

# Evolution of Neurology in the German-Speaking Countries

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## Abstract

In this region 18<sup>th</sup> century brain research met with scientist's prejudice against causal interaction of body and soul. Advances in neurology had to rely on rather mythological ideologies such as Phrenology and Vitalism which revived localizing research from the 17<sup>th</sup> century origins of neurology. In the early 1800s the last great Vitalist, Johannes Müller, set off an explosion of progress in biology that transformed medicine and neurology into applied biology and replaced Müller's Vitalism by hardline Mechanism. Later in the 1800s the typical Germanic neuro-psychiatrists developed psychiatry and completed cerebral localization, finally obtaining the divorce of neurology from psychiatry.

## 17<sup>th</sup> Century

The team of Thomas Willis (Oxford) created neurology, neuroanatomy, neurophysiology from interdisciplinary research on brain organs as tools of the soul [1]. The name and the content of neurology came out of neuroanatomy like Athena "from the head of Zeus" [2].

## An 18<sup>th</sup> Century Mainstream

The philosopher Leibniz wanted to solve the problem of the soul, an immaterial thinking thing, being unable to move the body, a material extended thing and vice versa (Descartes). Leibniz proposed preestablished harmony as a singular act of Creation, allowing parallel actions of body and soul without any causal interaction. Albrecht von Haller (1708-1777), physiologist at Göttingen, the leading physician of his age, based on Leibniz, discouraged localising brain research, the tracing of cerebral tracts and the concept of reflex action (revived by Unzer, after Willis) and rejected the theory of electric nerve action (Boissier de Sauvages) in favour of his holistic doctrine of sensibility and irritability of animal tissue. Haller's doctrines formed the mainstream of medical opinion. The development of neurology had to rely on the help of outsider ideologies.

## Outsider Ideologies

The pietist-led Prussian university at Halle accepted dissertations on electrotherapy (Oppermann 1746) and hourly headache attacks (Oppermann 1747), the latter rediscovered only in the mid-20<sup>th</sup> century. Georg Ernst Stahl (1660-1734), pietist professor of medicine, proposed his Animism where the soul controls the body in health and disease, contested by Leibniz in their joint book «Negotium otiosum» (Leisure Business) of 1720. Stahl proposed causal interactions of soul and body throughout. Animism survived during the first half of the 18th century and was replaced by Vitalism, the doctrine of a vital force (Lebenskraft) responsible for all functions of the body in health and disease. Vitalism, another pre-scientific ideology, unsupported by evidence, nevertheless led to progress in brain research, neurology and psychiatry from the late 18<sup>th</sup> century (JC Reil) to the first half of the 19<sup>th</sup> century (Johannes Müller). Reil, head of the Vitalist school, proposed psychiatric hospitals for humane treatment of the insane, invented the word «psychiatry», praising psychotherapy and improved the methods of brain dissection, demonstrating pathways for reflex action. In the brain he defined the insula, the lemnisci, the lenticular nucleus, claustrum, internal and external capsules and the corona radiata. The Vitalists saved and advanced the knowledge of 17<sup>th</sup> century brain research and neuropsychiatry [2,3] in spite of the prevailing dogma of the complete separation of body and soul. In the first half of the 19<sup>th</sup> century the Vitalist Johannes Müller set off a veritable explosion of scientific progress in medicine, when his

students, following his advances, discovered animal, plant and nerve cells and developed modern electrophysiology, sensory physiology and experimental psychology, an expansion of research only comparable to that of the founders of the Royal Society at Oxford. They also replaced Müller's Vitalism with strict mechanistic reasoning.

Neuro-mythologies and brain research: from Vienna to Paris. Franz Anton Mesmer (1734-1815) developed his doctrine of animal magnetism in Vienna. He claimed that he restored the flow of magnetic fluid in the body by nearly touching his patients («magnetic stroking») in analogy to early electrotherapy. He left for Paris in 1778. In 1784 a commission headed by Benjamin Franklin concluded that his cures could be completely explained by suggestion. Animal magnetism remained popular and suggestion (Bernheim, Nancy) and hypnosis (Charcot, Paris) were later used in the treatment of nervous diseases. One follower of Mesmer in Germany, the physician and poet Justinus Kerner, discovered botulinus toxin whose effect he demonstrated 1821-22 by animal experiments and a self-test. It was to be used for neurological disorders only after 1970.

