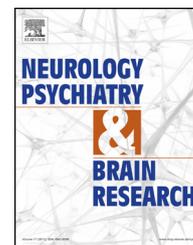


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Review

Hans Helmut Kornhuber: Neurologist—Engaged Clinician—Neurophysiologist—Scientist and Humanist

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ABSTRACT

Synopsis 1: This contribution in memoriam Hans Helmut Kornhuber, 1928–2009, Freiburg – Baltimore – Ulm, Chair of Neurology and founding Professor of Neurology of Ulm University was prepared for the “Memorial Symposium – Prof. Hans Helmut Kornhuber” on June 20, 2013 during the 53rd International Neuropsychiatric Pula Congress. It is an attempt to bear in remembrance Hans Helmut Kornhuber's scientific legacy. The aim is to give a review of his immensely broad range of interests. Kornhuber was one of the last shining examples of what has been called “Naturforscher und Arzt”/“Researcher and Physician” in the 19th and early 20th century. Reviewing his scientific oeuvre includes: Kornhuber's early interest in epistemology and brain function. His work on the sensory systems/perception, conducting many experiments at Baltimore with Mountcastle and his team on skin receptors/tactile sensibility, and also measuring the channel capacity of sensory systems and consciousness. The entire field of Neurology he knew in extenso, there were not many clinicians engaged with such an intensity as Kornhuber with his always up to date and profound knowledge about new developments and therapies in neurology, and he conducted his own research into new therapies with particular emphasis on multiple sclerosis, stroke, dementia, movement disorders, etc. For Psychiatry as well he made important contributions, e.g. the glutamate theory. To Oto-Rhino-Laryngology he contributed a lot, e.g. hand book articles such as “Physiology and Clinic of the Vestibular System”. Kornhuber also discovered the eye muscle field in the cerebellum.

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Synopsis 2: Kornhuber coined the term 'preventive neurology' and did a lot for prevention, e.g. he taught school children measuring their parents' blood pressure. He was always fighting for the integrity of the family. He extensively worked on addiction/substance abuse (cigarettes, alcohol, tranquillizers). His almost 5 years in a Russian prisoner of war camp made him appreciate how important human freedom is. He worked intensively in this field with many own contributions including the freedom of will. In the motor system he grossly enhanced our knowledge about motivation, intention, preparation and execution of volitional, self-initiated movements and actions along with their respective brain mechanisms, the *Bereitschaftspotential*. His concept of readiness for movement together with the author of this commemorative publication became the basis for all discussions about our willful actions and about the final question of freedom of will. It goes without saying that Kornhuber was an outstanding academic teacher and highly talented lecturer, and by the way the founder of the *Studium generale* at Ulm University.

1. Education and early scientific work

From childhood on Kornhuber had an inexhaustable thirst for knowledge, the burning questions of the young Kornhuber being: 'How does man see the world?' and 'How does the brain function?' Initially his interests lay in Chemistry, which he intensified early on still at school working at the University Chemical Institute of his hometown in Königsberg. One key incident, during his 5 years as a Russian prisoner of war determined his future professional life, making him choose to be a clinician as opposed to a theoretical researcher: he saved the life of a child who had suffered a mushroom poisoning. Kornhuber decided to study medicine, both his parents being physicians. He chose the universities where he would spend his undergraduate years, according to the philosophers at the department: Guardini in Munich, the group surrounding Nicolai Hartmann in Göttingen, Heidegger in Freiburg, Löwith in Heidelberg and Karl Jaspers in Basel. Whilst studying medicine, he spent his evenings reading the great philosophers, classics and world literature. His MD thesis entitled: 'Elicitation of cyclothymic depression by psychic distress,' was supervised by Kurt Schneider in Heidelberg. At the 'Neurological Hospital including Neurophysiology' in Freiburg under Richard Jung,

Kornhuber took up his first appointment, working unbelievably intensively as a senior resident for in- and out patients during the day time and conducting difficult neurophysiological experiments with single cell recordings from the brain of the cat at night, and also psychophysical and sensoriphysiological experiments in human subjects, and later, after his research sojourn at Johns Hopkins, Baltimore (Vernon Mountcastle), he was working extensively on the tactile sensibility, and among others measured the channel capacity of our major senses and of consciousness.

