad Tendon of this Mufcle, which is united with the Tendon of the *Membranofus.*
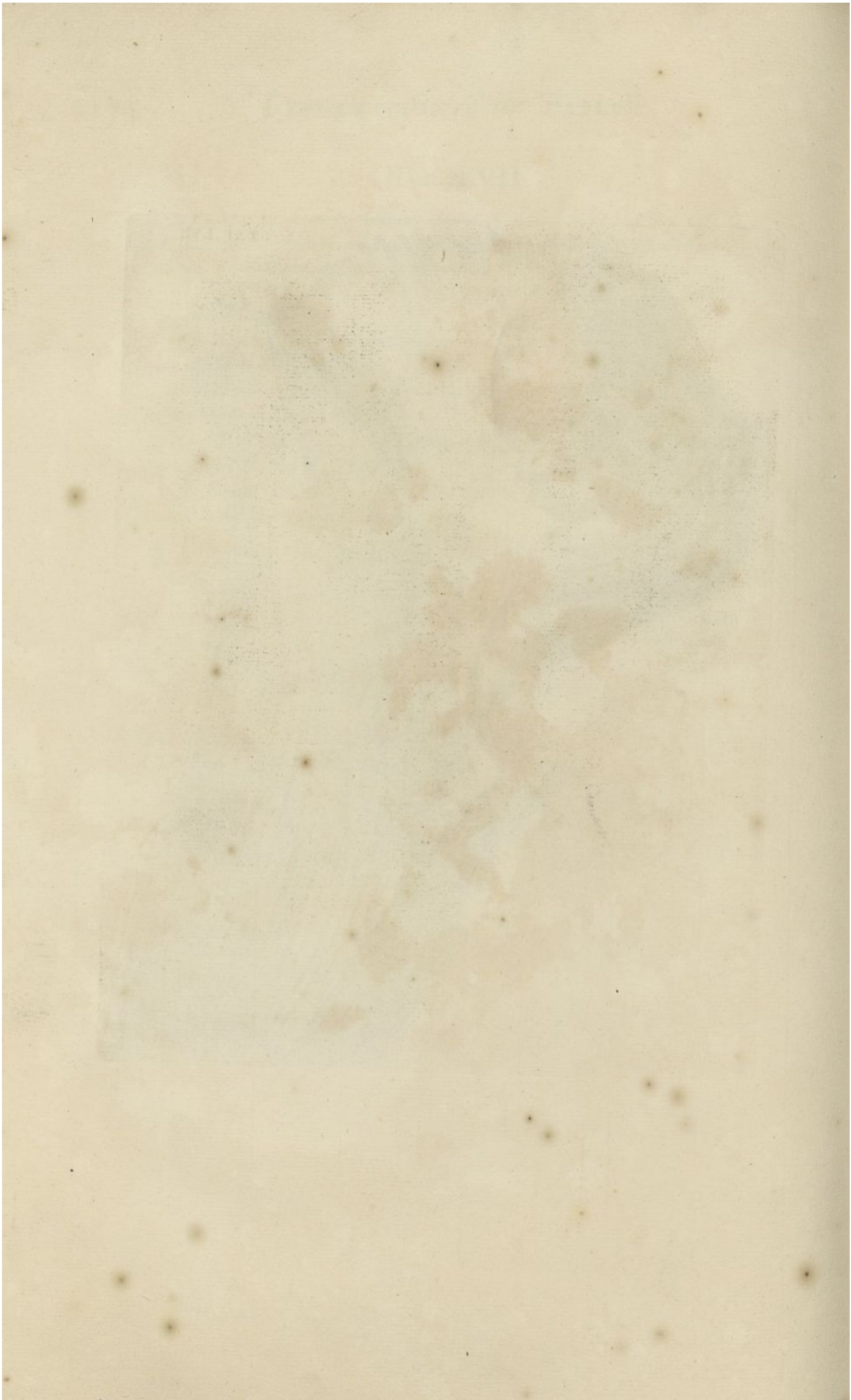
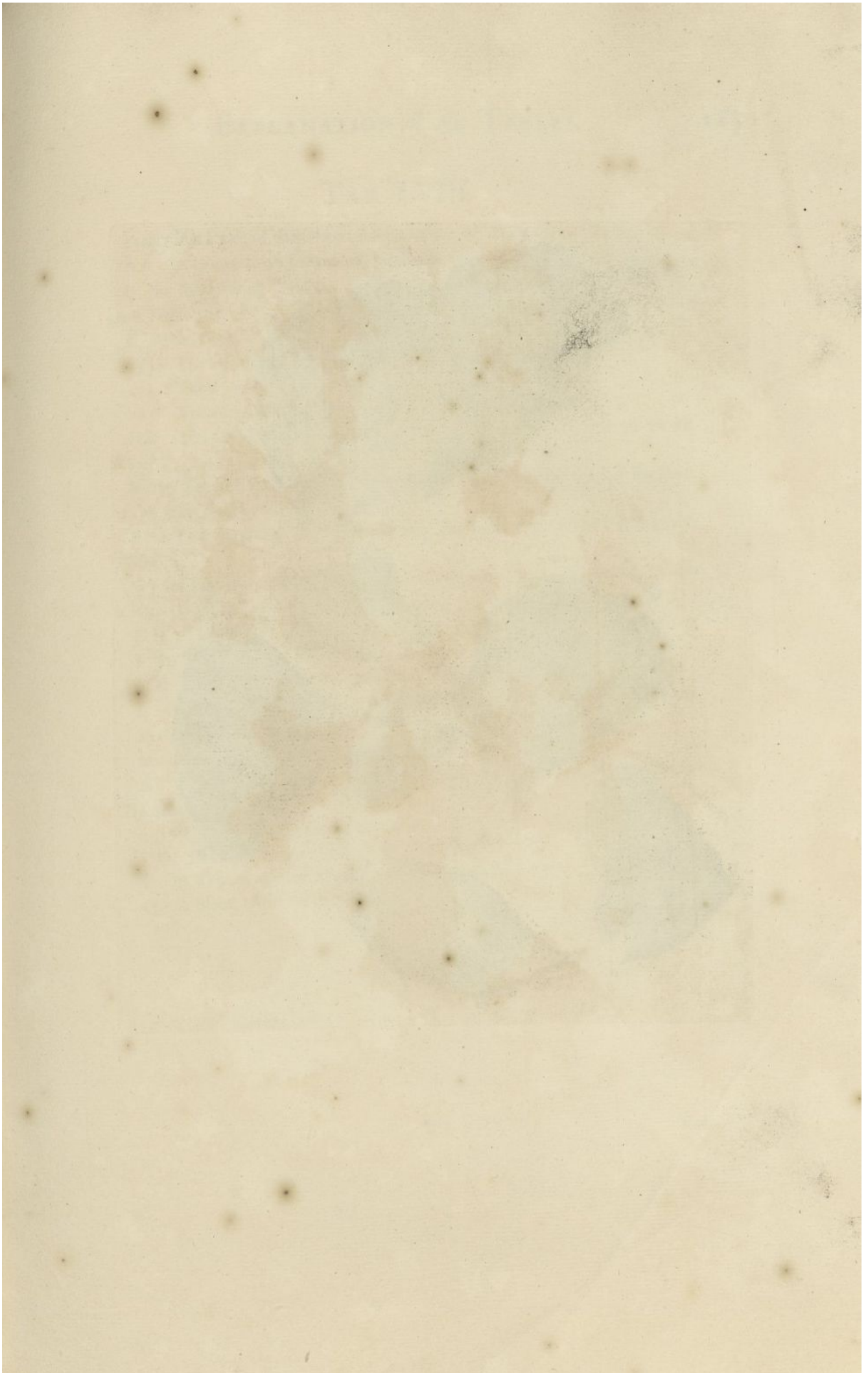159   The *Membranofus*, cut from its flefhy Origine at the fore part of the Spine of the *Os Ilium.*

