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Physiology in Europe and the birth of European Neuroscience

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The talk of Claude Debru has dealt with the development of French post-war Neuroscience in a European context. I will present as an illustration the birth of a French CNRS Institute in 1949, directed by Alfred Fessard and located in the former building of the Marey Institute. Fessard's research laboratory was devoted to the physiology of the Nervous System based on electrophysiological studies and was the leading research centre on the topic in France during the 40s until the end of the 60s. The rapid growth of the Institute after war was due to close contacts between Fessard and other leading laboratories in Europe. Neurophysiology had already developed as a European discipline during the first half of the century. In my talk, I will first trace the emergence of European physiology up to this period focussing on the role of societies, congresses, journals and laboratory exchanges. Then, I will examine the birth and development of Alfred Fessard's Institute in a European context.

The first International Congress of Physiology was held in Basel in 1889 and the details of its history have been gathered by Professor Franklin at Oxford in the 1930s. The congress was due to the wishes of the young British Physiological Society created in 1876 in reaction to anti-vivisectionist agitation. This society felt, with most European physiologists, that the International Congresses of Medicine founded in 1867 were not suited to discuss experimental physiology which required more simplicity, the use of fewer languages to encourage discussions and most of all experimental demonstrations of techniques and experiments. The second International Congress of Physiology took place in Belgium (Liège) and the organising committee consisted of the French physiologist Albert Dastre, three Belgian physiologists Fredericq, Heger and Kronecker and the British physiologist Sherrington.

Belgium was therefore from the start a key country in the development of European physiology, forming a link between the British Physiological Society, France and Germany. Kronecker wrote on behalf of the most eminent British physiologists to 109 physiologists in Europe to suggest International Physiological Meetings. At a meeting in Kronecker's house it was decided that the first congress would take place in Basel. Belgian physiology was flourishing in Belgium due to a favourable scientific policy from the ministry of Hubert Frère-Orban. Belgium fearing the strong political influence of its bishops supported secularity and the creation of the first ministry of public education by Frère-Orban. The laboratory of Léon Fredericq was built at Liège at a very impressive cost. Fredericq was the successor of Theodore Schwan and had worked with Paul Bert, a student of Claude Bernard. His Institute soon became a leading centre for Physiology in Europe.

In 1904, the sixth International Congress of Physiology returned to Belgium, after Switzerland, Great Britain and Italy. More than a third of the attending members were Belgian. Léon Fredericq and Paul Heger decided to create the first journal in French entirely devoted to normal physiology: Les Archives Internationales de Physiologie. The journal was edited with the collaboration of 8 physiologists from Belgium, 7 from France, 4 from Switzerland, 4 from Holland, 9 from Eastern countries, 1 from Italy, 1 from Germany and 1 from Great Britain. Most articles were from Belgium scientists. However, French made significant contributions among which Richet from Paris, Hédon from Montpellier, Russo from Lyon, Wertheimer from Lille, and Terroine from Strasbourg. The contribution of Italians was also important, while others from Poland, Czechoslovakia, Switzerland, Austria, Sweden, Spain and Holland also participated. The Proceedings of the International Congresses of Physiology were edited in the Archives founded by Fredericq and Heger. Therefore the role of Belgium in public affairs among French speaking physiologists was central during the first decades of the XIXth century.

In the 1920s, the old French Société de Biologie founded in 1848 gradually became the leading francophone organisation for Biology. Honorary members included in 1920 Albert I of Monaco, Ramon y Cajal (Madrid), Camillo Golgi (Pavia), Paul Heger (Brussels), Jacques Loeb (New-York), Pavlov (Petrograd), Edouard Schafer (Edimbourg), Emile Roux (Paris), Augustus Waller (London). While, les Archives Internationales de Physiologie published papers mostly from Belgium physiologists, the Proceedings of the Société de Biologie gathered papers from Societies in Brazil, Spain, Denmark, Hungary, Holland, Portugal, Czechoslovakia, Poland and Algeria. New French Speaking Societies and journals flourished world wide. Papers written and published in French were read at annual Meetings of Biological Societies from major French cities, Belgium, Buenos Ayres, Lisbon, Barcelona, and Copenhagen. The number of contributing societies increased until the second world war.

