

Institute of Environmental Sciences

Topic: Avian energetics under the influence of the microbiome

Name of supervisors: dr. hab. Ulf Bauchinger, dr. Edyta T. Sadowska

ulf.bauchinger@uj.edu.pl

Background information:

Gut microbiota are increasingly recognized as critical to the performance and fitness of their hosts. However, we are only starting to unveil the actual impact of microbiota on physiology and the underlying mechanisms that affect host fitness (Waite and Taylor 2015, Grond et al. 2018, Videvall et al. 2018). A qualitative and quantitative influence of the microbiome on the host metabolism and the immune system is deduced, but not well established. Aves are a diverse and evolutionarily successful taxon that hosts a diverse community of microbes. Their high aerobic performance and their relatively high resting metabolism when compared to mammals makes birds an attractive system for the study of the link between the gut microbiota, the energy metabolism and the immune system.

The main question to be addressed in the project:

The student will qualify and quantify the impact of the microbiota on the different properties of avian metabolism (ranging from resting metabolism, over short peak performances to sustained higher energy demands), on the maintenance and acquisition of immunity. Particularly, this research will centre around the question of how the gut microbiota modulate trade-offs in energy allocation between competing demands like physical activity and mounting an immune response.

Information on the methods/description of work: T

he student will perform basic measurements of avian metabolism at rest, at short performance bouts and sustained elevated energy use through respirometry, determination of the energy assimilation through quantification of the eaten food and faeces energy content. Immunological tests will be performed to quantify the immune response. These measurements will be combined with the characterization of microbiome through 16S rRNA sequencing of cloacal swaps and faeces.

Following the initial description of the great tit (*Parus major*) microbiota (annual cycle and the associated specific activities) the student will perform manipulations of the metabolism and the birds condition (through ambient temperature, physical activity, or dietary manipulations) to test for effects on the gut microbiota and their contribution to changes in metabolism and immune function.

Additional information:

The successful candidate will have a M.Sc. degree in a relevant field by September 2020, is eager to learn new methods, and has strong communication skills and strong English language.

Potential foreign collaborator: dr. Michal Vinkler, Charles University, Prague, Czech Republic

References:

- Grond, K., B. K. Sandercock, A. Jumpponen, and L. H. Zeglin. 2018. The avian gut microbiota: community, physiology and function in wild birds. *Journal of Avian Biology* **49**.
- Videvall, E., M. Strandh, A. Engelbrecht, S. Cloete, and C. K. Cornwallis. 2018. Measuring the gut microbiome in birds: Comparison of faecal and cloacal sampling. *Mol Ecol Resour* **18**:424-434.
- Waite, D. W., and M. W. Taylor. 2015. Exploring the avian gut microbiota: current trends and future directions. *Frontiers in Microbiology* **6**.