University of Zurich[UZH]

Walter Rudolf Hess

Nobel Prize in Physiology or Medicine 1949

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"for his discovery of the functional organization of the interbrain as a coordinator of the activities of the internal organs"

* 17 March 1881 in Frauenfeld
† 12 August 1973 in Ascona

1913–1916 Privatdozent
1917–1951 Professor of Physiology
at the University of Zurich

The Puzzle of Sleep

Parrots are more usually associated with pirates, but this one belonged to a professor: Joko the parrot was happiest sitting on Walter Rudolf Hess's shoulder and would repeatedly bite through the cable of his hearing aid. The bird could do as it liked, much to the annoyance of Mrs. Hess. The professor was interested in the mental abilities of the parrot, which he trained diligently. He taught him, for instance, to say "bon appétit" on the appropriate occasions.

A fascination with living beings is a leitmotif in the life of Walter Rudolf Hess, although he was no sentimental animal lover. In addition to entertaining him, animals served as objects of study and research; indeed, Hess believed animals and humans are physiologically very similar. As a researcher, he admired the ingenious design of the body, which he viewed as a self-sustaining machine that had achieved perfection through evolution. It was in the 1930s that Hess found his most fruitful field of research: The functioning of the brain.

It all started with observations of nature in rural Thurgau and with laboratory experiments that Walter Rudolf, born in 1881, carried out with his father, a physics teacher at the high school in Frauenfeld. This dual interest, combined with his "absolutely primordial originality" – referred to in the commemorative volume for his 60th birthday – made him a brilliant inventor and one of the most renowned exponents of experimental biology.

His medical studies took Walter Rudolf Hess to several universities at home and abroad: Lausanne, Berne, Berlin, Kiel, and Zurich. In recalling "my first encounter with work of a true scientific nature … I see myself in the dissection hall of the Zurich anatomy department," said Hess in the speech he gave in the main lecture hall of the University of Zurich after the announcement of his Nobel Prize. Hess was referring to the time he was able to ascribe a chance find during dissection – an anomaly in the arteries of the foot – to the laws of mechanics.

For his dissertation at the University of Zurich in 1901, Hess researched into the viscosity of blood, promptly inventing a new instrument for this purpose: The Hess viscometer, which was used for decades in medical practice. As an ophthalmologist in Rapperswil – a plaque on the house "Zum Pelikan" commemorates his work there – in 1909 he introduced a new method for the easy recognition of motor disorders of the eye and, in 1912, he developed a technique for stereo photography that only failed to achieve practical application on account of the impending outbreak of the first world war.

Walter Rudolf Hess viewed the body as a machine that had achieved perfection through evolution.

Hess entered into medical practice at the wish of his fiancée, Louise Sandmeier, who was also from Frauenfeld. But he was unhappy as a physician and longed to return to the world of research. Despite his wife's reservations concerning the financial consequences, in 1912 he took a position as assistant to Professor Justus Gaule at the Institute of Physiology. The Hesses moved, with their two-year-old daughter, Gertrud, to Winterthurerstrasse 27 in Zurich, where his son, Rudolf Max, was born

in 1913. "Lisy" Hess supported her husband in his work throughout his life, acting as his private secretary and typing his scientific articles for him.

Walter Rudolf Hess's habilitation thesis dealt with the physiological-biological basis of the cardiovascular system. Again, he demonstrated his extraordinary ability to derive scientific laws using logic. In 1915, he took the opportunity to work for a year in Bonn with renowned physiologist Max Verworn. Upon returning to Zurich, his professional situation had changed dramatically: The head of the institute, Justus Gaule, was seriously ill and had resigned prematurely. Hess assumed Gaule's position ad interim – but could he, a young Privatdozent, have any hope of being appointed Gaule's successor? The appointment procedures took on political overtones. Initially, an experienced German physiologist was preferred over Hess, leading to resentment at the institute. In addition, it was discovered that a very strong recommendation for Hess given by Verworn had been kept quiet. The director of education in Zurich, Heinrich Mousson, then intervened personally in the appointment procedure and, in September 1917, Hess was named professor of physiology and head of the institute. He showed his appreciation to the University by spending his entire research career there.

Right from the start, Walter Rudolf Hess took his teaching duties seriously. Known to his students as an inspiring lecturer, if at times severe and impatient, he was one of the first instructors to make use of film in his lectures and research. He recorded athletes in motion, thus documenting the perfect combination of the active, holding, and supporting muscles. To better explain his physiological insights, Hess had animated films and ingenious models designed. His physiology lectures were always minutely prepared, and if a lecture went wrong, the laboratory assistant would hear all about it – Hess had inherited his mother's lively Saxon temperament.

Hess worked for many years at the Institute of Physiology, housed in the top floor of the University's physics building at Rämistrasse 69. At the end of 1923, however, Hess's realm was seriously endangered when a caretaker's negligence resulted in an attic fire one night. Yet the destruction had a positive consequence: The building was radically rebuilt, with an extra floor giving the physiology researchers more space. In addition, Hess gained a further, unique location for science with the – hotly contested – foundation of the international High Altitude Research Station on the Jungfraujoch.

Literature, art, and music had little clout in Hess's life – the microscope was culture.

The private residence of the Hess family was now a dwelling appropriate to his status, located on Susenbergstrasse 198, near the Kurhaus Rigiblick. Yet the household remained emphatically modest, with no room given to personal luxury. Hess built an aquarium and a terrarium for the children on the veranda so they had the opportunity to study nature. The family was completed by a small wolfhound named Jürg.

