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Medical History

A Memorable Decade in the History of Neurology 1874-84—II

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Richard Caton 1842-1926

THE PIONEER OF ELECTROENCEPHALOGRAPHY

Richard Caton had been a medical student with Ferrier at Edinburgh, and they were both founding members of the Physiological Society in 1876. Caton had examined the electrical activity of nerve-muscle preparations and tried to discover whether similar changes in electrical potential occurred in the brain. His experiments were conducted on rabbits and monkeys in Liverpool where he had been appointed lecturer in physiology. He discovered that not only were there changes with sensory stimulation, but that "feeble currents of varying direction passed through the multiplier when the electrodes are placed on two points of the external surface, or one electrode on the grey matter and one on the surface of the skull. The electric currents of the grey matter appear to have a relation to its function."[49] In this first publication (1875) he noted the electrical changes which occurred when Ferrier's topographical zones were in action. He sought to demonstrate his results at a meeting of the Royal Society in 1875, but was not successful. It was at that very meeting that Ferrier's own new experiments were demonstrated.

In his second paper in 1877[50] Caton concluded that "all the brains examined have shown evidence of the existence of electric currents" and he considered that these currents were related to cerebral activity because they varied with the degree of alertness of the animal, whether it was awake or asleep, and because he noted that the currents were abolished by anaesthesia and ceased at death. Caton was primarily engaged in studying the localization of sensory functions in the brain and he succeeded in noting the effects of visual and probably tactile stimulation, but not with auditory and olfactory stimulation. He observed what is known as intermittent photic stimulation. "I tried the effect of alternate intervals of light and darkness . . . I found that light caused negative variation almost invariably." Brazier[51] comments that this was the "gaslight era" and the mention of flame as a source of light in his experiments exemplifies the skill and degree of success which these Victorian physiologists managed to achieve. Caton thought that "the study of these currents may prove a means of throwing further light on the function of the hemispheres." He said "I obtained more definite results when experimenting on Ferrier's motor and sensory areas."

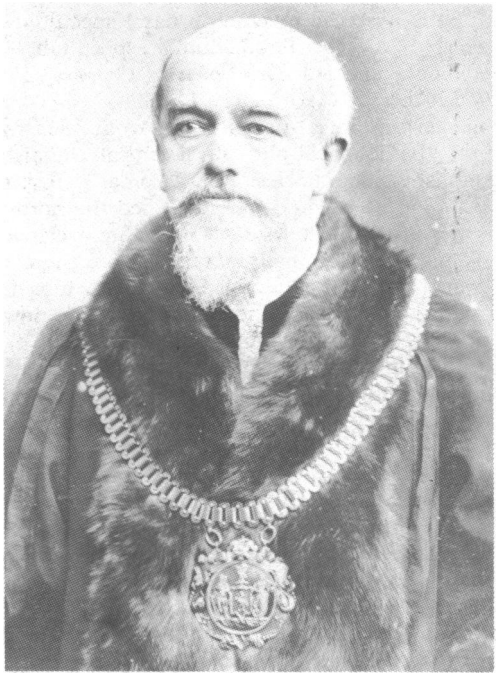

FIG. 1—Richard Caton, Lord Mayor of Liverpool, 1907

In 1887 Caton attended the Ninth International Medical Congress in Washington, U.S.A., and read a paper on "Researches on Electrical Phenomena of Cerebral Grey Matter."[52] He thought "it was well received but not understood by most of the audience." Brazier[51] comments that "this pebble that Caton dropped into the pool in Washington in 1887, was to produce no ripple in this country until 1930, when the first American publication on the electrical activity of the brain appeared." The Russian journal *Vrach* published an abstract of his paper but, in Brazier's words "this abstract was no more successful in catching the eye of Russian and Polish workers than those in the English language were in attracting the attention of Caton's countrymen."

In 1890, in the pages of the *Centralblatt für Physiologie*, Beck of Cracow and Marxow of Vienna were arguing their case for

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the priority of the discovery of the electrical activity of the brain. In January 1891 Gotch and Horsley joined in, but all were finally silenced when Caton's letter was published in February, 1891. All were entirely ignorant of Caton's discovery 15 years previously. "All claimed to have found the potential shift on sensory stimulation but of them only Beck had found the "spontaneous" oscillations of the brain's potentials."[51 53] In that same year Caton resigned the professorship of physiology in Liverpool, of which he was the first holder, and he was succeeded by Gotch himself. Caton became Lord Mayor of Liverpool in 1907.

J. L. W. Thudichum 1829-1901

CHEMIST OF THE BRAIN

Ludwig Thudichum was a native of Büdingen, who graduated at the nearby University of Giessen in 1851. He was much influenced by the teaching and research of the famous professor of chemistry at that university, von Liebig. Thudichum emigrated to London in 1853 (bringing with him a combustion furnace, a present from von Liebig)[55] and lived there until his death in 1901. He became a naturalized British citizen in 1859. He had an original and fertile mind and wrote several books, among which were treatises on the urine, on gallstones, on diseases of the nose (he invented a nasal speculum still sometimes referred to as Thudichum's speculum)—and even published books entitled *The Spirit of Cookery* (1895) and *A Treatise on Wines* (1894).