EE   Part of its membranous Expanfion, together with that of the *Glutæus*, freed from the Mufcles of the Thigh.
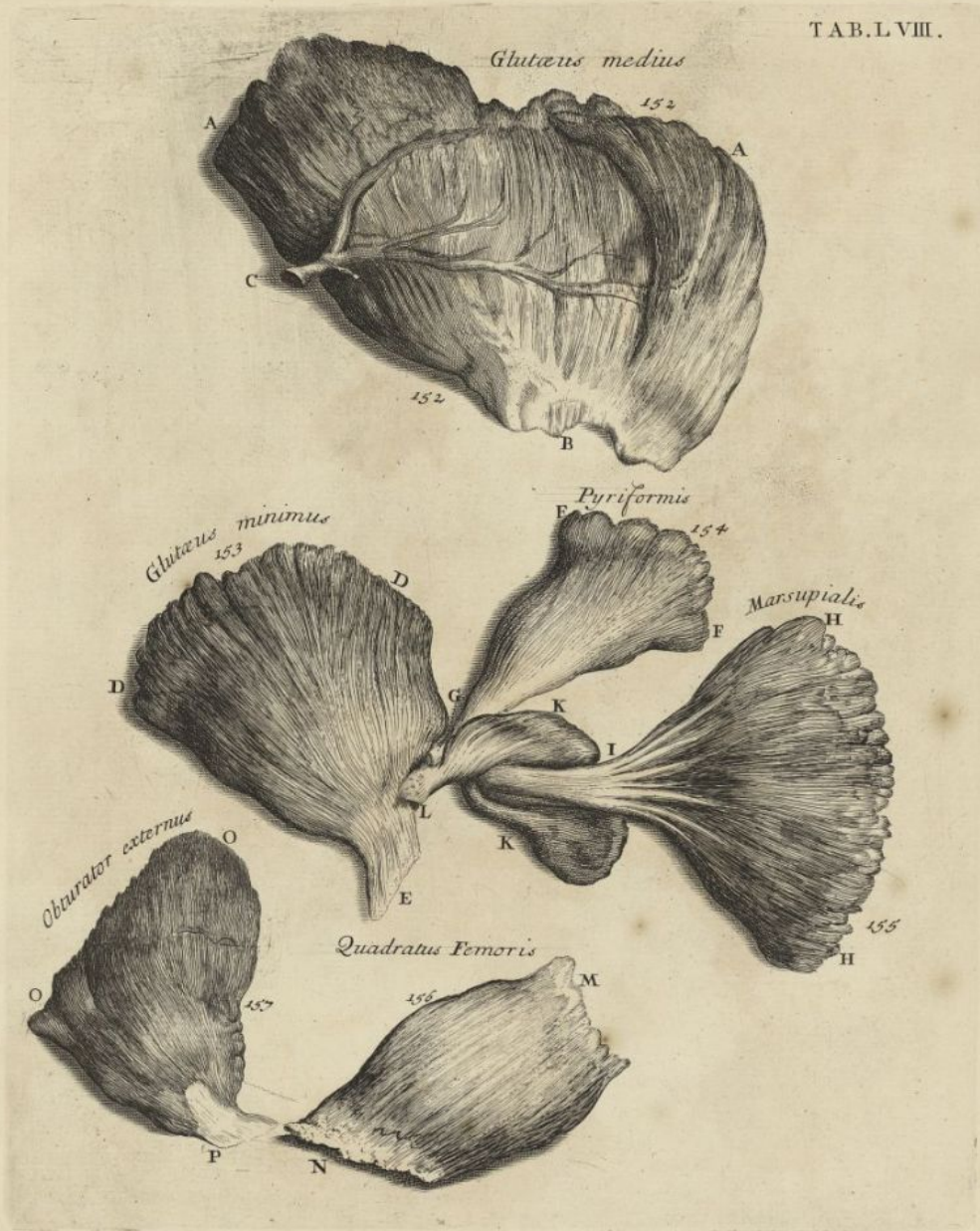
TAB.

TAB. LVIII.

Glutæus medius

152

A

A

C

152

152

B

Glutæus minimus

153

D

D

Pyriformis

F

154

F

Marsupialis

H

G

K

I

K

L

E

H

155

Obturator externus

O

O

157

P

Quadratus Femoris

156

M

N

TAB. LVIII.

152 The Inside of the *Glutæus Medius* of the left Thigh.

A A Its Original, cut from the Spine of the *Os Ilium.*

B Its short strong Tendon, cut from the superiour and external part of the great *Trochanter.*

C The Trunk of an Artery with its Branches fill'd with Wax.

153 The external Surfaces of the *Glutæus Minimus,* and

154 The *Pyriformis,* with

155 The *Marsupialis,* together with its *Marsupium,* of the left Thigh.

D D The Origination of the *Glutæus Minimus* from the back part of the *Os Ilium.*

E Its Tendon, freed from its Implantation into the superiour part of the Root of the great *Trochanter.*

F F The Origine of the *Pyriformis* from the *Os Sacrum,* in the *Pelvis* of the *Abdomen.*

G Its Tendon, cut from its Insertion into the Root of the *Trochanter ;* where it is joyn'd to the Tendon of the *Marsupialis.*

H H The Origine of the *Marsupialis* from the *Os Ilium, Ischium* and *Pubis.*

I Its Tendons, that pass the *Sinus* of the *Ischium.*

K K Its *Marsupium* open'd, to shew the Progress of its Tendon.

L The Tendon of the *Marsupialis,* cut from the Root of the great *Trochanter.*

156 The *Quadratus Femoris.*

M Its Origine from the *Ischium.*

N Its Termination at the posteriour part of the *Os Femoris,* below the great *Trochanter.*

