Curriculum vitae

Personal data

Name: **István Fodor**
Date of birth: Ajka, 1993. 02. 19.
Mailing address: 8237 Tihany, Klebelsberg K. str. 3.
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Workplaces

From 2021: **Ecophysiology and Environmental Chemistry Research Group (ELKH BLRI)**
2015-2021: **NAP Adaptive Neuroethology Research Group (CER BLI)**

Projects:

1. Identification of anthropogenic contaminants in Lake Balaton and its catchment area and investigation of their effects on aquatic invertebrates and lower vertebrates with a "top-down" approach
2. Progestogen-induced alterations in the neuroendocrine- and reproductive system of the great pond snail (*Lymnaea stagnalis*)
3. Cellular and molecular mechanisms of age-related changes in a defined simple neuronal network encoding associative memory

Education

- From 2018 **Doctoral School of Biology and Sport Biology (PhD programme)**
  Faculty of Science, University of Pécs (Pécs, Hungary)
- 2015-2018 **Biology MSc (Molecular biology specialization)**
  Faculty of Science, University of Pécs (Pécs, Hungary)
- 2011-2015 **Biology BSc**
  Faculty of Science, University of Pécs (Pécs, Hungary)

Spoken languages

English (complex, B2), German (complex, B2)

Research and areas of interest

Invertebrate neuroscience (neurophysiology, neuroendocrinology, learning and memory), Cellular and molecular mechanisms of cognitive ageing, Chemical-ecology (adaptation mechanisms), Molecular biology, Bioinformatics, Analytical chemistry

Educational activity

- 2013-2016: Scientific demonstrator in the Institute of Biology of University of Pécs (Biochemistry practice, Basic Biology practice)
- 2018-: Lecturer in the Doctoral School of Chemistry and Environmental Sciences of University of Pannonia

Study trips

- 2021 September 20-October 08: Bordeaux School of Neuroscience (Bordeaux, France) – Cajal Advanced Neuroscience Training - Ageing cognition
- 2020 February 10-20: Vrije Universiteit (Amsterdam, the Netherlands) - Dr. Joris M. Koene

Academy awards

- **2020**: "VEAB - Outstanding young researcher" (Hungarian Academy of Sciences)

Scholarships, fundings

- **2022**: Stephen W. Kuffler Research Scholarship (Stephen W. Kuffler Research Foundation): PhD Scholarship: István Fodor; 1 900 €
- **2021**: Publication Scholarship (PTE/127258-11/2021; University of Pécs): PhD scholarship; István Fodor; 200 €
- **2021**: László János Doctoral Scholarship (498/2021/PTE DOK; University of Pécs): PhD scholarship; István Fodor; 12 months; 1 300 €
- **2021**: Hungarian Scientific Research Fund (138039; National Research, Development and Innovation Fund): Research grant (PI: Dr. Zsolt Pirger); participant; 48 months; 110 000 €
- **2021**: Scholarship for National Young Talents (NTP-NFTÖ-21-B-0212; EMET): PhD scholarship, István Fodor; 2300 €
- **2021**: Institutional professional and scientific scholarship (125/2021/PTE DÖK; University of Pécs): PhD scholarship; István Fodor; 330 €
- **2020**: Cooperative Doctoral Programme for Doctoral Scholarships (KDP-2020-1018493; National Research, Development and Innovation Fund): PhD scholarship; István Fodor; 24 months; 55 000 €
- **2020**: New National Excellence Program (ÚNKP-20-3-II-PTE-888; National Research, Development and Innovation Fund): PhD scholarship; István Fodor; 12 months; 4 000 €
- **2020**: Publication Scholarship (PTE/ 82780-9/2020; University of Pécs): PhD scholarship; István Fodor; 230 €
- **2020**: Institutional professional and scientific scholarship (84/2020/PTE DOK; University of Pécs): PhD scholarship; István Fodor; 250 €
- **2017**: National Brain Project 2.0 (2017-1.2.1-NKP-2017-00002; National Research, Development and Innovation Fund): Research grant (PI: Dr. Zsolt Pirger); participant; 48 months; 350 000 €
- **2015**: Kriszbacher Ildikó Scholarship (University of Pécs): graduate student scholarship; István Fodor; 12 months; 1 000 €

Memberships

Society of Hungarian Biochemistry; Endocrine Society; Society of Hungarian Ecotoxicology; Hungarian Neuroscience Society; Federation of European Neuroscience Societies

Top 5 publications

Fodor I, Svigruha R, Bozsó Z, Tóth G, Osugi T, Yamamoto T, Satake H, Pirger Z. *Sci Rep* (2021) 11:10028 (**D1, IF_{2020}: 4.37**)

Fodor I, Svigruha R, Kemenes G, Kemenes I, Pirger Z. *J Gerontol A* (2021) 76:975-982 (**D1; IF_{2020}: 6.05**)

Fodor I, Zrinyi Z, Horvath R, Urban P, Herczeg R, Buki G, Koene JM, Tsai PS, Pirger Z. *Gen Comp Endocrinol* (2020) 299:113621 (**Q1; IF_{2020}: 2.82**)

