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# Echanges franco-britanniques entre savants depuis le XVIIe siècle.

# Maison française d'Oxford, 24 et 25 mars 2006

JG Barbara, Conférence du Colloque international de la European Society for the History of Science et la Société Française d'Histoire des Sciences et des Techniques. Maison française d'Oxford, 24 et 25 mars 2006.

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**Franco-British relations in Neurophysiology in Edgar Adrian's Era**

Alfred Fessard (1900-1982) was the key Figure in French Post-War Neurophysiology, and a distinguished electrophysiologist, in both microphysiology (the electrophysiology of single nerve fibres and single sensitive organs) and brain physiology (including early electroencephalography). We have been studying for over three years, with Claude Debru and his group, the role of Fessard's personality and institutional policy in the foundation, after 1945, of modern French neurophysiology, in the Marey Institute and at the Collège de France. The stories of the Marey Institute and Fessard are illustrative of the Franco-British relations in physiology, especially with Cambridge, from the end of the XIXth century to the mid XXth century.

The story begins in 1898, when the fourth International Physiological congress was held in Cambridge. Etienne Jules Marey (1830-1904) prompted the creation of an International Commission for the unification of graphical instruments used in physiology. The idea was accepted and Marey built a small cottage, with assistance from the French Government, the city of Paris and the Royal Society (London), to host the commission and preserve physiological instruments. This building would later become the C.N.R.S. Institute Fessard created after Second World War.

After Marey's death in 1904, Louis Lapicque soon became the French prominent figure in French nervous physiology. Franco-British relations were excellent and Lapicque was in close contact with Henry Dale, Edgar Adrian, and Archibald Hill. The Lapicques were famous for organising parties in Paris. However, Louis Lapicque became scientifically increasingly isolated, when he extended his concept of chronaxie from a simple measure of nervous tissues' excitability to a grand theory of nervous transmission. His theory was based on isochronism, the idea that nervous transmission occurred between two elements only and only if they shared the same excitability. As William Rushton from Cambridge put it in the 70s: "[Isochronism] had never been accepted in Cambridge." In his book entitled "L'Excitabilité en Fonction du Temps" published in 1926, Lapicque attacked the results of Keith Lucas, the supervisor of Edgar Adrian, calling Lucas "an engineer turned to physiology". Lucas was killed in an airplane accident in 1916. By 1930, Rushton, an admirer of Lucas, was determined to attack Lapicque. Rushton wrote: "Lapicque was a formidable opponent, Napoleonic in the mobility with which he varied his fighting positions […] I met Lapicque only once. It was in 1932 at the international Physiological Congress in Rome […] Lapicque was charming. He asked me to object to the paper he would be giving on chronaxie "and (as Lapicque said) we shall have one or two coups de boxe, no knockouts, judged on points. And you", turning to Gasser (the prominent American electrophysiologist) and the rest, "you must be the judges." In 1937, when the controversy raged, the famous London biophysicist Archibald Hill invited Lapicque to cross the channel in his yacht to discuss Rushton's results. But no agreement was found.

This polemic contradicts what a French academician said three weeks ago, that in History no French scientist could ever win a battle against a Cambridge scientist! Lapicque's theory was nevertheless fully abandoned in the following decades. Before Second World-War, Lapicque was a rigid Parisian mandarin and his relations with Britain may explain the poor scientific Franco-British exchanges in neurophysiology before 1936.

*Tea party at the Institut Marey*

*Symposium in honour of Edgar Adrian, Cambridge, 1964*

At the same period one man, Alfred Fessard, was taking advantage of four distinct physiological schools: the school of Lapicque, of whom Edgar Adrian once said "His ingenious experiments and trenchant exposition had a classical quality that will long be remembered", Henri Piéron's school of Psychophysics at the Collège de France. Fessard learnt from both, physiology with Lapicque and scientific psychology with Piéron. In 1927, Piéron gave Fessard the opportunity to buy a small Dubois oscillograph, built in Paris by the Maison Charles Beaudouin, with funds from the Singer-Polignac foundation. In adopting oscillography, Fessard acknowledged the great influence of two other schools, Gasser's school in America, the first to adopt oscillography in physiology, and Adrian's school, studying single nerve fibres' activities with capillary electrometers, linked to a valve amplifier and a film recording system. The oscillographic revolution was a major factor linking French, British and American physiology. But it took years for Fessard to extend his collaborations with Britain, which became the major foundations in the re-construction of French neurophysiology, after Lapicque's era.