157 The external Surface of the *Obturator Externus.*

O O Its Origine from the *Os Ischium,* and *Pubis.*

P Its Tendon inserted at the Root of the great *Trochanter.*
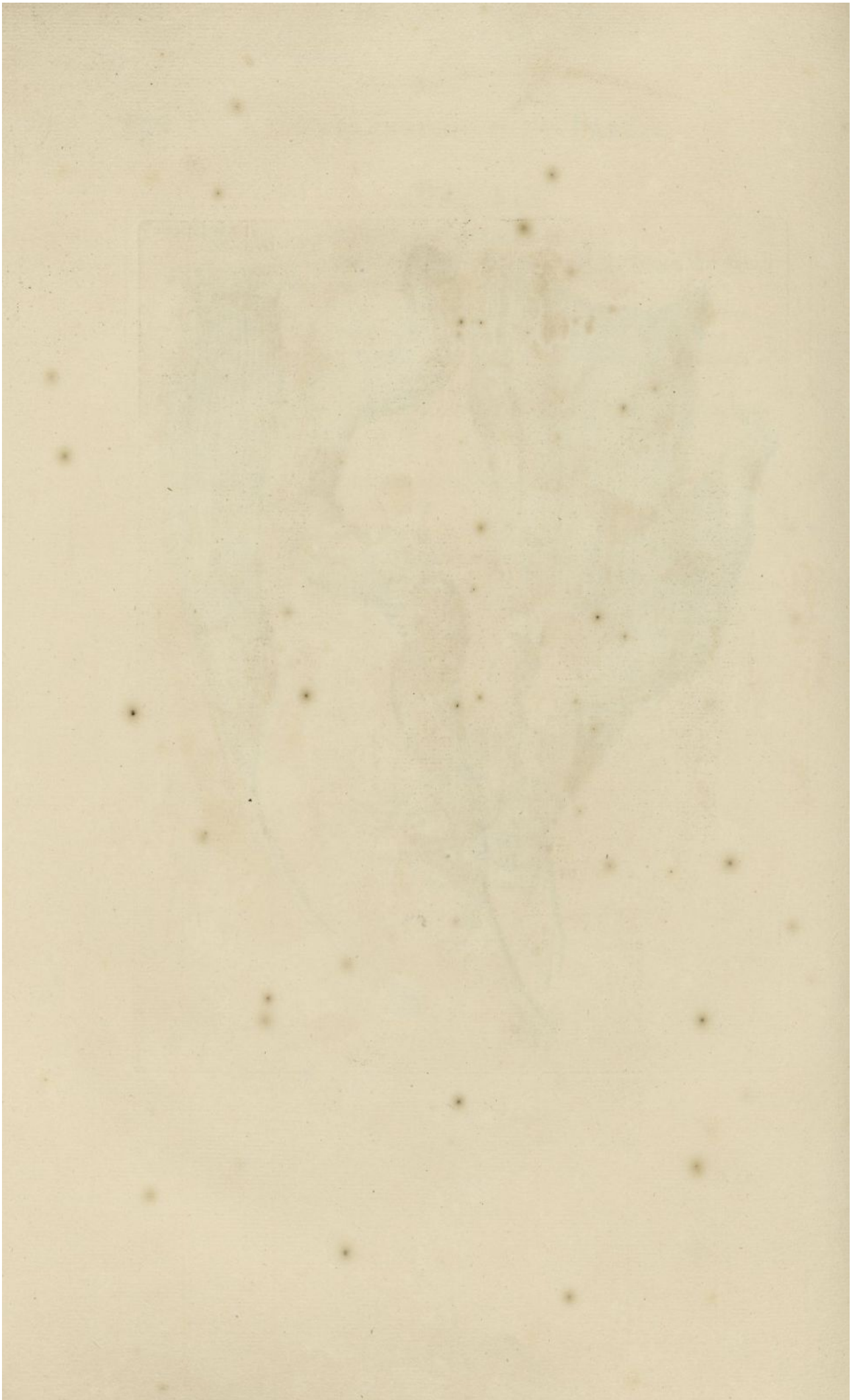
Q A Blood Vessel on its outside.
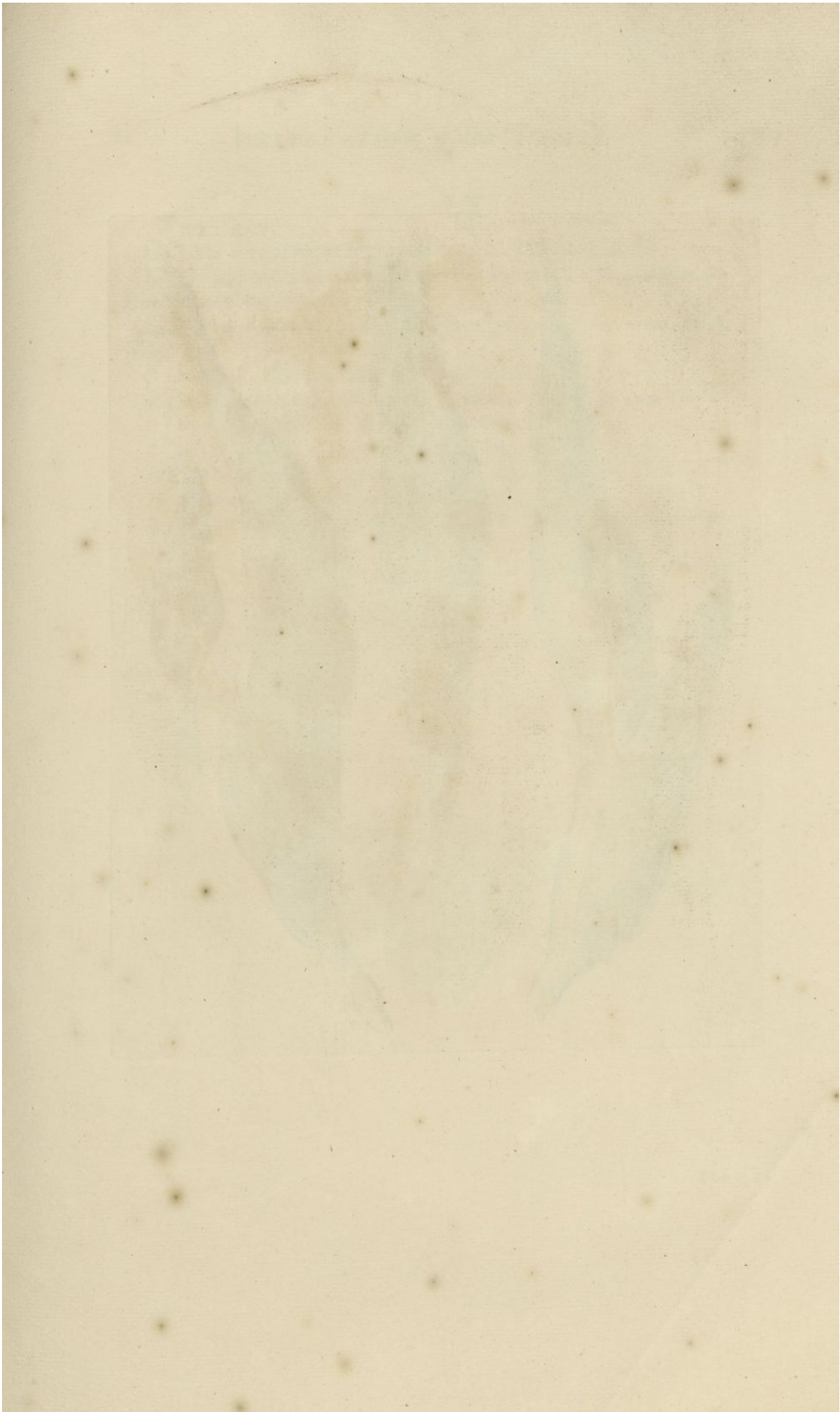
Bbb TAB.

TAB. LIX.

158   The Infide of the *Triceps* of the left Thigh.

A   The firft defcrib'd Head, and largeft beginning of the *Triceps*, that fprings from the *Os Ifchium* and *Pubis*.

B   The fecond Head, or tendinous beginning of it, cut from the *Os Pubis*.

C   The third beginning of the *Triceps*.

D   Its ftrong round Tendon, cut from the upper part of the lower *Appendix* of the Thigh Bone.

EE   The Tendon of the *Triceps*, freed from its Infertion into the *Linea Afpera* of the Thigh Bone.

160   The *Sartorius*.

F   Its Origine from the Spine of the *Os Ilium*.

G   Its Termination on the *Tibia*.

161   The Infide of the *Gracilis*.

HH   Its broad tendinous Origine from the *Os Pubis*.

I   Its Termination on the *Tibia*.

TAB.

TAB.LIX.
Gracilis

Triceps
158

Sartorius

Biceps femoris

Semi-
nervosus s.
Semi-
tendinosus

TAB. LX.

Semimembra-

-nosus

Popliteus

TAB. LX.

162   The external Surface of the *Biceps* of the left Thigh.

A   The superiour Head of this Muscle, which is a round Tendon, cut from the Protuberance of the *Os Ischium*.

B   The lower Head of the *Biceps*, cut from the *Linea Aspera* of the Thigh Bone.

C   Its Tendon, ending on the superiour *Epiphysis* of the *Fibula*.

163   The outside of the *Seminervosus*, or *Semitendinosus*, of the same Thigh.

D   Its tendinous and fleshy Origine from the *Ischium*.

E   Its Tendon, in this Subject divided, at its Insertion into the *Tibia*.

164   The outside of the *Semimembranosus* of the right Thigh.

F   Its flat tendinous Origine cut from the *Ischium*.

G   An Impression, made in this Muscle, by the Tendon of the *Seminervosus* passing over it.

H   Its Tendon, cut from its Termination on the superiour part of the upper *Appendix* of the *Tibia*.

165   The inside of the *Popliteus*.

I   Its tendinous Origine, from the external Head of the inferiour *Appendix* of the *Os Femoris*.

