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EDITORIAL

Remembering *Franz Huber* (November 20, 1925–April 27, 2017), a pioneer of insect neuroethology

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Clearly, it was a rich life, of which one can say that to be a scientist not only is a profession but also or even more so a way of living. Franz Huber provides abundant proof of that. In his older days as an emeritus professor he wrote his memoires on as many as 467 pages, with scrutiny, charm, lots of anecdotes and photographs, both personal and scientific and many of them of historical value now (Huber 2016). The reader of this book learns about all the stages of Franz Huber's very active and successful life. It started in Nussdorf, close to Traunstein, a small Bavarian village, then of some 600 inhabitants, and ends in idyllic Starnberg close to Munich (Bavaria).

On 11th April 2017 Franz sent me a touching e-mail congratulating me on my forthcoming birthday. Despite some physical fragility a little more than two weeks before he passed away, approaching his 92nd birthday, Franz was still perfectly alert, curious, and open for the many colors and beauty of life and for nature's depths. His last e-mail to me contained both a poem and a list of intriguing questions concerning the insect brain.

When I read through his book *"Das war mein Leben"* (Huber 2016), I was moved and caught, realizing what I had not thought of for a long time, namely that our paths, though different and mine with some 15 years delay, showed some surprising relatedness. A few of many examples are the following. My biology teacher at high school, whose enthusiasm for biology had contributed crucially to my later decision to choose biology as my major field of study, turned out to have been a close friend of Franz from his student times at Munich University. Most of the people, academic and non-academic, of the Munich Institute of Zoology with Karl von Frisch as its director were still around, when I took up my studies there in 1959, 11 years after Franz had started. This gives me a particular depth of understanding and amusement when reading all the stories he reports. Later, in 1962, when I arrived in Ted Bullock's laboratory at the University of California in Los Angeles (UCLA) on the fourth floor of the Zoology building (to stay there for more than a year), Franz had just left a few months earlier after having spent some 11 months as a postdoc there. We shared quite a few dear friends for a lifetime, which we both had first met at UCLA. And we even had our civil marriages at the same place at Ruppertstrasse in Munich, both to a Swabian. Most likely Franz, like me, was asked whether he would like to have the ceremony with or without harmonium, the difference being 5 DM (Deutschmarks). More importantly, we shared our interest in neuroethology and the invertebrates, always advocating the necessity of an organismic and integrative approach. Franz once charmingly promoted our valued experimental animal, the spider *Cupiennius salei*, to the status of an "honorary insect". We always had something to laugh about and enjoyed the commonality of our Bavarian roots, which included a specific sense for enjoying life or "pura vida", as I learned in Costa Rica.

At the same time Franz Huber was a dedicated, ambitious and hard-working scientist. He pioneered neuroethology, searching for the neuronal and sensory basis of behavior. Already in his doctoral thesis work (Fig. 1) under the guidance of *Werner Jacobs* in Munich Franz managed with remarkable success to elicit complex song patterns and various behaviors associated with

A publication list of Franz Huber can be found at: https://www.orn.mpg.de/3891578/Publikationen_Franz-Huber_1952-2013.pdf.

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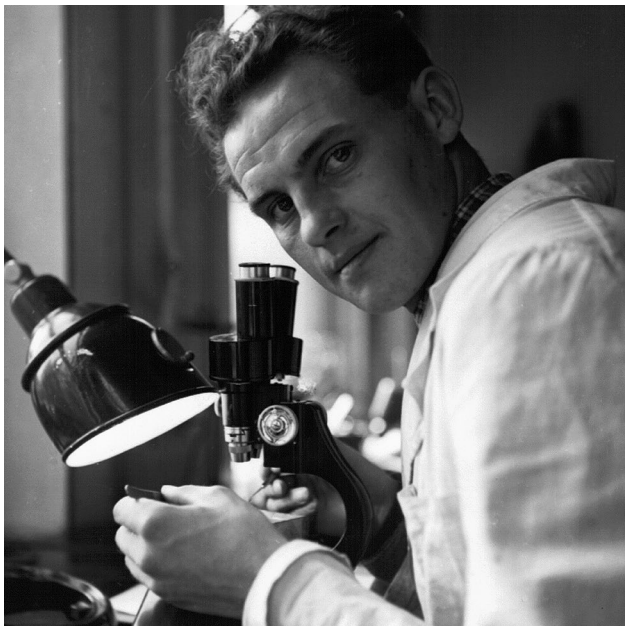

Fig. 1 Franz Huber as a young Ph.D. student in 1950 at the Zoologisches Institut of the University of Munich, dissecting the nervous system of a grasshopper (courtesy and copyright: Johannes Huber)

reproduction by setting minute lesions in the tiny and delicate brain of the field cricket *Gryllus campestris*. Who would have thought that this might work? Thereafter, insect brains were back to science, and so were other parts of their central nervous system. In 1953 Franz finished his dissertation entitled "*Sitz und Bedeutung nervöser Zentren für Instinkthandlungen bei Insekten*". As he remembers, *Karl von Frisch* commented in an interesting way: "Mr. Huber, if you can offer five pioneering studies in your lifetime as a scientist, you have fulfilled your debit" (Huber 2016). To be offered such wise advice is hard to imagine in our present times, where quantity so often comes before quality. In 1955 the truly pioneering work was published in Zeitschrift für Tierpsychologie (Huber 1955).

