

Ph.D. project: **Comparing life-history trade-offs between fat-and food-storing hibernating species**
(Supervisor: C. Habold, DEPE-IPHC, 23 rue du Lœss, 67037 Strasbourg
In collaboration with S. Giroud, University of Veterinary Medicine Vienna).

This project will aim at comparing the energetics and the dynamic of telomere length during winter hibernation and subsequent reproductive success between fat-storing and food-storing hibernators. Fat-storing hibernators do not feed during the entire winter and largely rely on their body fat stores during hibernation. They stay most of the time torpid and spend very little time in euthermy during their inter-bout arousals (usually < 20h). This is the case of dormice and some ground squirrel species. Conversely, food-storing hibernators hardly show any significant fat accumulation prior to winter (sometimes even shrunken their body) and instead feed during their long (>24h, could also be days) inter-bout arousals to sustain their hibernation over winter. Examples are the Syrian hamster, the European hamster and chipmunks. Also, reproductive strategies might differ between fat-storing and food-storing hibernators. Food-storing hibernators emerge from hibernation in better body conditions than fat-storing animals, which have to replenish body reserves before starting reproducing. Given the contrasting hibernating behavior between these two types of species, one might expect differences in energy expenditure, body condition, oxidative balance, dynamic of telomere length and subsequent reproductive success. Based on our previous results, we specifically hypothesize that food-storing hibernators that spend more time in euthermy will shorten their telomeres to a greater extent and have a lower reproductive success compared to fat-storing individuals, which spend more time in torpor during winter. Further we expect the maintenance of the digestive function in food-storing animals to negatively impact the dynamic of telomere length over winter.

The study will be performed on two fat- (the Garden dormouse and the Columbian ground squirrel) and two food-storing species (the European hamster and the Siberian chipmunk). The laboratory has access to captive-bred animals (in Strasbourg and in Vienna) except for the Columbian ground squirrel. This latter is studied in the wild since many years by the DEPE and data on the life-history traits of individuals are available as well as blood and buccal swabs' samples. The experiments will consist in characterizing the hibernation behavior of these species using data loggers for body temperature and activity, food intake in food-storing hibernators, energy expenditure through respirometry. The reproductive success will be recorded (breeding occurrence, size and mass of litters, pups' body condition and rate of growth) according to the different hibernation strategies. Finally, the individual costs of hibernation and reproduction will be evaluated through measurements of body condition by bio-impedance spectroscopy and of changes in telomere length. All these techniques are routinely used in the two laboratories and have already been established on these species. These data will bring new knowledge on the physiology of hibernation and will contribute to develop the field of evolutionary biology.

Time schedule: 1st year, October-June: experiments on European hamsters during hibernation and reproduction. In parallel, analysis of data already collected on garden dormice and Columbian ground squirrels. 2nd year, October-June: experiments on Siberian chipmunks during hibernation and reproduction. August-December: telomere analysis on all the samples. 3rd Year: data analysis and redaction.

The candidate must have a strong knowledge in physiology and evolutionary biology. To obtain the Ph.D. grant, he/she will have to candidate at the doctoral school contest in Strasbourg in July 2018. In that aim, the candidate must belong to the 1st quarter of his/her Master's degree and have obtained more than 14,5/20 during the 1st year of Master's degree.

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