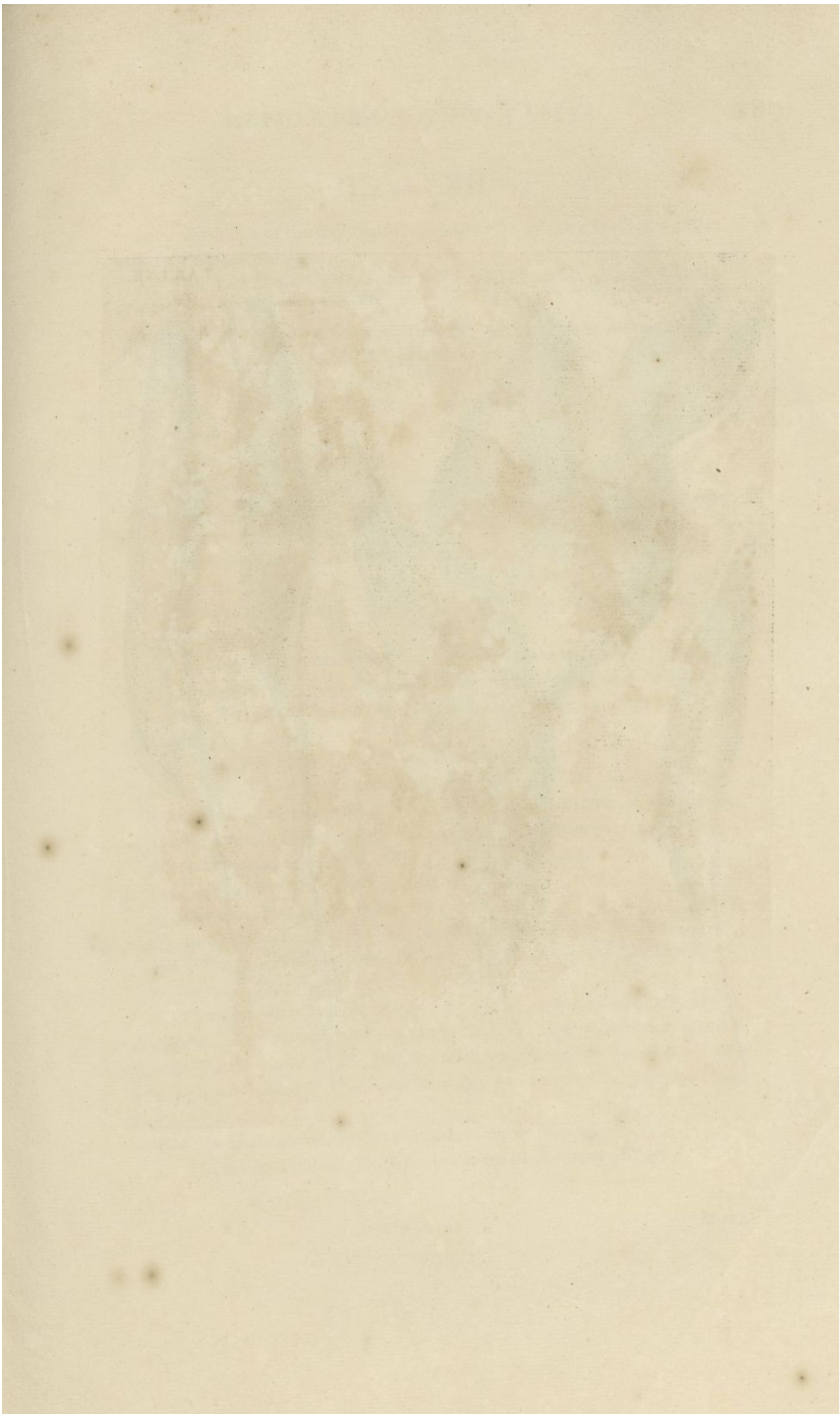K   Its fleshy Termination, cut from the *Tibia*.

TAB.

TAB. LXI.

166   The internal Surface of the *Rectus Femoris*.

A   That part of its Origine, that springs from the Margin of the *Acetabulum*.

B   The other part of its Origine, from a Tubercle under the Spine of the *Os Ilium*.

167   The internal Surface of the *Vastus Externus*.

168   The internal Surface of the *Vastus Internus*.

169   ——————————————*Crureus*.

C   The Branches of an Artery, on the internal Surface of the *Crureus*, next the *Os Femoris*.

D   A Transverse Order of Fibres, between the two *Vasti* on the *Crureus*.

E   The Tendon of the *Crureus*, joyn'd with those of the two *Vasti*.

FG   The mucilaginous Glands on these Tendons, above and below the *Patella*.

H   The internal Surface of the *Patella*.

I   The Termination of all these extending Muscles of the Leg, cut from the *Tibia*.

170   The internal Surface of the *Tibialis Anticus*.

K   Its upper fleshy Part, cut from the *Tibia*.

L   Its Tendon, or lower Part, cut from the *Os Cuneiforme Majus*, and *Os Metatarsi* of the great Toe.

TAB.

TAB.LXI.

A   B
Rectus   Femoris
166

Crureus
165

K
Tibialis anticus

Vastus externus

167

E
F

H

G

I

168

Vastus internus

170

L

TAB.LXII.

Gasterocnemius 171

Peroneus primus M

Tibialis posticus

E A B R

Plantaris 172

C

K 173

D

Peroneus Secundus 175

D

P

D

F

Soleus 173

174

176

175

S

F

T

L

N V

G

Q

I X

H 172 O

TAB. LXII.

171   The Infide of the *Gafterocnemius*, or *Gemellus*, of the right Leg, together with the *Plantaris* and *Soleus*.

A   That Part of the *Gafterocnemius*, which arifes from the external Tubercle of the Thigh Bone.

B   Its other Beginning from the internal Tubercle of the fame Bone.

C   Some Trunks of Arteries fill'd with Wax, paffing into this Mufcle.

DD   The internal tendinous Surface of this Mufcle, next the external Tendon of the *Soleus*, by which thefe Mufcles are render'd more apt to flide on each other, when they act.

172   The *Plantaris*.

E   Its Original from the external Tubercle of the *Os Femoris*.

FF   Its long flat Tendon, refembling a narrow Satin Riban, paffing between the *Gafterocnemius* and *Soleus*.

G   Its tendinous Expanfion, freed from the bottom of the Foot.

H   The tendinous Expanfion, that fprings from the *Os Calcis*.

I   That part of it, that terminated in the lower Parts of the *Offa Metatarfi*, and the firft Bones of the Toes.

173   The internal Surface of the *Soleus*, or *Gafterocnemius Internus*.

K   Its tendinous and flefhy Origine from the upper *Appendix* of the *Fibula*.

L   The Tendons of this and the *Gafterocnemius Externus*, at their united In-fertion into the *Os Calcis*.

174   The infide of the *Peronæus Primus* of the right Leg.

M   Its flefhy Fibres, cut from their Original at the fuperiour part of the *Fibula*.

N   A fmall cartilaginous Body in the bending of the Tendon of this Mufcle, as it paffes on the *Os Cuboides*, from whence it runs to the bottom of the Foot.

O   Its Termination on the *Os Metatarfi* of the great Toe.

175   The outfide of the *Peronæus Secundus*.

P   The upper Part, which fprings from the *Fibula*.

Q   Its tendinous Ending, cut from the *Os Metatarfi* of the little Toe.

176   The outfide of the *Tibialis Pofticus*, of the fame Leg with the former.

R   Its upper Part, that fprings from the *Fibula*.