While Fessard was turning from the Lippmann electrometer to Dubois' oscillograph and Dufour cathodic oscillograph in 1927, Brian Matthews was constructing, in the Cambridge Physiology Department headed by Edgar Adrian, "a new electrical recording system" based on a "new moving iron oscillograph", linked to a camera, which remained competitive until major developments in electronics, during Second World War. If Fessard used oscillography to ask physiological questions on isochronism on torpedo fish's electric organ, he soon adopted Adrian's microphysiology, as a theoretical foundation of his electrophysiological research programme. This appears in the Review he wrote in 1931, on Nervous rhythms and relaxation oscillations. The electrophysiological experiments of Fessard were conducted on man, fish, or insect ganglia and results were always compared to the previous work of Adrian. Oscillographic measurements from pieces of excitable tissue concerned the isolation of unitary activities, the temporal isolation of central latencies, and synchronisation. While experiments attempted at first to confirm the concepts of Lapicque, the emphasis on unitary events led Fessard to adopt the dominant style of research in the field created by Adrian.

From 1934 to 1936, Fessard also was involved in the field of electroencephalography, after Edgar Adrian had published, in the journal Brain, his paper on cerebral alpha rhythm, initially discovered by Hans Berger. It is not entirely clear how Fessard decided to be the first in France to adopt electroencephalography. He probably was aware of the German literature, but always acknowledged Adrian's results in his studies on brain waves.

In 1937, Fessard decided to enter the domain of end-receptors, the sensitive nervous organs in skin, sense organs, and muscles. This was the initial field of Edgar Adrian's microphysiology. Remembering this period in 1960, Fessard wrote: "I then performed, in the line of the work of the Cambridge school, a microphysiological study of the sensitive messages coming from muscle stretch receptors". Fessard obtained a grant from the Rockefeller foundation to stay six months in Plymouth, at the Laboratory of the Marine Biological Association, working with the zoologist Sand. Two years later using a cathode oscillograph, Sand discovered the function of the shark ampullae involved with the perception of local temperature changes as small as 0.1ºC. Fessard and Sand contributed to a classical study on records of muscle stretch receptors from single end-organs in the ray pelvic fin, using the Matthews type oscillograph. This work was published in English in the Journal of Experimental Biology in 1937.

On his return to the Collège de France, Fessard pursued this work with a Dubois oscillograph, referring to his entire experimental arrangement as "similar to that used by Matthews [in 1931]". He collaborated with the neurophysiologist Francis Echlin, perhaps from Britain, showing that high frequency stimulation of stretch muscle receptors could produce synchronized muscular discharges. The work, probably submitted from France, was published in the Journal of Physiology (London), an extremely rare occurrence for French studies of the period.

In 1939, a new grant from the Rockefeller foundation permitted Fessard to spend 4 more months in Britain, this time working in the Cambridge Physiology Department with Bryan Matthews himself. Fessard was able to record unitary potentials from the dorsal roots of spinal cord. Matthews and Fessard used for the first time the now classical term "synaptic potentials".

The same year at the Marine Station in Arcachon (France), Fessard settled a collaboration with two Jewish scientists, escaping from Germany, one of whom was in Henry Dale's laboratory in Britain.

Fessard was involved in the war in Bordeaux, and created after war a C.N.R.S Institute devoted to Electrophysiology.

We hope our presentation has clearly shown how much the renewal of French neurophysiology, led by Fessard, owed to Cambridge physiology as well as broader Franco-British relations. In 1960, Fessard and his wife Denise Albe-Fessard were invited to the symposium honouring Edgar Adrian that was held in Cambridge. Fessard's school was prolific. Each afternoon at five, people would meet for tea. Today, elder scientists still remember those times and acknowledge the debt to Britain of Fessard and French post-war neurophysiology.

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ED Adrian et BHC Matthews. The Berger rhythm: potential changes from the occipital lobes in man. Brain, 1934, 57, 355-385.