**Institute** of Environmental Sciences

**Topic: Physiological limits in vertebrates**

**Supervisors:** Dr. Edyta Sadowska and Dr. hab. Ulf Bauchinger

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**Background information:**The main interest of the project is to understand how animals keep their heat balance, how maintenance of the heat balance is affected by the ageing process, and how dissipation of heat may set limits for animal performance (HDL theory, Speakman and Krol). We use two animal models with opposing strategies of maintenance of heat balance during reproduction. The incubation of eggs represents an important period during which birds voluntarily generate a lot of heat, whereas heat is produced as a by-product during the mammalian milk production during lactation period. In both cases, uncoupling processes play a key role in keeping heat balance, but in birds these are rather increased while in mammals they need to be decreased. These effects are likely even more pronounced with increasing age. Older animals are known to show an impaired ability to maintain thermal balance compared to young adults, and also the reproductive success is lower in old animals in comparison with young adults.

The prospective student will have the opportunity to conduct a project on laboratory mice with ablation of uncoupling protein in Sweden with cooperation with Jan Nedergaard (Department of Molecular Biosciences, The Wenner-Gren Institute).

**The main question to be addressed in the project: I**s HDL theory responsible for age-dependent decline inreproductive output of small vertebrates?

**Information on the methods/description of work:**We will measure components of energy budgets in an experiment with manipulation of heat dissipation capacityperformed on differently aged animals.Wewill use unique mammalian model: a strain of laboratory mice with ablation of UCP1; and also two avian model species: great tits in the field and zebra finches in the laboratory.

**Additional information:** The student can receive a 24-month tax-free stipend from the National Science Centre (NCN) grant, expected at 3000 PLN per month, and a supplement to attend conferences and travel for field work – separate competition according to NCN rules.

**Place/name of potential foreign collaborator:** Jan Nedergaard, Stockholm University, Sweden.

**References:**

Sadowska, E. T., E. Krol, K. M. Chrzascik, A. M. Rudolf, J. R. Speakman, and P. Koteja. 2016. Limits to sustained energy intake. XXIII. Does heat dissipation capacity limit the energy budget of lactating bank voles? Journal of Experimental Biology.

Grémillet, D., L. Meslin, and A. Lescroël. 2012. Heat dissipation limit theory and the evolution of avian functional traits in a warming world. Functional Ecology 26:1001-1006.

Speakman, J. R., and E. Król. 2010. Maximal heat dissipation capacity and hyperthermia risk: Neglected key factors in the ecology of endotherms. Journal of Animal Ecology 79:726-746.