As head of the Institute, Hess was free to choose his own area of research. After investigating topics related to circulation, from 1929 onwards he determined to learn more about the nature and purpose of sleep. Doing this involved experiments on animals, and Hess chose cats because they vary little in their physique and because they sleep a lot during the day. Over the course of this work, Hess developed a method for electrically stimulating individual areas of the interbrain. For years, he conducted these difficult and complicated experiments with the greatest care, yet with little support. A nanny, whose help was no longer required at his home, became his faithful assistant: For 20 years Anna Jaussi took notes of the experiments and compiled the statistics on the experiments on the brain. Thus, step by step, fundamental insights were obtained into the functioning of the brain.

At the age of 68, and still hard at work, Walter Rudolf Hess was awarded the Nobel Prize for his research into the interbrain. He regarded the award ceremony in Stockholm in December 1949 as one of the great moments in his life. Despite his international experience, Hess was also very fond of local celebrations and social occasions, although there was no real place in family life for literature, art, or music. "The microscope is culture," Hess remarked when his daughter, Trudi, complained about this state of affairs. While his son, Rudolf Max, a neurologist, supplemented his father's studies of the brain with electroencephalogram investigations, Trudi went her own way: After studying biology, in 1948 she trained as an analyst at the newly founded C.G. Jung Institute.

When Walter Rudolf Hess retired as head of the institute in 1951, he had

made Zurich into a globally renowned center of brain research, and he could look on with satisfaction as his students continued his work. As professor emeritus, he retained an office in the Institute of Anatomy at the University Hospital where he continued to write academic papers, his dog "Schnäuzli" often keeping him company. From Goldauerstrasse 25 – in the 1940s the family had moved somewhat closer to the city – Hess usually took the Rigiblick funicular and the tram to work, with his dog running alongside the tram car – a spectacle that gave rise

Hess transformed Zurich into an internationally renowned center of brain research

to numerous comments from passers-by. His grandson, Christian W. Hess, himself a professor of neurology, recalls his grandfather taking him and his siblings on highly educational walks, which often ended with a cup of Ovomaltine at the Kurhaus Rigiblick.

In 1967 the Hesses left Zurich and moved, with Joko the parrot, to their holiday home in Ticino. Walter Rudolf Hess died there, of heart failure, at the age of 92. *Margrit Wyder*

Source: Margrit Wyder: *Einstein und Co. – Nobelpreisträger in Zürich;* Verlag NZZ libro, Zürich 2015 **Illustration:** Aline Telek **Translation:** University of Zurich

Revealed in Zurich:

The Organization of the Interbrain

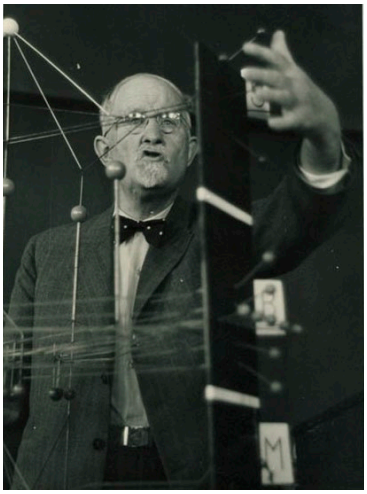
The diencephalon, or "interbrain," is, as its name implies, located between the brain stem – which sits on the spinal cord – and the cerebrum, the brain part that is particularly well developed in humans. The interbrain controls vegetative functions and emotional reactions essential to life: Body temperature, the body's water balance, feelings of hunger and satiation, flight-or-fight responses, and also sleep. The biological function of sleep had long represented a puzzle for scientists. Walter Rudolf Hess understood it as an essential means of allowing the body to recover from daily activities, thus permitting "maintenance work" to be carried out in conditions of external calm.

Researching the interbrain was highly complicated. First, scientists gave the laboratory animals, in this case cats, food to get them used to the laboratory bench. After being giving anesthesia, the cats were fitted with an electrode socket on the skull, through which the fine steel wires could be threaded into the brain, which is insensitive to pain. After being subjected to light electric stimulus, the animals displayed, for instance, drowsiness or aggressive behavior, depending on the location of the electrodes. The traces made by the electrodes in the interbrain could then be observed after the animal had been euthanized, allowing scientists to explore brain tissue, millimeter by millimeter. They subsequently created a cartography of the brain and were able to allocate individual functions to localized areas.

Hess placed great importance on treating the cats as humanely as possible. "Animal welfare in animal experiments" was a major consideration, and he wrote about this topic in *Der Tierfreund,* an animal magazine for young people: "If the welfare of laboratory animals - and our noble aims oblige us to observe their well-being - is ever disregarded, we are unconditionally on the side of animal rights advocates."

The possibility that his basic research could result in therapeutic applications was not one of Hess's key concerns. Indeed, interventions in the brain in the first half of the 20th century were still brutal affairs. Spanish neurologist Egas Moniz was awarded the Nobel Prize in 1949, together with Hess, "for his discovery of the therapeutic value of leucotomy in certain psychoses." In this operation, the nerve tracts in the frontal region of the brain are severed, which was intended as a cure for delusions. The procedure, however, tragically resulted in irreparable damage and personality changes in patients.

Yet Hess's own research method using deep electrical brain stimulation has been used successfully in recent years to treat the symptoms of Parkinson's Disease and other motor disorders. Electrodes are surgically implanted in the brain and linked though thin wires with a pulse generator in the chest area. The impulses can prevent trembling or overcome akinesia in patients. Nevertheless, discovering precisely how these "pacemakers for the brain" function remains a task for future generations. *(MW)*



Inspiring and demanding: Walter Rudolf Hess in the lecture hall.

Walter Rudolf Hess was interested in what the brain can do: He taught his parrot Joko to say “bon appétit” before meals. Image: Private collection Christan W. Hess. Photo: Privatarchiv Christian W. Hess

An experiment on a cat in Walter Rudolf Hess’s lab, documented by Anna Jaussi. Photo: Privatarchiv Christian W. Hess