S   That Part of its Tendon, which in old Bodies grows hard and bony, but in this Subject, who was young, did not appear fo. This flips up and down, not un-like the *Patella* placed in the Tendons of the extending Mufcles of the *Tibia*, whereby thefe Tendons are defended from any Attrition on the Bones they pafs over.
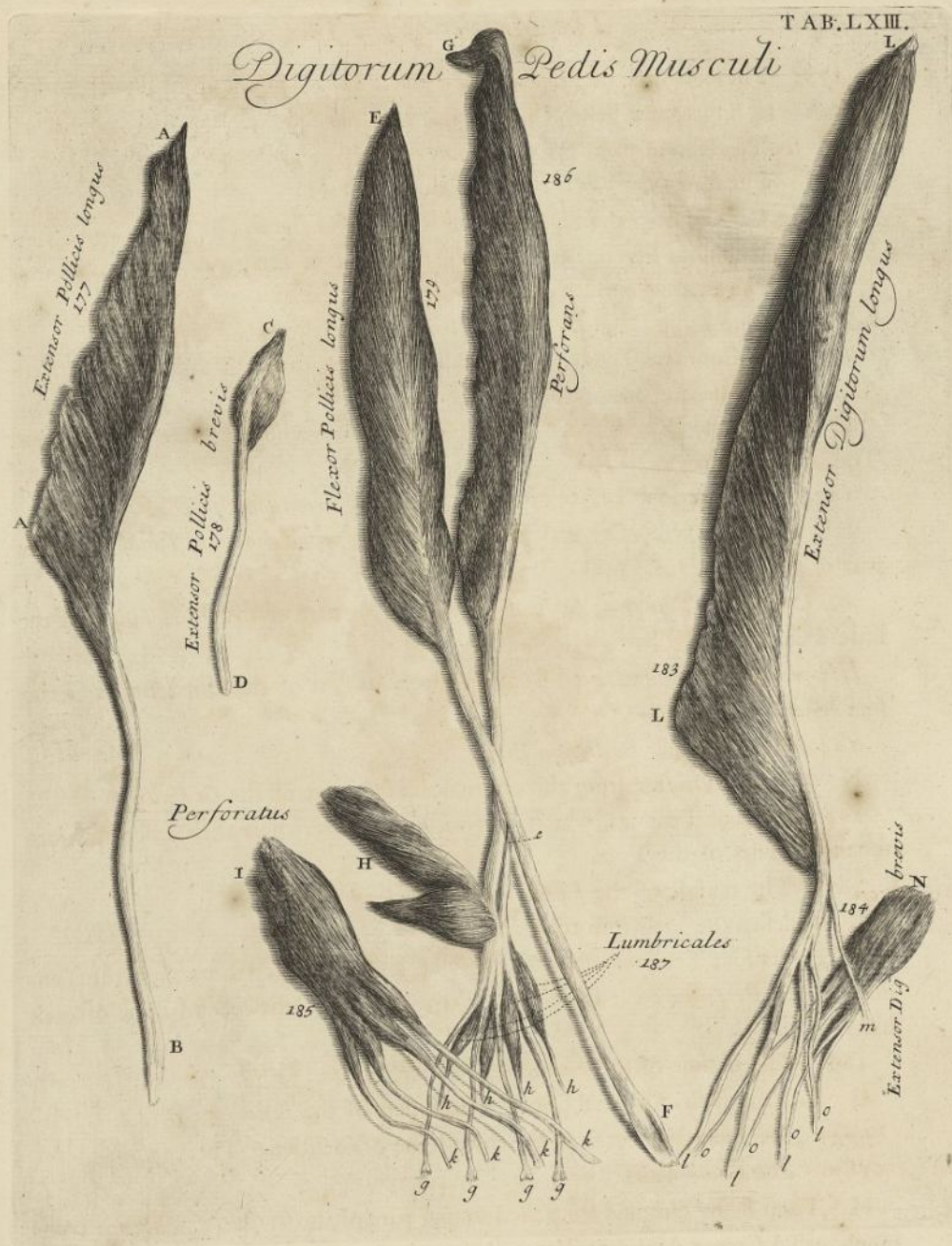
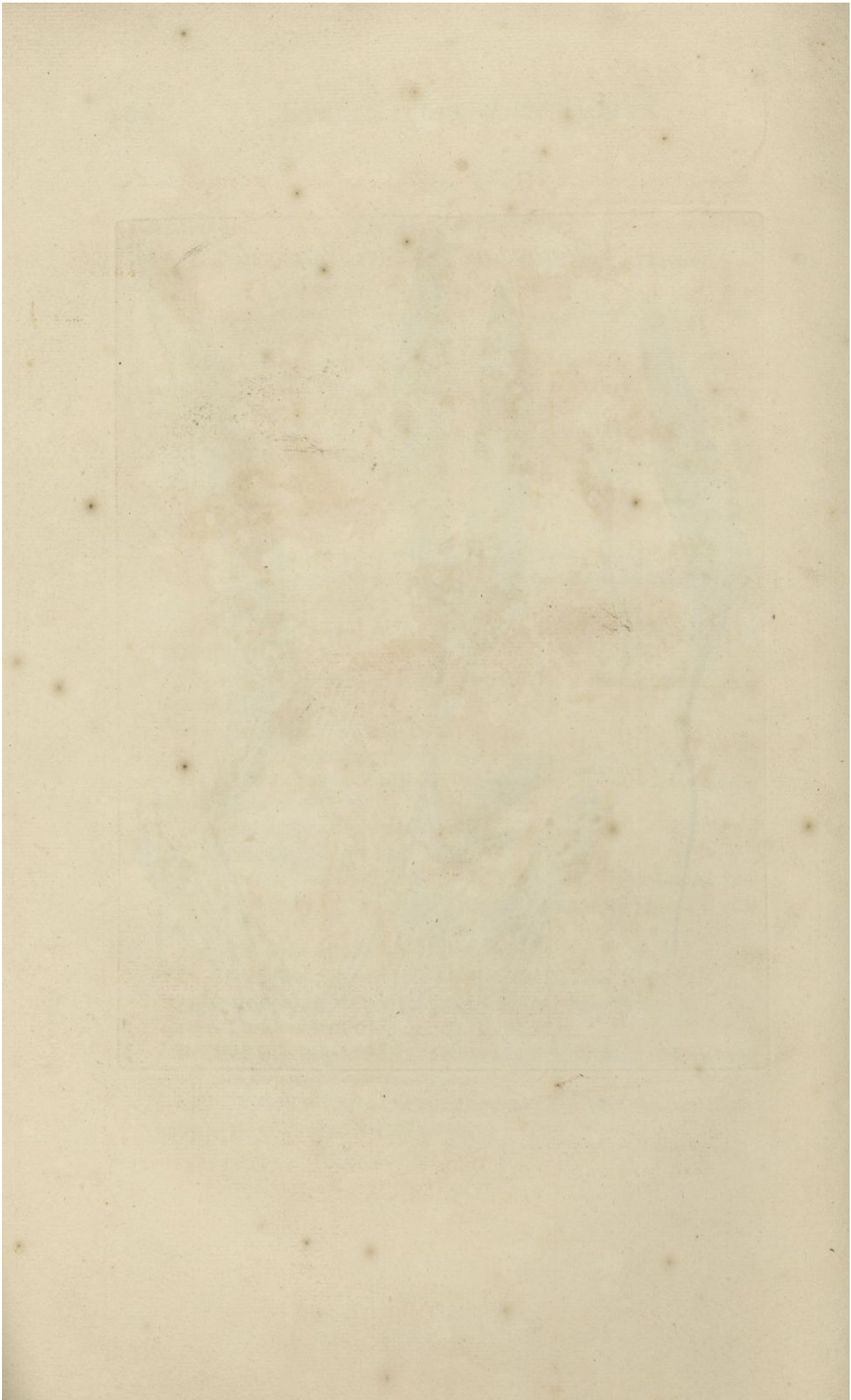T V   Its tendinous Fibres, that terminate in the *Os Naviculare*.

