Curriculum Vitae Prof. Dr. Bernd Fritzsch

Name: **Bernd Fritzsch**
Born: **1 May 1948**

Bernd Fritzsch is a comparative molecular neuroembryologist at the University of Iowa, Department of Biology with a focus on ear neurosensory development and evolution. His main area of research focuses on the molecular evolution of inner ear neurosensory cells (hair cells and neurons) with the aim to elucidate crucial developmental steps that would allow hearing restoration. To this end he also works on the molecular developmental evolution of the organ of Corti, the mammalian hearing organ, the spiral ganglion cells and the brainstem auditory nuclei.

Academic and Professional Career

2015 - 2017	Co-Director, Center on Aging
2015 - 2017	Co-Director, Aging Mind and Brain Initiative
2014 - 2015	Director, Center on Aging, University of Iowa, Iowa City, USA
2014 - 2015	Director, Aging Mind and Brain Initiative
2011 - 2014	Co-Director, Aging Mind and Brain Initiative
2008 - 2017	Chair, Department of Biology, University of Iowa, USA
2004 - 2007	Assistant Dean for Research, Creighton University, Omaha, NE, USA
2003 - 2008	Director for Basic Research, Creighton University, USA
1993 - 2008	Professor, Creighton University, Dept. of Biomed. Sciences, USA
1991 - 1993	Associate Professor, Creighton University, Dept. of Biomed. Sciences, Omaha, NE, USA
1988 - 1990	Research Fellow, Scripps Institute for Oceanography, University of California, San Diego, CA, USA
1986 - 1990	Heisenberg Fellow of the German Research Foundation
1985	Habilitation, Universität Bielefeld, Germany

1981 - 1986 Assistant Professor, Universität Bielefeld, Germany

1978 - 1981 Assistant Professor, TU Darmstadt, Germany

1973 - 1978 Ph.D., TU Darmstadt, Germany

1968 - 1973 Studies in Biology, TU Darmstadt, Germany

Membership in Scientific Societies and Committees

Freunde der TU Darmstadt

Society for Neuroscience

Association for Research in Otolaryngology

American Association for the Advancement of Science

Honours and Awarded Memberships

since 2017 Collegiate Fellow, University of Iowa College of Liberal Arts and Sciences (CLAS)

since 2015 Member of the German National Academy of Sciences Leopoldina

2010 Fellow of the American Association for the Advancement of Science

2008 - 2010 Endowed Iowa Entrepreneurial Professor, University of Iowa

2007 Outstanding Mentor Award, Inaugural Award, Creighton University

1993 Distinguished Research Career Award, Creighton University

1991 John C. Kenefick Award, Creighton University

1986 Heisenberg Award

1973 PhD Fellowship of the Studienstiftung des deutschen Volkes

Member of The New York Academy of Sciences

Major Scientific Interests

Fritzsch's early work concentrated on eye muscle innervation development and evolution. Collaborating with colleagues at the Karolinska Insitutet (Stockholm, Sweden) he demonstrated that the six eye muscles of lampreys are differently innervated and not homologous to other vertebrates. In an attempt to understand what developmental change might guide such reorganization he collaborated with A. McMahon on the first knockout mouse with a brain defect, Wnt1 null mouse, and showed that oculomotor and trochlear motoneurons require Wnt1 and Fgf8 of the midbrain/hindbrain boundary for normal development. More recently they showed that mutations in human kinesin motors lead to mis-innervation of eye muscles and functional deficits. They recently developed the evolutionary and developmental context of this work in a team effort to generate a broad

perspective for future research in this area.

In parallel to this work Fritzsch became intrigued about the efferent innervation of the ear und studied the distribution pattern in many vertebrates which suggested that efferents to the ear are evolutionarily derived facial motoneurons. To support this notion he studied the development of the inner ear efferents and demonstrated that they develop from a population of facial motoneurons that undergo lateral instead of caudal migration. Acceptance of the motoneuron nature was achieved after others identified the alpha 9/10 cholinergic receptors that mediate efferent function. Candidate genes that guide the differential projection during development have been identified and seem to be associated in part with planar cell polarity signals. Our studies corrected several misconceptions on arrival of efferents days after afferents by demonstrating near simultaneous arrival of both at hair cells.

A major aspect of Fritzsch's research concentrates on the evolutionary origin of the mammalian organ of Corti and spiral ganglion cells. This led to the discovery of a basilar papilla like organ in the coelacanth fish, a better understanding of progressive and regressive evolution of amphibian auditory receptors and in recent years a more detailed understanding of crucial steps in this transformation. The ideas derived from this analysis have been expanded to provide a testable scenario of hair cell and sensory neuron evolution that he investigated over the last few years to provide a better understanding of the molecular evolutionary processes underlying the generation of functionally and developmentally interconnected neurosensory cells.

The evolutionary hypothesis on the lineage relationship of sensory neurons and hair cells as the result of gene duplication followed by differential cell fate assignment led to testable predictions of developmental changes in molecular interactions that sort out hair cells and sensory neurons from multipotent precursor populations. Fritzsch's and his colleagues' own work and more recently that of others support this 15 year old hypothesis guiding their investigations. One prediction of this hypothesis was the possible transformation of neuronal precursors to hair cells and vice versa. They have already demonstrated conversion of neurons to hair cells and are still working on conversion of hair cells to neurons using complex transgenic and knocking approaches.

Following initial work to demonstrate dependency of cerebellar development on neurotrophic support, they clarified numerous technical and conceptual errors on the role of neurotrophins in ear development. This work culminated in demonstrating guidance function of neurotrophins for afferents using a targeted replacement of one neurotrophin by the other neurotrophin relevant for the ear, specifically replacement of Ntf3 by Bdnf. Using this strategy they could reroute vestibular fibers to reach the cochlea, work that stimulated attempts by us and others to explore this ability for guidance of afferents to reach closer to cochlear implants. Due to perinatal lethality they could not explore the postnatal effect of compound elimination of both neurotrophins further until they had viable conditional deletion mice of both neurotrophins relevant for the ear, Ntf3 and Bdnf. These mice and the data they have collected on them thus far are the basis for the current application.

Bernd Fritzsch's work has received thus far ~12000 citations and an h-index of 61 (2015).