The Different Careers of Gustav Fritsch (1838-1927)*

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Two works published independently and almost simultaneously in 1870 had a particularly important bearing on neurology and neurophysiology. Hughlings Jackson reported in that year[27] his conclusion, based on clinical evidence, that an area of the brain must exist which is not only associated with motor activity, but which furthermore must be so organized topographically as to account for patterns of motor involvement in certain regularly spreading epileptic seizures. In the same year Gustav Theodor Fritsch and Eduard Hitzig[24] published their experimental demonstration that contrary to Flourens' doctrine there is an area in the cerebral cortex which may be excited electrically to produce movements both discrete and complex, resembling in their patterns those that are now known as Jacksonian epilepsy.

Occurring as it did in the early days of modern neurophysiology, this remarkable concordance between clinical and experimental findings had a far-reaching influence. Thenceforth, the study and analysis of central nervous activity could the more easily disregard mystical notions of soul or spirit and concentrate on mechanisms based on a physical substrate. Neuroanatomy and neurophysiology were thereby urged on, and neurology itself at this early date became one of the more scientifically oriented of the clinical disciplines.

Fritsch worked in a number of fields during a life span of almost 90 years. He was a traveller and explorer in South Africa

* This note is contributed in memory of Professor John F. Fulton, whose love for the history of science was but one facet of a warm-hearted, cultured, and gifted scientist. A query from the late Professor Fulton, whether the "electric fish" Fritsch was the same as the Gustav Fritsch of the "Fritsch and Hitzig experiment" uncovered an historical error. The three current editions of English-language histories of medicine[4, 25, 31] unanimously list the Fritsch of the "experiment" as having lived between 1838 and 1897. None identifies him with the "electric fish" Fritsch, although this was in reality one and the same man, who lived until 1927. This article was started at Fulton's urging, but its writing was discontinued when Walker[34] published a photograph of the "experiment" Fritsch giving the correct dates in the caption. My attention was recently called, however, to two widely disseminated surveys of the history of physiology[3, 30] both of which give a still earlier date of Fritsch's demise—1891. It is particularly surprising that Dr. Brazier[3] should have published an erroneous date, since her careful scholarship is well known and since she reproduced Fritsch's photograph from Professor Walker's paper where the dates are right.

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and participated in several astronomical expeditions. Prior to and after his excursion with Hitzig into the physiology of the mammalian brain, Fritsch published numerous papers on comparative anatomy. Under the inspiration of his great patron, Emil du Bois-Reymond, Fritsch systematically studied the anatomy of five of the seven known families of electric fishes and became one of the leading authorities of his day on electric organs. He published several books on physical anthropology and was a pioneer and a leading spirit in establishing scientific photography on a professional basis.

The esteem in which Fritsch was held by his contemporaries is evidenced by the first of a projected series of articles on "Neurologists and Neurological Laboratories," devoted entirely to "Professor Gustav Fritsch," that appeared in 1892 in the *Journal of Comparative Neurology*.[29] Although unsigned, it was undoubtedly written after a tour of Europe by the editor and founder of the journal, C. L. Herrick, brother of the late C. Judson Herrick.

Fritsch's various accomplishments were noted in Herrick's sketch. Nevertheless, none of the current historical sources connect Fritsch of the Fritsch and Hitzig experiment with his other work, or as the friend and associate of du Bois-Reymond, Virchow, and Waldeyer, all of whom he long outlived. Despite the fact that the historical accounts cited above[3,4,25,30,31] give the date of Fritsch's death as 1897 or 1891, the catalogue of the Library of Congress (and its replicas in indexes and catalogues of other libraries) give no date for his demise, implying that he is still alive.*

Gustav Fritsch was born on 5 March 1838 in Cottbus, the son of a minor government official of Prussia. His maternal grandfather was an important Silesian industrialist, Kranspa.** Fritsch's financial independence from this source, probably further in-

* I have not been able to track down the origin of the error in the historical sources, but it may be based on the following: The 1900 volume of the *Index Catalogue* of the U.S. Surgeon General's Office[33] lists Fritsch as having died in 1891. A fine-print item cites the 1892 sketch by Herrick.[29] It is therefore possible that the compiler of the *Index* assumed that the sketch was an obituary notice. However, Fritsch is also listed in the *Index* as co-editor, in 1896, of a journal on scientific photography. The historians who adopted 1897 therefore may have surmised that 1891 was a misprint for the later date.

A possible source of confusion is the listing of Fritsch as Gustav Theodor by the German biographical handbooks[2,32] which, however, give the correct dates of his life span as do the *Encyclopedia Americana*[7] and a recent Germany history of medicine.[5] Fritsch himself apparently preferred to omit the Theodor, since it is absent from the title-pages of his major works. It was also omitted in the brief biographical articles that were written after Fritsch's death.[1,6,26,28] Nevertheless, library catalogues usually list the full name. At one time the general catalogue of the Columbia University Libraries listed Fritsch as two apparently different persons, but the cards have since been combined, with a pencil line drawn through the middle name whenever it appears.