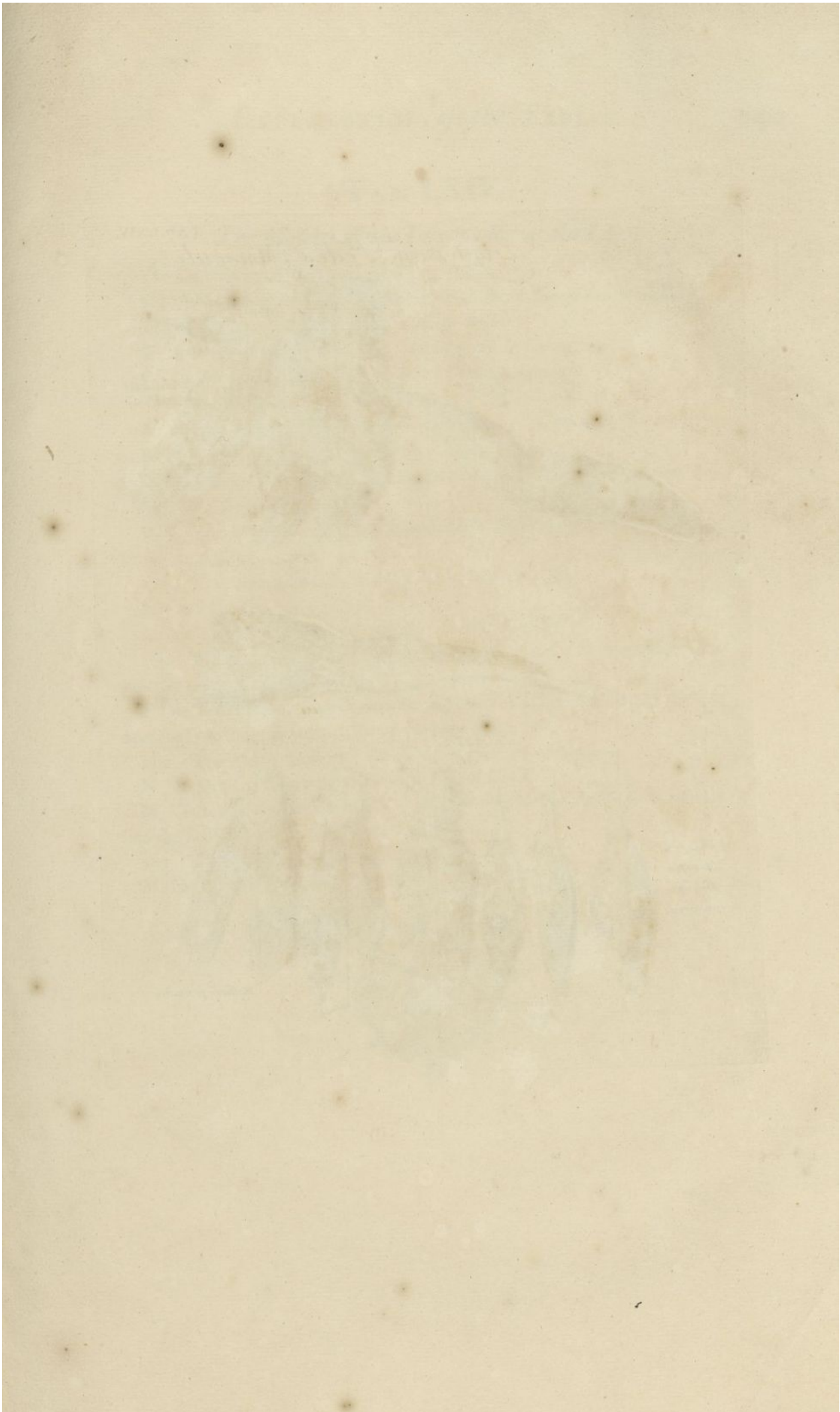X   The ftrong Tendon, that terminates in the *Os Cuneiforme Majus*.

C c c

TAB.

TAB. LXIII.

The Muscles of the Toes.

177   The underside of the *Extensor Pollicis Longus* of the right Foot.

A A   Its disgregated fleshy Original from the *Fibula.*

B   Its Tendon cut from the upper part of the second Bone of the great Toe.

178   The *Extensor Pollicis Brevis* of the same Foot.

C   Its Origine from the superiour and fore part of the *Os Calcis.*

D   Its tendinous Ending, cut from the first Bone of the great Toe.

179   The external Surface of the *Flexor Pollicis Longus.*

E   Its acute fleshy Original from the back part of the *Fibula.*

e   A Slip from the Tendon of this Muscle, going to the Tendons of the *Perforans,* as it passes the bottom of the Foot.

F   The broad Extremity of its Tendon, cut from the last Bone of the great Toe.

183   The exteriour Surface of the *Extensor Digitorum Longus.*

L L   Its long fleshy Original from the upper *Appendix* of the *Tibia,* and fore part of the *Fibula.*

m   One of its Tendons, cut from the superiour part of the *Os Metatarsi* of the little Toe.

llll   Its four Tendons freed from the superiour Part of the third Bones of the four lesser Toes.

184   The *Extensor Digitorum Brevis.*

N   Its fleshy Origine from the external and fore part of the *Os Calcis.*

oooo   Its four Tendons, which join with the former, near their Insertions into the third Bones of the Toes.

185   The outside of the *Flexor Digitorum Perforatus.*

I   Its fleshy Original from the *Os Calcis.*

kkkk   Its four Tendons, (after being split, or perforated, to transmit the Tendons of the *Perforans*) cut from their Terminations on the second Bone of each lesser o e.

186   The outside of the *Flexor Digitorum Perforans.*

G   Its acute fleshy Original from the back part of the *Tibia.*

gggg   Its Tendons, cut from the third Bone of each lesser Toe.

187   The *Lumbricales.*

H   Their fleshy Original from the internal part of the *Os Calcis.* This is commonly call'd *Carnea Massa in Planta Pedis.*

hhhh   Their four Tendons, springing from their four fleshy Parts, and terminating on the inside of the four lesser Toes.
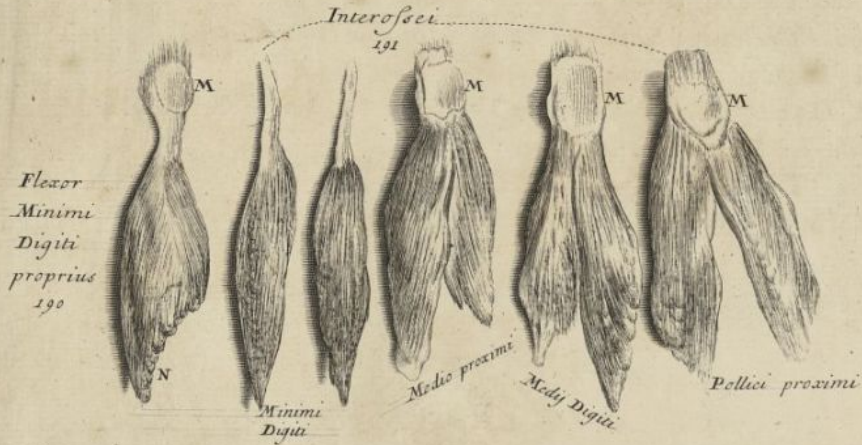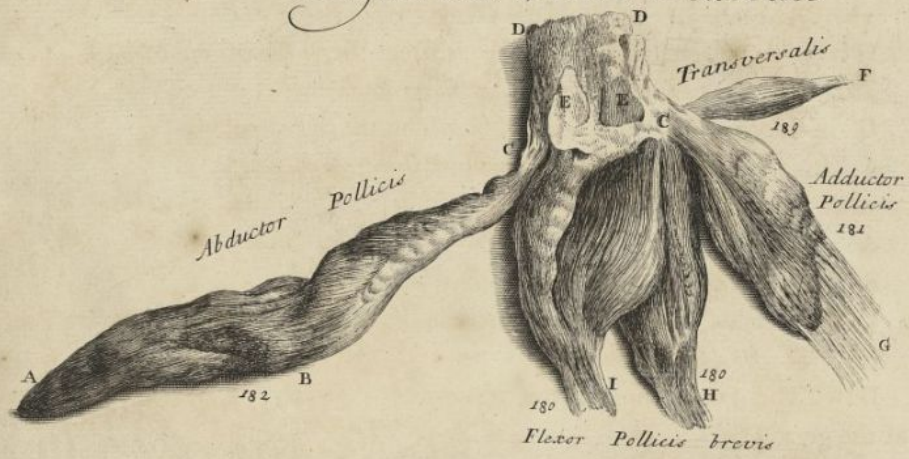
TAB.