2. Kornhuber's work on the vestibular system

His enormous workload did not prevent him from lecturing, also in non-medical faculties, but also producing essential publications and making seminal contributions to Neurology, Psychiatry and even Oto-Rhino-Laryngology: 'Psychology and Psychiatry in captivity as a prisoner of war.' 'Visuo-vestibular and somato-vestibular integration in neurons of the cerebral cortex'. Discovery of the eye muscle field in the cerebellum. 'Physiology and clinic of the vestibular system,' with which he managed to revolutionise the area of the vestibular system (Kornhuber, 1974b).

3. Human freedom, free will and the *Bereitschaftspotential*

Kornhuber held seminars on *human freedom* for members of all faculties. It was Kornhuber's productive thinking, his mental and creative energy that paved the way towards the discovery of a brain potential in the EEG which precedes all our willed movements and actions—the *Bereitschaftspotential*. The publication, even though originally in German, became a citation classic, surprisingly the term *Bereitschaftspotential* was not anglicised and succeeded worldwide in its German form. In Ulm, Kornhuber and the author of this commemorative publication continued with this research and shared 46 years of productive research collaboration. This brain potential became famous; it appears to precede all our volitional, self-initiated movements and willful acts. The voluntary movement paradigm, *Bereitschaftspotential*, also provided the basis for Libet's experiments. Thus, the *Bereitschaftspotential* elicited a general worldwide multidisciplinary discussion about human freedom of will.

Kornhuber was a real advocate of human freedom, the concept of freedom accompanying him all his life. His firm belief that man is free and needs to promote this freedom "our culture is based on the interaction of free citizens"—was no doubt not only philosophically and theoretically based.

4. Clinical work—advocate of preventive medicine and neurology

In 1966 Kornhuber was appointed the chair of Neurology in Ulm. Not surprisingly, with much enthusiasm and fervour, he managed to transform a local MS-clinic (*Dietenbronn*) into the

new Neurological University Hospital, creating a widely respected and well known hospital covering the whole spectrum of neurological disorders. With similar vigour, from 1984 on, he built up the Neurological Department of the Rehabilitation Hospital of Ulm. As a never tiring defender of health and preventor of abuse–dependency drastically reducing our degrees of freedom (!)—Kornhuber engaged himself early on against the smoking of cigarettes, abuse of alcohol and tranquillizers. He introduced the concept of a health fund on alcohol and cigarettes, not as a tax, but a duty payable to the health insurances on the basis of causality. Lobbies are working against such a law, however it seems an appropriate ruling is still in consideration to being realised. As one of the first, Kornhuber used modern epidemiological methods to explain the origin of high blood pressure, this being one of the prime risks for stroke. He saw overweight and alcohol consumption as one of the prime causes of hypertension. Alcohol consumption in men also lead to abdominal obesity (and the metabolic syndrome). As always, he did not wait long to turn theory into practice and introduced the measurement of blood pressure in school, where pupils in turn measured their parents' blood pressure. This opened the possibility of early prevention. As a consequence he suggested 'preventive medicine' to be part of the medical curriculum and coined the term 'preventive neurology.'

Kornhuber was a Physician with therapeutic fantasy, he encouraged decentralised care and rehabilitation at home and developed practical courses for the relatives of patients with chronic diseases. For patients with a neurogenic bladder dysfunction he developed a portable ultrasound to measure residual urine. With his team he developed a baby-protector against sudden infant death (SID). His suggestions, which he presented to the minister of health, lead to a law placing care and treatment on an even footing and securing optimal care of the chronically ill. Kornhuber developed effective methods for the therapy of multiple sclerosis, as well as methods to develop medication for the effective therapy following acute stroke and cerebral haemorrhage. In his search to prevent Alzheimer dementia, Kornhuber illustrated that a micro-angiopathy underlies Alzheimer, when patients are over 65 years of age. In his search to treat schizophrenia effectively, Kornhuber investigated the role of glutamate, which lead him to give his dementia patients glutamate antagonists. To promote therapies of neuromuscular diseases, Kornhuber founded a multidisciplinary centre, as well as a centre for the treatment of epilepsy, which was worldwide among the first of its kind. Surgical interventions, such as the removal of the amygdala and the hippocampus, being the most epileptogenic brain structures, were conducted without side effects. Following these interventions, the realisation of the comparatively small significance of the amygdala in man, as compared to animals was made. Instead, Kornhuber could show that man is dominated to a greater extent by his frontal lobe.