Fodor I, Urban P, Scott AP, Pirger Z. *Mol Cell Endocrinol* (2020) 516:110949 (**Q1; IF_{2020}: 4.10**)

Fodor I, Hussein AAA, Benjamin PR, Koene JM, Pirger Z. *eLife* (2020) 9:e56962 (**D1; IF_{2020}: 8.14**)

Collaborators

- From 2017: Genomics and Bioinformatics Core Facilities, University of Pécs, Hungary **– Mr. Peter Urbán; Mr. Bence Gálik**
- From 2017**:** Department of Ecological Science, VU Amsterdam, the Netherlands – **Dr. Joris M Koene**
- From 2018: Integrative Physiology, University of Colorado Boulder, the USA – **Prof. Pei-San Tsai**
- From 2019: Centre for Environment, Fisheries and Aquaculture Science, the UK – **Prof. Alexander P. Scott**
- From 2020: Sussex Neuroscience, University of Sussex, the UK – **Prof. George Kemenes, Prof. Paul R. Benjamin; Prof. Ildikó Kemenes**
- From 2020: Bioorganic Research Institute, Suntory Foundation for Life Sciences, Japan – **Prof. Honoo Satake; Dr. Tomohiro Osugi**

Research interest

My main scientific interest revolves around invertebrate neuroscience and neuroendocrinology. During my PhD work, I focus on two research themes. First, I investigate the effects of progesterone-type oral contraceptive residues (progestogens) present in the global environment on the aquatic ecosystem. Second, I examine the cellular and molecular mechanisms underlying cognitive ageing.

I perform my experiments using the great pond snail (*Lymnaea stagnalis*) which has been used extensively as a neuroscience model animal for over 50 years. This mollusc with a simpler nervous system exhibits defined behaviours, similar to the ones in vertebrates, such as feeding, locomotion, respiration, risk-taking, and learning. Furthermore, the neuronal mechanisms responsible for developing behavioural patterns are also similar to that of vertebrates. At the same time, these 'brain' processes in *Lymnaea* – due to the advantages of its central nervous system (e.g., relatively low number of neurons) – can be investigated easier in many ways than in vertebrates. Hence, *Lymnaea* provides a great opportunity 1) to investigate the neuronal and neuroendocrinological underpinnings of the behavioural alterations caused by progestogens as well as 2) to identify the molecular mechanisms of cognitive ageing.

During my work, I identified the coding sequence of the gonadotropin-releasing hormone/corazonin neuropeptide in *Lymnaea* and demonstrated that – although it plays a role in reproduction – it is a multifunctional peptide. I investigate the presence of genes involved in the *de novo* synthesis and receptor-mediation of sex steroids in molluscs in general. I demonstrated that genes for two key enzymes (CYP11A and CYP19A) of the sex steroidogenesis pathway, as well as for functional nuclear sex steroid receptors, are not present in the molluscan genomes. However, there are membrane receptor homologs, but their steroid-binding ability has not yet been investigated. I also examined the presence of the genes involved in the *de novo* synthesis and receptor-mediation of sex steroids specifically in *Lymnaea*. In doing so, I identified several new genes and confirmed the findings obtained in molluscs in general. My results have contributed to the functional and evolutionary understanding of the neuroendocrine and reproductive systems of molluscs and to the mapping of the adaptation mechanisms of aquatic organisms to drug residues of human origin.

Due to the complexity of central nervous system, the study of ageing processes in vertebrates is not an easy task at the level of neural circuits and individually identified neurons. As a result, ageing research heavily relies on invertebrate model organisms. Although many age-related findings have been obtained for *Lymnaea* over the years at the level of neural circuits and associated behaviours, the underlying detailed molecular mechanisms had not yet been studied in the absence of sequences of evolutionarily conserved, relevant key molecules. To make this possible, I identified a number of evolutionarily conserved sequences in *Lymnaea*

to genes that are associated with the ageing of vertebrates or the development of human neurodegenerative diseases (e.g., Parkinson's, Alzheimer's, and Huntington's disease). We hypostatize that the proteins encoded by these sequences are involved in age-related impairments of learning mechanisms in *Lymnaea* by targeting the identified components (e.g., NMDA receptor) of the signalling pathways of LTM formation. Furthermore, we propose that their effects may be exerted at the level of transcriptional regulation of some of the key molecules involved in LTM formation and that some of the newly described sequences could also be transcriptionally regulated in an age-dependent manner. Using transcriptomic and proteomic approaches, our research group demonstrated several cellular- and molecular differences between the central nervous system of young and old snails. The identified changes at the system level may play a role in ageing and age-related memory impairment. Currently, we are investigating the molecular mechanisms underlying cognitive ageing at the singe-cell level and working on the development of the CRISPR/Cas9-mediated gene modification method for *Lymnaea* to slow down age-related memory impairment by genetically manipulating the evolutionarily conserved genes.