He engaged in clinical practice and from 1865 to 1871 was lecturer on "pathological and physiological chemistry" in the newly established laboratories of St. Thomas's Hospital Medical School. In 1864 he isolated and identified the normal pigment of the urine, urochrome. In 1869 he wrote a classic paper on "luteines" pigments originally obtained from the corpora lutea of the ovary and subsequently isolated by him from many animals and plant sources. These substances are now known as carotenoids, precursors of vitamin A.

His studies in various aspects of physiological chemistry attracted the attention of Sir John Simon, then principal medical officer to the Privy Council, who in 1864 engaged him to undertake a series of researches, the results of which were embodied in *Reports on Chemical Researches to promote and improve Identification of Disease*. These reports were published as appendices to the reports of the medical officers of the Privy Council and the Local Government Board and appeared at various dates down to 1882. His classic work *The Chemical Constitution of the Brain* was published in 1884.

Thudichum was appointed chemist to the medical department of the Privy Council. It seems that he was originally requested to investigate the effects of typhus on the brain, but his interest was in its chemistry. Leibrich, a German chemist, thought that the brain consisted almost entirely of one single chemical substance containing carbon, hydrogen, nitrogen, and phosphorus, which he named "protagon." Thudichum showed that this was actually a mixture of substances: lecithins, cephalins, and myelins. Lecithin and its structure had been discovered in 1867; Thudichum correctly classified the cephalins and myelins as phosphatides.

He identified sphingomyelin, the sulphatides, and cerebrosides in the brain. The classification of these substances was a major achievement and Thudichum bequeathed us several flowery names of Greek derivation for his new brain compounds.[56] He noted the manner in which they were distributed in the grey and white matter but he made no serious attempt to relate his findings to the processes of disease. Nevertheless, he did say "I believe that the great diseases of the brain and spine, such as general paralysis, acute and chronic mania, melancholy and others, will be shown to be connected with specific chemical changes in neuroplasm . . . in short it is probable that by the aid of chemistry many derangements of the brain and mind, which are at present obscure, will become accurately defineable and amenable to precise treatment, and what is now an object of anxious empiricism, will become one for the proud exercise of exact science." He thought there should be laboratories of research established in all large hospitals, "in these the purely chemical diseases, no less than the diseases caused by micro-organisms, should be investigated."

He was a controversial figure and his researches had little influence in their day and indeed were suspected and criticized.

FIG. 2—Dr. J. L. W. Thudichum (1829-1901).

A notorious review was published by Professor Gamgee in 1877.[57] "Dr. Thudichum's paper bristles with new names for old facts, and with the names of numberless new substances which the author discovered at each step of every investigation . . . every analysis furnishes the material for a new formula, and every formula the excuse for a new name. No wonder then that an alphabetical list of chemical educts and products stated to have been found in or produced from the brain of man and animals, there are eighteen marked with an asterisk, indicating that they are 'believed to be now described for the first time as ingredients in gray matter.' "

Gamgee continued "Dr. Thudichum's researches are always conducted on a large scale" and he went on to say that Thudichum had used over 1,000 ox brains in his studies. His discovery of myelin was not accepted—"it was but impure lecithin." "A critical mind fails to make out what cephalin can be, certainly no definite substance. It would be as rational to analyse bread and butter and attribute a formula to it as to do so with cephalin." Science had gained "little or nothing" from these researches.

Thudichum himself did not under-rate his own achievements and indeed like so many Victorian scientists he spoke proudly of them. "They are of fundamental importance and all further developments in chemical neurology must start from them as a basis."

When Thudichum died research on the chemistry of the brain almost came to a halt and his obituary notices reveal that few thought much of his work. Thus, in the *British Medical Journal* "it is possible that Thudichum attempted in these researches too much . . . the results were not generally considered to correspond adequately to the time and money which they cost . . . his views have not been generally accepted by other workers . . . and his lifelong labours in physiological chemistry do not appear to have borne adequate fruit." *Nature*[59] thought that he "did his best, he was an honest and indefatigueable investigator" but that his researches were "relatively insignificant . . . and gave rise to considerable polemic." *The Times*[60]

thought that "the knowledge yielded by these researches was hardly commensurate with the time and cost at which it was obtained . . . that his scientific achievements seldom, if ever, realised the expectation which had been formed with regard to them." But *The Times* also added "it is by no means improbable that some of his investigations may yet bear important fruit."

Certainly Thudichum's fame is entirely posthumous. He was 50 years before his time. Page[61-2] considers that "he was the father of brain chemistry." Dr. Otto Rosenheim,[54] the London biochemist, uncle of the late Lord Rosenheim, thought that "Thudichum might justly be called the first English biochemist." In 1930 Dr. Rosenheim discovered samples of Thudichum's preparations, many of the highest purity, in the stable of his house. In 1931, largely through Rosenheim's efforts, a Civil List Pension was awarded to each of Thudichum's five daughters who still resided there—at 11 Pembroke Gardens, Kensington.

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Clinical Problems

Sterilization of Soft Contact Lenses Using Boiling Water in a Vacuum Flask

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Summary

The vacuum flask method of using boiling water to decontaminate soft contact lenses is better and less expensive than other ways of using moist heat and can be safely and effectively applied under most domestic circumstances.

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Introduction

The soft contact lens hydrogel material has properties which render disinfection of its surfaces by chemical methods difficult to achieve without side effects.[1 2] Damage to contact lens due to inefficient sterilization has been noted many times in this laboratory. Lenses from two patients were contaminated with a fungal growth (fig. 1).[3]

The purpose of this study was to show the reliability of "sterilizing" soft contact lenses by placing them in a soaking