Franz Huber's early brave work met with early recognition. After a few years at the "Zoophysiologisches Institut" in Tübingen as an assistant of *Franz Peter Möhres*, he had the opportunity in 1956 of a research stay in Zürich, Switzerland. There, *Walter Rudolf Hess*, 1949 Nobel Prize winner (Physiology or Medicine), was still around as a professor emeritus. The idea of spending some time in Zürich was to learn the methods of finely localized electrical stimulation and deletions by coagulation in the cricket brain. Walter R. Hess had received the Nobel Prize for his work on the functional organization of the mammalian midbrain (diencephalon), for which he had developed such techniques and applied to the cat brain. Franz Huber's experiments, carried out in the laboratory of Professor *Oscar A.M. Wyss*, also a neurophysiologist and successor of Walter R Hess, were successful again and became the basis of his habilitation (*venia legendi*) in 1960 at the University of Tübingen.

Among the numerous important people in the dense and lively scientific atmosphere of Tübingen I assume that two broad-minded visitors in the late 50ies had a particular influence on the career of Franz Huber: *Kenneth Roeder* of Tufts University and *Theodore H. Bullock* of the University of California at Los Angeles (UCLA), now, like Franz, considered founding fathers of neuroethology. Remarkably, they had come from the USA to learn more about the electrical stimulation of the cricket brain and both invited their host to come to their respective laboratories in the USA. Franz decided for Los Angeles. He stayed there as a postdoc from June 1961 until April 1962. His main goal at that time was to learn intracellular recording techniques and details about the various electrical activities of single neurons. The marine snail *Aplysia* with its big and easy to access neurons was his experimental animal and the obvious choice in those days. *Aplysia* had been brought to cellular neurophysiology mainly by *Angelique Arvanitaki-Chalazonitis* (Marseille) and *Ladislav Tauc* (Paris) in France and later reached the height of its fame when *Eric Kandel* received the Nobel Prize (Physiology or Medicine) in 2000 for his work on the cellular and molecular mechanisms of memory. As Ted Bullock always did with his postdocs from all over the world, he asked Franz Huber to demonstrate his special knowledge and experience to his own students and collaborators at UCLA. Thus, Franz had to demonstrate experiments performed by *Erich von Holst* and *Horst Mittelstaedt*. Bullock much admired both of them. Examples from their work were "relative coordination" of centiped locomotion and "feedback networks" in the optomotor response of a fly running in a striped cylinder. A long lasting impact of the time spent in the USA must have had the personal contacts with numerous interesting and outstanding neurobiologists and zoologists. Much of this was owed to the openness and broadmindedness of Ted Bullock's lab where there was a very stimulating and continuous coming and going of national and international celebrated researchers. The vibrant early 60ies were times full of promise in the USA and of purpose. Maybe particularly evident in California, one was full of the idea that America can do and achieve anything (like landing on the moon) and John F. Kennedy, the president, quite different from nowadays, talked about global alliances and global responsibilities. Most of the students, postdocs and associates in Ted Bullock's lab from abroad took a large share of this attitude back home with them and made it part of their success and their way of life, running bustling labs and maintaining an international perspective. This is certainly true for Franz Huber.

A subsequent big step forward in Franz Huber's career was his move to the University of Cologne in 1963, where

he had been offered a full professorship for animal physiology (Fig. 2). Brain stimulation was now done with freely moving animals. In particular *Norbert Elsner*, one of Huber's first Ph.D. students in Cologne, turned out to be a world-champion in recording electro-myograms from a multitude of muscles in singing grasshoppers simultaneously. *David Bentley*, a postdoc, developed techniques to record from motor- and interneurons of crickets during singing and *Dieter Möss* started the sensory work related to it. *Harald Nocke* started the biophysics work on sound production and hearing, the latter being strongly advanced by *Axel Michelsen*, who then came from Copenhagen to join Huber's team. Franz Huber´s ten years in Cologne were highly successful and reflect the enthusiasm and dedication with which he followed his goals. These now fully included hearing and singing, the afferent and efferent control of cricket song, which later turned out largely not to be under the control of the central complex, as originally suggested by the brain stimulation experiments. At a now legendary farewell party, national and international colleagues and friends presented their data and ideas about the "Neural Basis of Animal Behavior" in Cologne, promoting neuro-ethological thought in Germany and beyond.

