

Institute: Environmental Sciences

Topic: The effects of energy availability on pace of life and microbiome of bank voles

Name of supervisor: Paweł Koteja, Anni Hämäläinen

Background information:

Acquiring energy from the environment is fundamental for the reproduction and survival of all organisms and animals have evolved many ways to gain energy. The community of microbes inhabiting the animal intestine (gut microbiota) has coevolved with animal hosts and participates in the critical task of extracting energy from food eaten by the animal (e.g. by producing different short-chained fatty acids). The microbiota can thus be especially important in matching the energy requirements of the animal with the resource availability in its environment. Coping with limited resources should depend on both the animal's metabolic demands and the efficiency of the gut microbes to extract energy from food. To test this idea, we study the effects of food manipulations at different life stages on the life history, physiology, and gut microbiome of animals from a unique experimental evolution model system: selection lines of a non-laboratory rodent, the bank vole (*Myodes glareolus*), selectively bred for a high metabolic rate and unselected control lines.

The main question to be addressed in the project:

Does the microbiome mediate the effects of energy availability on the fitness of individuals with different energetic needs?

Information on the methods/description of work:

- Analysing the gut microbiota (by sequencing a region of the 16S-gene to identify bacterial taxa) using existing samples.
- Conducting bioinformatics and statistical analyses.
- Participating in method validation and applying short-chained fatty acid analyses of fecal samples.
- Participating in food manipulation experiments with captive voles in Krakow.
- Taking physiological measurements, monitoring life history traits (e.g. pup growth, reproductive success), conducting dissections, collecting biological samples.
- Presenting work at local and international conferences and preparing publications in close collaboration with an international team.

The enrollment to this project is based on special rules. The deadline for application is August 16. Details of the application procedure is described [here](#).

Additional information (e.g. Special requirements from the student):

Requirements:

- MSc degree in a relevant field of life science, such as biology, molecular biology or ecology, achieved by the time of enrollment;
- evidence of good quantitative/computational skills;
- strong English language, communication, organizational and collaboration skills;
- experience with molecular laboratory analyses and bioinformatics.
- Previous experience with analyses of microbial communities, working on small mammals, animal physiology and/or evolutionary biology are considered advantageous.

An National Science Centre stipend (4500 PLN/month gross) is available for one student for 2.5 years, followed by 1.5 years of the stipend offered through the regular PhD program of the Jagiellonian University.

Place/name of potential foreign collaborator:

University of Jyväskylä, Finland (Prof Phillip Watts, Dr Tapio Mappes, Dr Esa Koskela)

References:

Kohl, K. D., Sadowska, E. T., Rudolf, A. M., Dearing, M. D., & Koteja, P. (2016). Experimental evolution on a wild mammal species results in modifications of gut microbial communities. *Frontiers in microbiology*, 7, 634.

Sadowska, E. T., Stawski, C., Rudolf, A., Dheyongera, G., Chrzęścik, K. M., Baliga-Klimczyk, K., & Koteja, P. (2015). Evolution of basal metabolic rate in bank voles from a multidirectional selection experiment. *Proceedings of the Royal Society B: Biological Sciences*, 282(1806), 20150025.

Zilber-Rosenberg, I., & Rosenberg, E. (2008). Role of microorganisms in the evolution of animals and plants: the hologenome theory of evolution. *FEMS microbiology reviews*, 32(5), 723-735.