Digitorum Pedis Musculi

Extensor Pollicis longus 177

Extensor Pollicis brevis 178

Flexor Pollicis longus 179

Perforans

186

Extensor Digitorum longus

183

L

Perforatus

185

Lumbricales 187

184

brevis

Extensor Dig.

TAB. LXIV.

Digitorum Pedis Musculi

Transversalis

F

Abductor   Pollicis

Adductor
Pollicis
181

D   D

E   E   C

C

A   B
182   180   I   180

180
H
G

Flexor   Pollicis   brevis

188

K

L

Abductor Minimi Digiti

Interossei
191

M   M   M   M

Flexor
Minimi
Digiti
proprius
190

N

Minimi
Digiti

Medio proximi

Medij Digiti

Pollici proximi

TAB. LXIV.

The Muscles of the Toes, as big as the Life.

180   The internal Surface of the *Flexor Pollicis Brevis.*

H I   Its two Beginnings in this Subject, from the *Os Cuneiforme Medium.*

181   The internal Surface of the *Adductor Pollicis.*

G   Its broad tendinous Beginning, cut from the *Os Calcis.*

C   Its Tendon inserted into the internal *Os Sesamoideum,* E.

182   The *Abductor Pollicis.*

A   Its first described fleshy Beginning from the *Os Calcis.*

B   The second, from the *Os Cuneiforme Majus.*

C   Its Tendon, inserted into the external side of the first Bone of the great Toe.

EE   The *Ossa Sesamoidea.*

DD   The Terminations of the last mention'd Muscles, cut from the first Bone of the great Toe.

188   The external Surface of the *Abductor Minimi Digiti.*

K   Its fleshy Original from the *Os Calcis.*

L   Its Tendon, cut from the first Bone of the little Toe.

189   The *Transversalis Pedis,* left at its Original from the *Os Sesamoides* of the great Toe.

F   Its Termination, cut from the Cartilage of the first Articulation of the Toe next the little Toe, as well as that of the little Toe it self.

190   The internal Surface of the *Flexor Minimi Digiti Proprius.*

N   Its Original from the *Os Metatarsi Minimi Digiti.*

M   Two *Ossa Sesamoidea* in the Tendon of this Muscle, before it is inserted into the first Bone of the little Toe.

191   The eight *Musculi Interossei.*

MMM   The *Ossa Sesamoidea* in their Tendons.

TAB.

TAB. LXV.

*For the better explaining the Muscles on the Bottoms of the Feet,
they are reprefented in the two following Tables, as they ap-
pear'd in the Diffection of the right Foot.*

FIG. I. II.

*The firft fhews the Appearance of the Bottom of the Foot, after the Skin and Fat is
removed.*

*The fecond reprefents the external Tendons and Mufcles diffected and difplay'd, to fhew
thofe under them in their natural Situation.*

A A   The *Os Calcis.*

B B   Part of the *Malleolus Internus.*

C   Fig. I. Part of the *Malleolus Externus.*

D D   The fuperiour and external part of the *Os Metatarfi Minimi Digiti.*

E E   One of the *Offa Sefamoidea* of the great Toe.

F F   Fig. I. A tranfverfe Ligament, which tyes the firft Internodes of all the
little Toes together.

G G G   Fig. II. The Chanels, which are invefted with Ligaments, that enclofe
the Tendons employ'd in bending the Toes.

172   The Tendon of the *Plantaris* as it appears on the bottom of the Foot,
in its natural Situation, Fig. I.

The fame raifed and left to the *Os Calcis*, Fig. II.

I   Its Original from the *Os Calcis.*

I I I   Its Termination freed from the firft Internodes of the leffer Toes.

180   *Flexor Pollicis Brevis*, Fig. II.

182   The *Abductor Pollicis in Situ*, Fig. I.

Rais'd from its Origine, Fig II.

3   That part of the *Abductor Pollicis*, that arifes from the *Os Cuneiforme Majus.*

13 Fig. II.   *V.* Tab. 66. *

188   The *Abductor Minimi Digiti in Situ*, Fig. I.

Left at its Termination, Fig. II.

187   Fig. II. The *Carnea Maffa in Planta Pedis*, which I take to be the true
Original of the *Lumbricales.*

10 10 10   The *Mufculi Lumbricales*, commonly fo called.

4   The Tendon of the *Flexor Pollicis Pedis Longus*, lying under the Tendon
of the *Perforans.*

186   The Tendon of the *Perforans*, to which the *Carnea Maffa*, or *Mufculi
Lumbricales* adhere, foon after it croffes the *Flexor Pollicis Longus.*

185   The

TAB.LXV.