Finally, in 1973, at the age of 48, Franz Huber was appointed director at the Max Planck Institute for

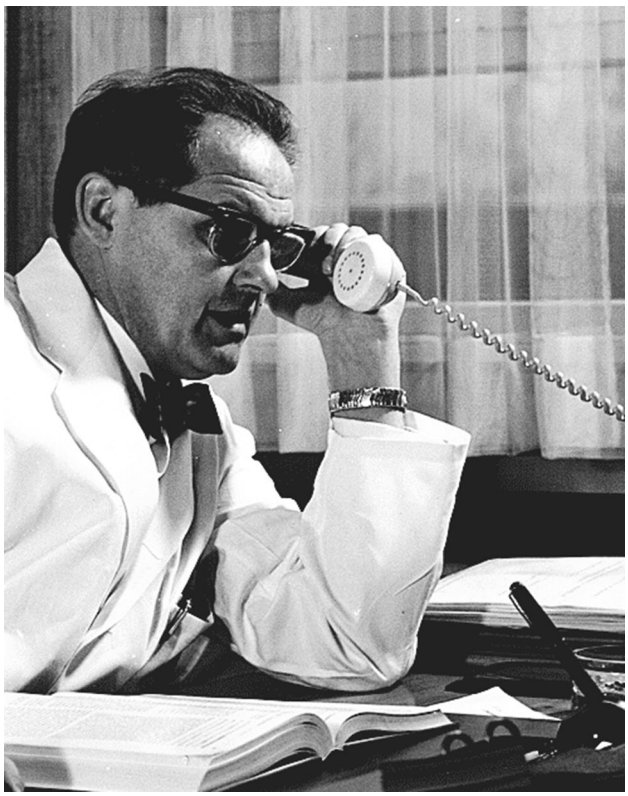

Fig. 2 Franz Huber as a full professor in 1970 in his office at the University of Cologne (courtesy and copyright: Johannes Huber)

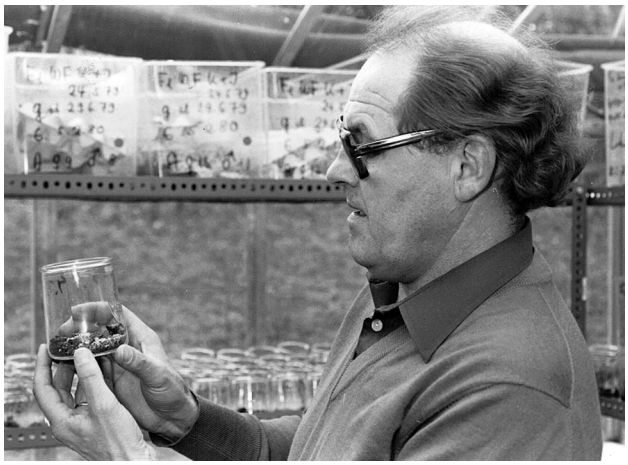

Fig. 3 Franz Huber at the Max Planck Institute for Behavioral Physiology in Seewiesen, inspecting cricket ears, ca. 1976 (courtesy and copyright: Johannes Huber)

Behavioral Physiology in Seewiesen (Bavaria) (Fig. 3). He became one of the successors of *Konrad Lorenz*, who had just received the Nobel Prize (Physiology or Medicine) together with *Niko Tinbergen* and *Karl von Frisch*. Franz held this position for 20 years and made his lab an international center of insect neuroethology. Visitors came from all over the world. Behavioral and neurobiological experiments with crickets, grasshoppers and cicadas clarified mechanisms serving female phonotaxis on the way to the singing male, the neural basis of song pattern analysis and the localization of the sound source. The experimental approach was always organismic and the goal to trace down natural behavioral patterns to the activities of identified single neurons, sensory cells and circuits. Many discoveries enriched the field substantially. Quite a few of them were published in the *Journal of Comparative Physiology*. Cricket research by now had attracted the attention of laboratories in the USA (Ithaca, *Ron Hoy*), in the Soviet Union (then Leningrade, *Andreji Popov*) and lived on in Cologne (*Gernot Wendler*, Huber's successor at the University). In1983 Franz Huber and *Hubert Markl* edited a book entitled *"Neuroethology and Behavioral Physiology – Roots and Growing Points"* as the outcome of a highly successful symposium. They dedicated the book to Kenneth Roeder, who had addressed key questions of the field very early and lucidly (Huber and Markl 1983). Later, in 1989, a more specialized book entitled *"Cricket Behavior and Neurobiology"* edited by F Huber, T Moore and W Loher summarized current knowledge (Huber, Moore, Loher 1989). In his *laudatio* on the occasion of Franz Huber's 90th birthday, *Berthold Hedwig* (Hedwig 2016) pointed to more recent advances in insect neurobiology and acoustic communication, to a large extent made possible by the availability of refined and new techniques. In the meanwhile

the first knock-out crickets have been created for the study of learning and memory (Awata et al. 2015). However, "Neuroethology and Behavioral Physiology – Roots and Growing Points" (Huber and Markl 1983), edited more than 30 years ago and with a thoughtful epilogue by Ted Bullock, still is a must-read for someone interested in key questions of neuroethology. The same goes for a voluminous book jointly written by *Carl Gerhardt* and Franz Huber and comparing problems of acoustic communication in frogs and insects (Huber and Gerhardt 2002).