** The biographical data and some of the bibliography derive from the obituary articles by Benda, R. du Bois-Reymond, and especially that of Haller.[1,6,26]

creased by his marriage in 1871 to the daughter of a Breslau publisher, seems to have furnished, at least in part, his freedom to move about in a number of scientific fields. He determined at the age of nineteen to study physiology in Berlin under Johannes Müller, but since the latter died in the same year (1857), Fritsch first did his military service in a Guards regiment* and then turned to medicine. His doctoral thesis[8] was published in 1862 and he received his medical license the next year. He then promptly left for three years' stay in South Africa (1863-1866), carrying out anthropological and geographical studies at his own expense.

Returning to Prussia, Fritsch participated in the war of 1866 and then became assistant to Reichert in the Anatomical Institute at Berlin (1867). However, he left the next year as a member of the Prussian Solar Eclipse Expedition of 1868 to Aden. Probably it was his photographic skill that led to his participation in an astonomical expedition.** After the latter mission was completed, he took part in a trip archeologically guided through Egypt by Dümischen. At this time, as on other journeys to Egypt and the Orient, Fritsch photographed many things. One of those early records was of biological as well as of archaeological interest. It is the bas-relief (Fig. 2) on the grave of the Lord Ti of Memphis (*ca.* 3000 B.C.) which shows many species of Nile fishes, including the electric catfish, *Malapterurus,* one of the electric fishes which Fritsch studied later.

After his return to Berlin, Fritsch published his first book on South Africa,[9] his *Habilitationschrift,* as Dozent,[10] and his work with Hitzig.[24] The outbreak of the Franco-Prussian War interrupted this creative activity and led him again into military service. R. du Bois-Reymond[6] suggests that this interruption caused Fritsch to abandon further research in mammalian neurophysiology.*** At any rate, the next few years witnessed a return to his interests in anthropology[22] and microscopy.[23] Appointed an *ausserordentlicher Professor* of comparative anatomy in Reichert's department in 1874, Fritsch again took off on an astronomical expedition, this time on the Prussian Venus Expedition to Ispa-

* Service in the Guards was usually open only to the well born and is an indication of the affluence of Fritsch's family.

** R. du Bois-Reymond[6] says Fritsch was the leader of this expedition.

*** It is interesting, however, that Eduard Hitzig (1838-1907) also left physiology for clinical practice. He became Professor of Psychiatry at Zürich (1876-1879) and then at Halle (1879-1903). Hitzig's office desk pad is now in the possession of Prof. H. W. Magoun of the University of California in Los Angeles.

han. He prolonged that journey by a stay at Smyrna, during which he studied the comparative anatomy of the fish brain.[13]

The absences from Berlin were probably related to difficulties with Reichert, which eventually led to Fritsch's leaving the latter's department. Virchow then gave him working space at his Institute* until Emil du Bois-Reymond made room for him as the chief of the histology and photography sections of his own new Physiological Institute. Virchow, the elder du Bois-Reymond, and Waldeyer were his friends and supporters in the Berlin Akademie der Wissenschaften, and much of Fritsch's work from this period on was financed by the Academy.

Under du Bois-Reymond's influence, Fritsch turned to the study of the electric organs of fish, undertaking for this purpose several extended journeys to Africa. Reports which he sent back in letters to du Bois-Reymond were sometimes transmitted by his patron in brief summary to the Berlin Academy or published as letters annotated by the founder of electrophysiology.** Fritsch himself later published the detailed studies in a series of papers and monographs,[15,16,18,19] as well as a travel book on Africa.[17]

Working still at the Physiological Institute after another electrophysiologist, Engelmann, had succeeded du Bois-Reymond, Fritsch shifted his interest chiefly toward physical anthropology, here, too, utilizing his photographic skills. A book on the human body for anthropologists[20] was profusely illustrated. Published first in 1899, it campaigned vigorously for the beauty of the naked body against the prudery of his time, and it reached a second edition in 1905. Another book[21] was on the body structure of modern-day Egyptians. A study of the human retina also combined his various interests. Like many Europeans of means of the period, Fritsch held strongly that there were superior and inferior races of man, the Caucasians naturally being regarded as the highest representatives of mankind. In the pursuit of his thesis that there were racial differences in visual acuity he journeyed around the world in 1904, carrying out physiological tests and gathering specimens of retinas fixed within an hour of death. In 1908 he designated for the first time the *fovea centralis* and *area centralis,* discarding the older name of macula.

* The German word "Gastfreundschaft"[26] is a happy one!