Another neuroscientist in Vienna, Franz Joseph Gall (1759-1828), attempted to find localised brain functions by mapping outcroppings of the skull. His method was based on Lavater's physiognomy but also on the neurophysiology of Willis [3]. Like Willis, Gall saw the cortex as the origin of cerebral functions, where specific organs would be identified. He believed that the outer skull was a precise cast of the cerebral surface and thus of the organs of the brain. This is still known as phrenology, long discarded as absurd. However Gall was one of the foremost brain anatomists of his time and besides his method of localisation, he viewed the brain as an interconnected entity where the balance between its organs was crucial, as shown by a case of left frontal lesion with aphasia and right hemiplegia. He claimed that mental diseases were brain diseases and that criminals should be treated, not punished. His doctrine of cerebral organs as instruments of the soul alarmed the catholic court in Vienna, as it would lead to materialism. Gall had to emigrate to Paris where he continued his research and teaching until 1828 [4,5]. His attempts at localisation of brain function were largely forgotten but the first successful localisation was published, also in Paris, after over 30 years.

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An intrusion of hard science into medicine. Johannes Müller (1801-1858), professor of anatomy and physiology at Berlin, integrated morphology, microscopy, chemistry and biology in his research. He was a Vitalist in the tradition of Reil. He reintroduced the soul in his handbook of physiology (1836-40), contributing to the international development of psychosomatic concepts. He advanced natural science by his anticipatory insights which were adopted by his disciples and led them to major discoveries: Remak discovered the living cell and the nerve cell, Schwann, the animal cell and the cell of the nerve wrapping and Schleiden, the plant cell, whereupon Virchow, discoverer of neuroglia, built up his cellular pathology. Helmholtz measured nerve conduction velocity, developed the physiology of hearing and the ophthalmoscope and Wundt, the head of Helmholtz's laboratory, created experimental psychology. Du Bois Reymond founded modern electrophysiology and Bruecke, the teacher of Freud and Breuer, initiated the physiology of speech. Munk's research at a veterinary institute allowed him to complete the localisations of visual, acoustic and somatosensory functions by animal experiments. Haeckel studied morphology, described his biogenetic principle (embryogenesis repeats the evolution of species) and became the great propagator of Darwinism.

### Brain Psychiatry

from neuropsychiatry to recent neurosciences. In the mid-19<sup>th</sup> century versatile neuro-psychiatrists took over neurology from the internists. They localized specific brain functions and simultaneously developed clinical psychiatry in specialized hospitals. One of them, the Burghölzli, Zürich, founded by the internist Griesinger who proclaimed "Geisteskrankheiten sind Gehirnkrankheiten" - 'mental diseases are brain diseases'-was headed by typical neuro-psychiatrists up to the second world war. Its first director, Bernhard von Gudden, later perfected the method of following tracts in the brain by secondary degeneration caused by experimental (in animals) or pathologic lesions. The entomologist Auguste Forel, later director of the Burghölzli, designed a microtome for him that produced fine cuts through the whole brain, so that degenerations in one hemisphere could be compared with the other, intact, hemisphere. Gudden was later put in charge of King Ludwig II of Bavaria and was drowned together with him in the lake near his hospital. Eduard Hitzig, his successor at the Burghölzli, studied electrical stimulation of the brain in animals with the zoologist Gustav Fritsch. They found that stimulation of the frontal lobe induced movements of the contralateral limbs. Between them Fritsch, Hitzig and Munk localized the principal functions of the frontal, parietal, occipital and temporal lobes. Auguste Forel's research, from

the acoustic brainstem pathways to hypnosis and the care of alcoholic patients gained him widespread social and international influence. Richard Semon's 1904 Mneme theory of memory as a common property of life where both genetic and individual memory receive information as «engrams» and reproduce, «ekphore» it, completed the holistic view of brain function of his protector Forel. Other neuropsychiatrists in Zürich, Bleuler, Monakow, Adolph Meyer, Rudolf Brun, accepted Semon's theory. Adolph Meyer, Forel's Zürich disciple, emigrated to the U.S. as a neuropathologist. From Johns Hopkins he reformed U.S. psychiatry, denouncing «the medically useless contrast of mental and physical» categories. His view of psychiatry is summarized in his term «psychobiology», the twin of his friend Monakow's "neurobiology". In 1898 Monakow introduced neurology in the University of Zürich, while Eugen Bleuler did the same for psychoanalysis. These neuropsychiatrists of Zürich created many classic neologisms, some of them still in current usage: Monakow's "Diaschisis" (from schizein "to cleave") for loss of function of groups of neurons caused by loss of input from distant centers, Bleuler's "Schizophrenia" of 1911 which replaced Kraepelin's "Dementia praecox", Bleuler's "ambivalence" which insinuated itself in everyday usage and Monakow's "chronogenic localization" that brought time and space together for better understanding of function and loss. Another protégé of Forel, Oskar Vogt, wishing to understand hypnosis, launched an interdisciplinary brain research project with his wife Cécile. It went on for 67 years in four successive institutes, reaching from comparative neuroanatomical and ethological studies of insects to the state-sponsored dissection of Lenin's brain, survived Nazi and Soviet oppression and established much of the groundwork for today's neurosciences [6,7].

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