With this expansion of physiological sciences, a new journal, les Annales de physiologie et de physico-chimie biologique, was founded in 1925 in Paris. The journal, was the first French publication devoted exclusively to normal physiology, and was created in part as a reaction against the medical orientation of French physiological journals. The following year, most French physiologists left the Société de Biologie and founded the Association des Physiologistes de langue française. The French Physiological Society was therefore founded 50 years after the British due to complex relations between physiology, anatomy and pathology. The society invited two scientists to write an extensive review in their field of research which generally had great success among members. The annual meeting of the Society was essential for both younger and elder scientists. Students and young investigators presented their work, while elder scientists enjoyed meeting to discuss advances in physiology. Meetings were occasionally organised in conjunction with the British Physiological Society.

Several other factors contributing to the construction of physiology as a European discipline might be noted briefly. Scientific academies and the journals they published played an important role. Physiology spread as a new scientific discipline both through the world wide francophone community, and emerged in the United States. European scientists developed contacts with American physiologists via international physiological meetings held in Boston (1929) and Washington (1968) as well as symposia held in the United States and Canada. The centre of gravity of physiological studies, and especially neurophysiology, gradually shifted towards North America after second world war.

We will now illustrate the evolution of factors contributing to the emergence of Physiology as an international science, by focussing on the Institut Marey whose complex history covers more than half of the XXth century. It was created in 1949 by the CNRS and loca-

ted in a cottage built by Etienne Jules Marey. The history of the building is an interesting episode. Marey was leading maker of physiological recording instruments. He developed new instruments such as chronophotography and improved others from the German school of physiology. During the 1898 International Physiological Congress in Cambridge, Marey suggested the creation of an International Commission for the control of graphical instruments of physiology. It was decided that Marey would preside the commission and that the newly built cottage which housed the commission's meetings would be named Institut Marey. The Institute was built near the Physiological Station which Marey had planned for studies on movement in the Parc des Princes, near le Bois de Boulogne (Paris). The Marey Institute was therefore a key element in the construction of European physiology, and fulfilled a crucial need for standardization of physiological instruments. After Marey's death in 1904, the Marey Institute progressively lost its international commitments. Every third year, the president of the International Association of the Institut Marey read a Report at each International Congress of Physiology. In 1907 the program of the Commission was defined as : "Since the creation of the Institut Marey, our commission has proposed to gather in our laboratory a panel of the most sophisticated instruments belonging to every branch of physiological techniques. This goal has just been reached and we are glad to communicate to the Congress that we have officially opened last May 18th in our Institute an international and permanent exhibition of physiological apparatus. Meanwhile, the Marey Institute is becoming an experimental museum as well as a technical research centre."

In 1949, when the CNRS decided to create a new Physiological laboratory dedicated to electrophysiology, the Marey Institute was nearly abandoned. However, between 1939 and 1946, with a short interruption due to the war, Alfred Fessard had had the opportunity to set up a small electrophysiological laboratory. Fessard was a student of Henri Piéron, professor at the Collège de France (chaire de physiologie des sensations), and had worked with Daniel Auger on elementary electrophysiology in the Lapicque school of neurophysiology at the Sorbonne. Fessard was helped by Henri Piéron, who had become the President of the Marey Institute after Louis Lapicque. At the time, Lapicque supervised all Parisian physiology and barely tolerated Fessard, keeping him at distance from the Sorbonne. Fessard was therefore sent in 1938 to Edgar Adrian's Physiological Laboratory at Cambridge with a grant from the Rockefeller foundation. There, he showed with Francis Echlin that high frequency stimuli could produce synchronized discharges from muscle afferent fibres. While the Sorbonne school of physiology progressively declined, Fessard began fruitful collaborations with the Cambridge school that would eventually led him to create his own school in France.