5. Kornhuber as a teacher

Kornhuber had enormous personal engagement and enthusiasm as far as the improvement and promotion of education was concerned. He brought to life and was responsible for the

Studium generale at the University of Ulm, which was a shining beacon, providing an example how promotion of education can be made accessible to the general public. Kornhuber founded a school for speech therapy, as well as for logopedics, and aphasia therapy, its curriculum being a precursor to many other schools, which were to follow their example. Kornhuber himself a father (three sons followed in his footsteps) was a fervent promoter of better family laws and made this known to the general public in his articles, sharing his concern at the ever falling birth-rate ('The situation of the family' and 'From a nation of thinkers to a nation of unskilled labourers'). Kornhuber repeatedly reminded that the family has primary responsibility in the moral and ethical education of its children, as well as in the care of the ill and infirm. He co-founded a scientific journal—this very journal here: *Neurol. Psychiat. & Brain Res.*—which avoided plagiarism and nepotism (Huber & Kornhuber, 1992). However, his most important late œuvre was '*Wille und Gehirn*' (Will and the Brain). Slowly it is realised that human interaction is not possible without free will. *Wille & Gehirn* appeared 2007, a second updated edition in 2009, when he was still alive. In 2011 it appeared in Tokyo in Japanese, and in 2012 in the US (Kornhuber & Deecke 2012). His last publication "*Freiheit–Forschung–Gehirn–Religion, Wege durch dichtes Gelände*" (*Freedom–Research–Brain - Religion, paths through dense territory*) is Kornhuber's life ending credo and a most rewarding read (Kornhuber 2009).

6. Honours and awards

Kornhuber received numerous national and international honours: the Bárány Society made him to the first prizewinner of the *Hallpike-Nylén-Awards*, for his pioneering research on the vestibular system, which is still valid today. Foreign otoneurological societies awarded him honorary membership and universities awarded him as honorary professor. The German EEG society honoured him with the Berger prize for his discovery of the cerebral foundations of will and purposeful actions (willingness to act). The Belgian neurophysiological society awarded Kornhuber an honorary membership and the University of Brussels the honorary doctor. The Federal Republic of Germany honoured him for his efforts concerning the rehabilitation of patients with the federal cross of merit (Bundesverdienstkreuz), and the German society of psychiatry honoured him for his research in the field of schizophrenia by awarding him the Kurt-Schneider prize.

7. Personal appraisal

Kornhuber conducted an extremely intensive and productive life. He had immense energy and creativity. He was a great personality, a character, he could be gruff, but he was always obliged to the truth and honest and upright. With him one of the last universal natural scientists and physicians has passed away, one who was familiar with classical brain research of clinical neurology and was able to relate it to new research developments. We, his disciples, are immensely grateful to him, having been strongly influenced by this great thinker, having been able to share his knowledge, witness his unflinching

memory, partake in his enormous energy reserves, witness his never tiring endurance, his altruistic understanding of duty, his exemplary discipline—not resting until a thing (illness, symptom, problem) was understood and solved. Deep reflection was characteristic of him—he was a thinker. Not last, we, his students have been deeply influenced by his extensive and most thorough ward rounds. The patient's well-being was always at the forefront and had utmost priority.

Kornhuber had lead a very healthy lifestyle and was in exemplary good mental and physical health up to his eighties, when succumbing to a malignant brain tumour, which had abruptly terminated his life on Oct. 30, 2009. Kornhuber was married twice and had five sons with his first wife, three sons followed in his footsteps and studied medicine, each one a specialist in his field. With his second wife, Prof. Doris Bechinger-Kornhuber, MD, he shared his passion for neurology.

There have appeared obituaries in this very Journal [Deecke L (2009/10) Obituary. Hans Helmut Kornhuber 1928–2009. *Neurol. Psychiat. & Brain Res.* 16: 75–77], in *J. Neurol.* [same title, *J. Neurol.* 257:1599–1601 (2010)], in the Journal 'Familiendynamik' [Deecke L: (2010) Nachruf auf Hans Helmut Kornhuber 1928–2009. *Familiendynamik* 36(2): 184] and in the 'Nervenarzt' [same title, *Nervenarzt* 81:1242–1244 (2010)].

An anthology of Kornhuber's oeuvre:

(a selection made by Kornhuber himself)

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