Throughout his lifetime, having many friends must have been a deep-rooted pleasure of Franz Huber. He had many illustrious friends indeed, all around the globe and for good reasons, considering his openness, charm, devotedness, enthusiasm and the obvious pleasure he took in interacting and communicating. Franz was in the center of an international community of outstanding scientists. I tacitly assume that there may also have been a little bit of vanity. Franz had made it from a poor village boy, who had lost his father at the young age of two and a half years, to a widely known and acknowledged Max Planck director. He enjoyed this idea and often talked about it. He travelled a lot and lectured abroad in many countries on all continents, he organized international workshops and symposia, served for four years as visiting research director at the International Centre for Insect Physiology and Ecology in Nairobi, and received many honors. Among these are four honorary doctor's degrees, the prestigious Karl Ritter von Frisch Prize and Medal of the German Zoological Society, the membership in several academies like the German National Academy-Leopoldina, the Academia Europaea, the Bavarian Academy of Sciences, the American Academy of Arts and Sciences, and others. He was also an honorary member of the German Zoological Society and a fellow of the International Society for Neuroethology (Fig. 4).

As Franz Huber once said (Huber 2013), his achievements were the result of 12 to 14 h work a day, including many weekends. Often he pointed out how much his wife Lore contributed to his success. At the same time he considered it a privilege to belong to a generation whose situation tended to improve continuously, starting from a materially very poor childhood and the years of war and post-war, which today are hard to imagine for those born much later. Continuous progress eased hard work and difficult times for those who were driven by curiosity and the intention to be productive and to give shape to something considered relevant.

The motto on Franz Huber's death notice was Heraclitus' famous "Panta rhei". I assume that Franz himself had chosen it, expressing his very biological awareness that continuous and eternal change is a fundamental property of all life. Most likely, thinking of many excellent young researchers, he was also enjoying the idea that "ever-newer waters flow on those who step into the same rivers" (Heraclitus).

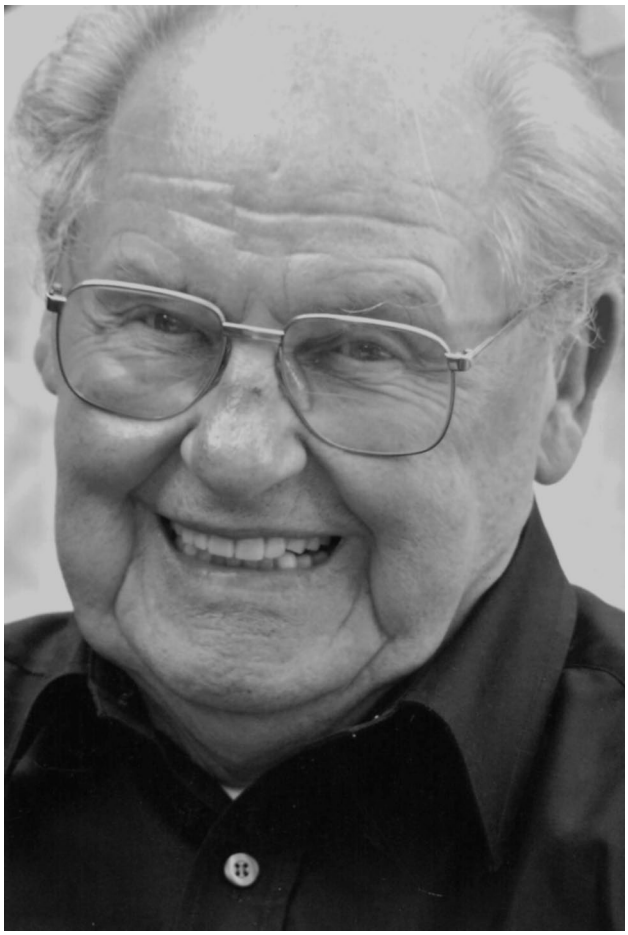

Fig. 4 Franz Huber as a professor emeritus in Starnberg in 2011 (courtesy and copyright: Johannes Huber)

Franz Huber will be remembered by many colleagues and friends all around the globe for his outstanding contributions to science and for his stimulating enthusiasm. He will also be remembered as a warm and special person and a tireless advocate of integrative and organismic biology.

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