** References 14 furnishes an example of this information. In the same volume of this journal, which was edited by du Bois-Reymond himself, are also published letters by Carl Sachs, sent from Venezuela where he was studying the electric eel, and by Babuchin, a Russian scientist who made frequent trips to Africa to study *Malapterurus* and other African electric fishes.

Fig.1. Portrait of Gustav Fritsch from a photograph in the Yale Historical Library. It is similar to one which appeared in Graf Haller's obituary[26] and later was published by Walker.[34]

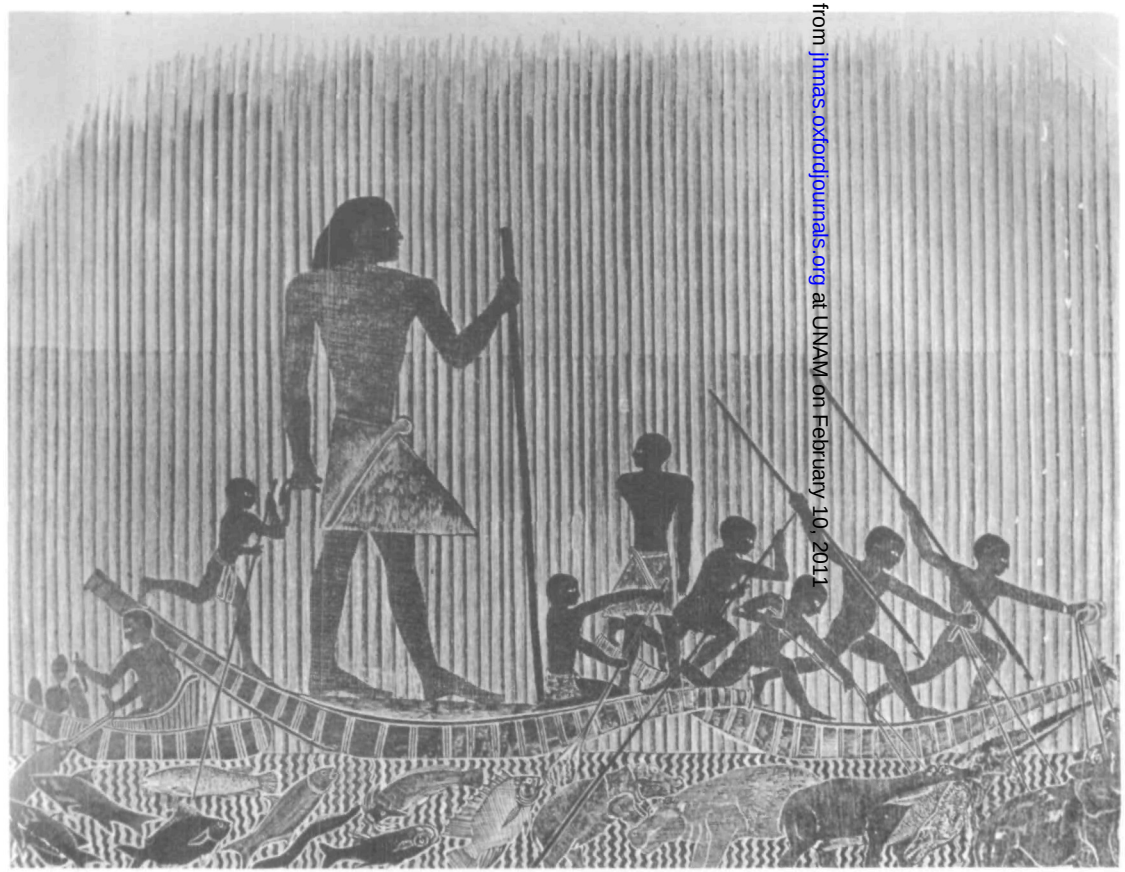

Fig. 2. A bas-relief in the tomb of the Lord Ti near Memphis. It was photographed by Fritsch in 1868 and was reproduced as a woodcut in his monograph on *Malapterurus*.[18] Ti, who was a court official about 3000 B.C., is shown as an imposing figure being punted through a papyrus thicket in the Nile. Nilotic fauna are represented below and include a clearly recognizable *Malapterurus electricus*, the Nile electric catfish. It is the lightly colored fish behind the pole of the rearmost boatman.

When Rubner succeeded Engelmann as Professor of Physiology at Berlin, the interests of the new head were foreign to Fritsch. Waldeyer, and later Fick, gave him space in the Anatomical Institute, where his career as a teacher ended in 1921. Fritsch's last extensive work was on the anthropological significance of head hair,[23] the material for which he had largely gathered on his 1904 world tour. It was another attempt to classify and order human races. Toward the end, his eyesight was impaired by a spray of chemicals, but he remained alert and of vigorously military bearing until his death on 12 June 1927 at the age of 89.

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