Fig:I

Fig:II
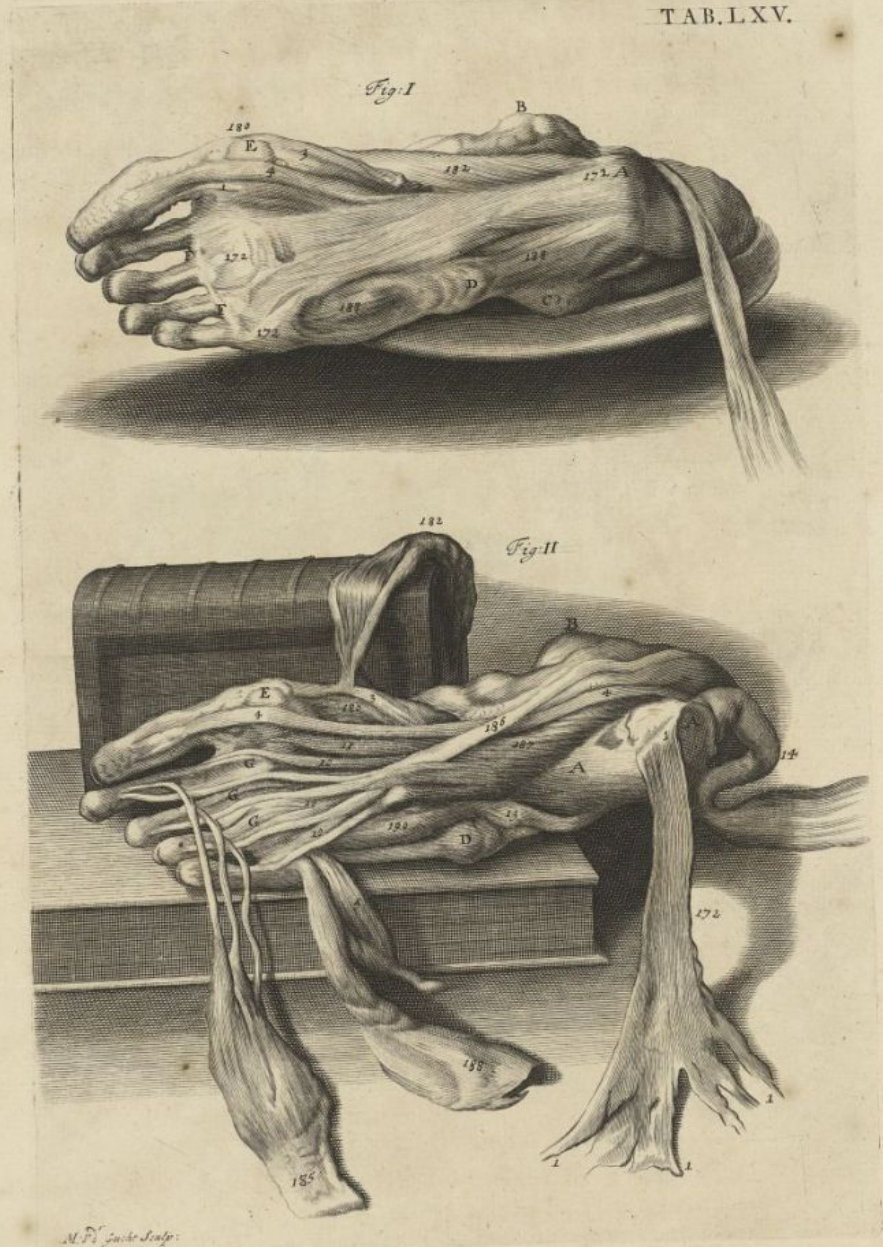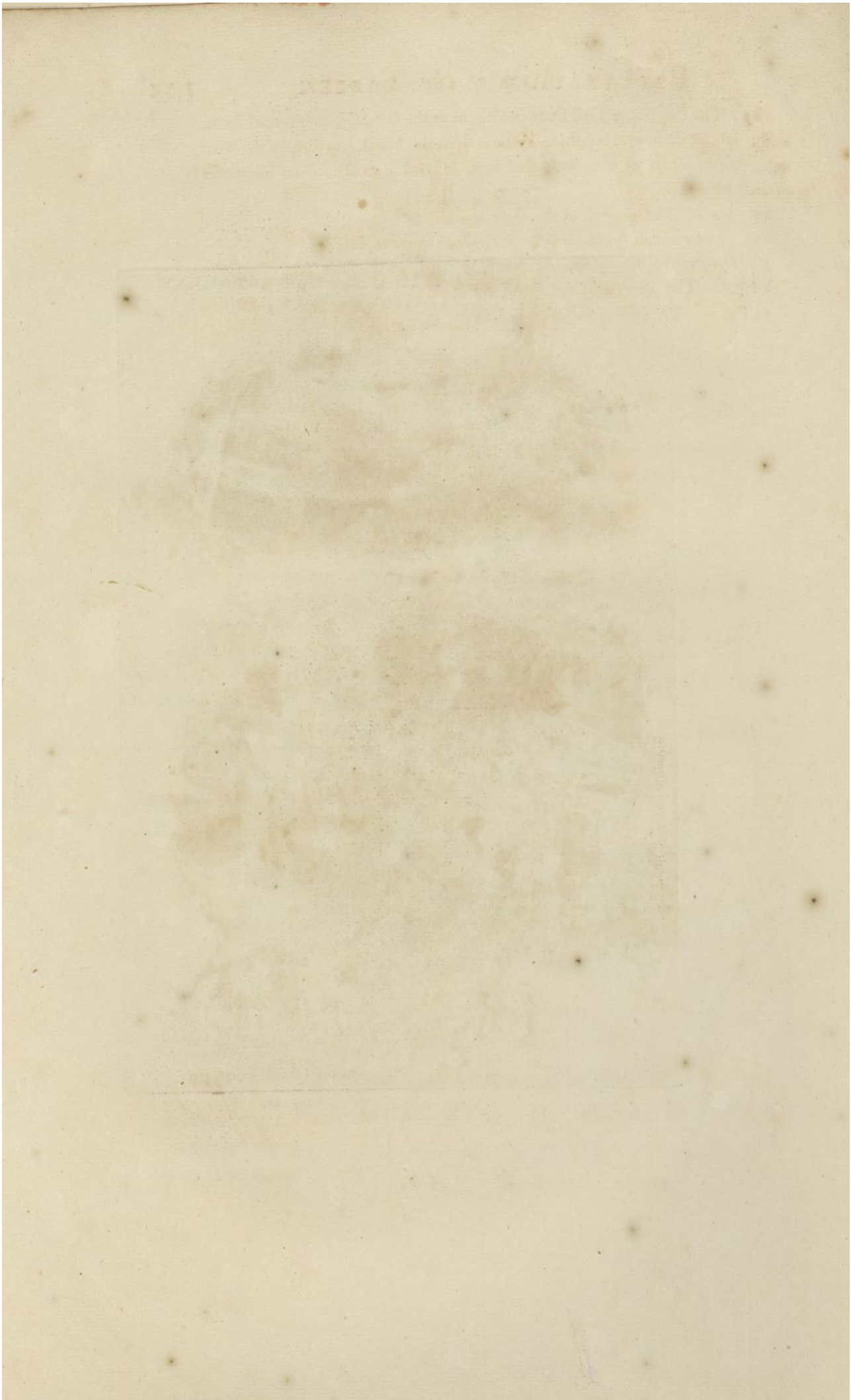
185   The *Perforatus* raifed from its Origine at the *Os Calcis*, and turned down. In this Subject there were but three Tendons from this Mufcle, to three of the Toes only; but in others we commonly find four, inferted in to the fecond Internodes of each leffer Toe.

14   Fig. II. The Tendon of the *Gafterocnemii, &c.*

190   *Flexor Primi Internodii Minimi Digiti Proprius in Situ.*

5   The external *Interoffeus*, improperly fo call'd, of the little Toe.

1 Fig. I.   The Tendon of the *Adductor Pollicis.*

11 Fig. II.   The *Adductor Pollicis in Situ.*

D d d   TAB.

TAB. LXVI.

FIG. I. II.

AA   The *Os Calcis*.

BB   The *Malleolus Internus*.

CC   A Prominence in the *Os Cubiforme*, cover'd wirh a Cartilage, that is receiv'd by a fmall moving Cartilage, placed in the Tendon of the *Peronæus Longus*. *174.

D   A Furrow or Chanel, in the *Os Calcis*, in which paffes the Tendon of the *Flexor Pollicis Longus*.

E   Another Chanel, party on the *Os Calcis*, and partly on the *Aftragalus*, for the Tendon of the *Flexor Digitorum Perforans*.

F   Fig. II. The *Os Metatarfi* of the great Toe.

G   *Ibid.* Its fmooth cartilaginous *Appendices*, on which the *Offa Sefamoidea*, h, h, placed in the Tendon of the *Flexor Pollicis Brevis*, move.

H   *Ibid.* The Surface of the *Os Cuneiforme Majus*, to which the *Os Metatarfi* of the great Toe is articulated.

i i i i   Ibid. The four *Offa Metatarfi* of the little Toes.

176.   *Ibid.* Part of the *Tibialis Pofticus*, next its Infertion into the *Os Cuneiforme Majus*.

174   *Ibid.* The Tendon of the *Peronæus Primus*, left at its Termination on the *Os Metatarfi* of the great Toe, F.

180   *Ibid.* The *Flexor Pollicis Brevis*.

181   *Ibid.* The *Adductor Pollicis*.

191   The *Interoffei*.

10 10 10 Fig. 1. The *Adductor Pollicis*.

8 Fig. 1. The Tendon of the *Tibialis Anticus*, at its Termination.

2   *Ibid.* The *Os Cuneiforme Majus*.

9   *Ibid.* A rifing of the *Os Calcis*, next the *Aftragalus*.

5, 6   *Ibid.* The internal Surface of the *Lumbricales*, and that part of them call'd *Carnea Maffa*, united with the Tendons of the *Perforans* in the *Planta Pedis*.

179   *Ibid.* The *Flexor Pollicis Longus*.

✛   Its tendinous Slip to the *Perforans*.

186   The *Perforans*.

8 F. II. The Tendon of the *Peronæus Secundus*.

F I N I S

TAB. LXVI.

Fig: II.

Fig: I.