In the same year, Bryan Matthews at the Cambridge Physiological Laboratory was studying slow potentials of the spinal cord, a subject he had worked on since 1935, with renewed interest following two publications by Jan Toennies. Matthews undertook novel recordings which led to his theory of dorsal root potentials. Fessard learned the recording technique and together they published new data on isolated unitary potentials in the Journal of Physiology. This collaboration illustrates how European scientists worked together to open new areas in physiology. The studies from Edgar Adrian in the late 1920s had opened the era of microphysiology. Adrian had shown how to isolate a few fibres or a single fibre for recordings which revealed a striking loss of variability in the properties of unitary elements. Progress in instrumentation was crucial to these developments and their diffusion required more exchanges among scientists. Fessard's interest in the unitary approach can be traced back to his first studies with Daniel Auger on the action potential of single cell algae and potentials recorded from small groups of fibres in the electric fish in the late 1920s and 1930s. In the Cambridge laboratory, Fessard applied this approach to the recordings mastered by Matthews. The goal of understanding elementary properties of living matter became central to the physiology of the late 1930s. Microphysiology was becoming an influential neurophysiological subdiscipline in the 1950s. The Institute of Fessard contributed significantly to microphysiological techniques and intracellular recordings in particular.

A year after his return from Cambridge, Fessard began to collaborate with Feldberg and Nachmanson, two German Jewish scientists established respectively in Dale's Laboratory in London and at the Sorbonne in Paris. Fessard's experience with the electric fish, Torpedo, led to this collaboration at the Station marine d'Arcachon where Torpedo were readily available. Such biological stations, including especially that at Arcachon, facilitated collaorations and so played an important role in the making of European physiology. Feldberg, Fessard and Nachmanson planned to examine, in Arcachon, whether acetylcholine was involved in neurotransmission in the electric organ of Torpedo, in the context of its role discovered three years previously at the neuromuscular junction by Dale, Feldberg and Vogt. The nature of neurotransmission was that kind of new issue that could favour collaborations between European scientists. The question of chemical versus electrical transmission raged. Feldberg, Fessard and Nachmanson were able to manipulate transmission with curare, eserine and low doses of acetylcholine providing strong support that acetylcholine was involved in neurotransmission in Torpedo. This exemplary collaboration shows how members of the European community of physiologists could react together to specific problems.

In the 1930's, physiology was moving in two distinct directions. While unitary recordings were leading to microphysiology, electroencephalography permitted recordings from much larger structures and proved essential in the new organisation of physiology in Europe. Edgar Adrian recalls how he made excuses for having demonstrated encephalography to the general public in England without mentioning Hans Berger as its official discoverer. Since then, encephalography was regarded as a novel mean to study the living brain. Alfred Fessard's initial interests in psychology led him to use electroencephalography as early as 1934, exploring, with Durrup, whether the blockade of alpha rhythm could be conditioned. Similar developments throughout Europe lead to the creation of societies of encephalography and new journals entirely devoted to the field appeared.

In mastering these new technologies, Fessard's Institute benefited from the collaborations with Cambridge and also from contacts with the United States. However, it remained in the tradition of the former Marey Institute since the CNRS advocated the Institute's commitment to diffuse new techniques and to teach them to French scientists. The Institute quickly became a leading world centre for all types of electrophysiological investigations of the nervous system and attratced young scientists from all over Europe.Jan Bruner from Poland initially worked with Pierre Buser on multimodal associative areas of the brain, Ladislav Tauc from Czechoslovakia defended his PhD on potential changes in plants, Thomas Szabo from Hungary made histological and electrophysiological investigations on electric fish, Jean Massion from Belgium and Alberto Mallart from Spain worked with Mme. Fessard on the thalamus. The Institute organised or attended most international meetings in their field. A symposium on microphysiology was held in Gif-sur-Yvette (France). Fessard gave lectures at symposia on "Brain Mechanisms and Consciousness" (Montreal, 1953), "Electroencephalography of higher Nervous Activities" (Moscow, 1958), "Sensory communications" (Boston, 1959), "Unspecific Mechanisms of Sensory Motor Integration" (Pisa, 1961). Fessard was also a key figure in the IUPS (International Union of Physiological sciences), which was born at the 1950 International Congresse of Physiology in Copenhagen. While European countries formed more than half of the initial 17 participants, the proportion of European countries further increased at later congresses.

The short history of the development of the Marey Institute of Alfred Fessard illuminates how collaborations on specific problems, diffusion of instruments, common publications with foreign laboratories and organisation of international meetings greatly influenced the rebirth of neurophysiology after second world war in European countries. The United States also played an essential role

both in the attribution of funds by the Rockefeller Foundation or the US Air Force, and by collaboration. In the second half of the XXth century European neurophysiology grew into a dynamic scientific community with a successful Society, the Federation for European Neuroscience created in 1998.