

Biology Msc from 2018

Name of specialization:

Neurobiology and Human Biology (NHB)

OVERVIEW OF THE FIELD

Neurobiology focuses on neuronal control of animal and human organisms while investigates the regulation of cellular, tissue, organ and organism level processes. The drive behind its dynamic development is the importance of mental and neural disorders for the society and the newly emerged genetics, systems biological, optical and imaging technologies. For example, they helped to identify the mechanisms of spatial memory, for which the 2014 Nobel prize was awarded. The objective of human biology education is the temporal (ontogeny, evolution, secular trends, biological reconstruction of past populations) and geographical (population differences, geographical variations, haplotypes) diversity in the development and morphology of the human body, and the understanding of abnormalities in the structure and function of the human body.

TEACHING CONTENT

The specialization offers a complex approach by ranging from cellular systems to animal models. The practical education is emphasized by participating in research laboratories, for example as part of the course **Methods in Neurophysiology**, or practicing and understanding the writing of scientific grant proposals during the **Research Methods** course. The major courses offered in the specialization are the following:

Regulatory Biology: The basics and novel progress are presented in the field of cellular, hormonal and neuronal regulations. This course provides basic knowledge necessary to understand other facultative subjects.

Cellular Neurophysiology: Cellular aspects of neurobiology – including an overview on neurogenesis, axon-dendrite specification, synaptic structure and functions, intracellular transport, neuronal plasticity – are discussed based on recent scientific review papers.

Behavioural Physiology: Regulatory control of behaviour and its physiological background is the topic of the course. The subject is presented and discussed using modern optogenetics and imaging techniques used in recent major scientific papers.

Neurochemistry: Overview of the basic mechanisms, function and communication of chemical synapses. The major neurotransmitter systems of the central nervous system are also described in detail.

Human growth and development: The course summarizes the main processes of prenatal and postnatal development, from the proontogenesis through fertilisation to the development of human organs and organ systems.

Paleopathology: The course will introduce students to the aim of study ancient diseases and how to recognize the paleopathological alterations. Sources, difficulties, and limits of paleopathology are presented based on recent scientific papers.

Human evolution: The aim of the course is to present general characteristics and taxonomy of primates based on anthropological and genetic results. Primate and human evolution, including appearance and migration, are discussed considering the fossils and the newest genetic results.

Physical anthropological research methods: Within the course, the classical anthropological methods are presented in practice. The interdisciplinary approaches (stable isotope analysis, archaeogenetic) and their potential in bioarchaeology is also discussed.

RESEARCH PERSPECTIVES

The Department of Physiology and Neurobiology includes the Neuronal Cell Biology Laboratory, which aims to identify the molecular mechanisms behind memory problems or posttraumatic stress disorder (PTSD) using fluorescent live cell imaging in cultured neurons in combination with molecular biological and optogenetical tools, as well as electrophysiology and behavioural analyses. The Molecular and Systems Biology Laboratory investigates the molecular and neuronal network level of controlling the social behaviours using system biological methodology, neurogenomics, and chemogenetics. The Microelectrophysiological Laboratory analyse the background of normal and pathological synchronized rhythmic activity *in vivo* and in brain slices. The main research field is to study sleep processes and epileptiform seizure activity. The Neurochemical Research Laboratory investigates the molecular mechanisms of neurodegenerative and psychiatric diseases via basic and translational studies. All labs of the department take part in Neurotoxicological investigations with their special methodology. First of all, the effects of toxins of microscopic fungi and also insecticides on mammalian nervous system is analysed.

The current research topics of the Department of Biological Anthropology address normal temporal and spatial development of the human body including e.g. ontogenesis, evolutionary changes, population differences, geographical variations, as well as appearing structural and functional abnormalities.

TEACHERS AND RESEARCHER

Department of Physiology and Neurobiology

László Détári investigates the mechanisms of sleep and circadian rhythms by using *in vivo* electrophysiological approaches.

Árpád Dobolyi's research field is the molecular and neuronal networks underlying social behaviour, which is addressed with molecular biological, neurogenimical, as well as ckemogenetical techniques.

Katalin Schlett's research interest is the transport of neuronal cell surface receptors and ion channels as well as key molecular regulators of neuronal plasticity. Investigations are carried out in primary mouse neuronal cell cultures and in transgenic mice.

Ildikó Világi, Head of the Department of Physiology and Neurobiology, investigates the background of synchronized rhythmic neuronal activities, epilepsy and neurotoxicology.

Department of Biological Anthropology

Tamás Hajdu performs physical anthropological research and biological reconstruction of past populations of the Carpathian Basin with special regard to the origin and continuity of prehistoric and Migration Period populations.

Krisztina Takács-Vellai, Head of the Department of Human Biology, works in the field of human and animal molecular genetics and investigates the biological function of tumor genes using cell lines and human serum samples.

Annamária Zsákai examines the growth pattern of children with hypothyroidism, the relationship between vitamin D supply and body structure parameters in children, and age changes and sexual dimorphism in basal metabolic rate.

CAREER OPPORTUNITIES

Knowledge obtained in the specialization enables students to medical-biological research as well as to work in research and development divisions of companies ranging from innovative start-ups to big pharma. After getting their MSc degree, students can start a PhD training, including our Neurobiology Program as well. Neuroscience is a prosperous field exemplified by the National Brain Program in Hungary, a framework and grant system, which allowed funding of hundreds of researchers recently in Hungary. Developing drugs acting on the central nervous system is a key aim of Hungarian pharmaceutical companies, providing a possibility to students to join following their neuroscience education. In addition, a number of smaller companies engaged in diagnostics and biotechnology are eager to employ researchers with a neurobiology background. The MSc students in human biology specialization can start their careers in Hungarian and foreign museums handling anthropological collections, as well as in forensic, epidemiologic and higher educational institutions.