The Centre for Fish and Wildlife Health at the University of Bern invites applications of prospective master students starting ~ June 2021 (flexible)

MASTER THESIS

Environmental biology of gametogenesis in wild and domesticated zebrafish

Background:

The Zebrafish (Danio rerio) has become one of the most popular animals in laboratory research worldwide. Routinely used strains, however, differ from their wild counterparts as a result of over 150 generations of domestication. For instance, laboratory zebrafish appear to have lost the genetic architecture for sex determination, resulting in sexual development that is determined strongly by the environment (Kossack and Draper 2019). Other possible differences relating to reproduction remain unclear, but are important for evaluating the continued usefulness of the zebrafish model, particularly in reproductive biology.

The dynamics of gametogenesis (the process of egg or sperm production) pose one such area of intrigue. Laboratory zebrafish can spawn all year round, and their duration of spermatogenesis (sperm production) is among the fastest in all vertebrates, at just six days (Leal et al. 2009). In the wild, spawning is confined to an annual breeding season (although wild-caught fish readily breed in the laboratory) and it is not known whether the rapid spermatogenesis represents a conserved trait. Meanwhile, the relative impact of stressors such as temperature or hypoxia, which fluctuate considerably in the wild but not in the lab, on the speed and quality of gametogenesis have not been compared between wild and laboratory strains.

Project Outline and Techniques:

In this project, the candidate will learn and apply histological techniques to investigate genetic and environmental influences on gametogenesis. Using a synthetic nucleoside, BrdU, combined with antibody-based staining and histological evaluation of gametes (Leal et al. 2009; Rossteuscher et al. 2008), the candidate will track the rate of spermatogenesis and / or oogenesis in real time in response to hypoxia and in both wild and domesticated strains. Other reproductive parameters, such as fecundity and fertility, could also be measured to provide deeper insight into the reproductive consequences of environmental exposures. The Centre for Fish and Wildlife Health (FIWI) has ample experience in characterizing fish gametogenesis in response to environmental stressors (Burkina et al., 2016; Steinbach et al., 2019), and has excellent histology facilities available.

The project will enhance our understanding of the effect of domestication on reproduction and the potential vulnerability of wild fish reproduction to hypoxic conditions. Determining the pace of gametogenesis in wild vs domestic zebrafish will also provide a valuable resource for the community to facilitate future comparative studies of fish reproduction.
Team:
You will join a group of enthusiastic researchers working on diverse aspects of fish health, ecology and evolution. Please email an application package (CV, motivation letter, and certificates) in PDF format to Professor Irene Adrian Kalchhauser (irene.adrian-kalchhauser@vetsuisse.unibe.ch) and Dr James Ord (james.ord@vetsuisse.unibe.ch) with the subject title "Fish gametogenesis" by 31.03.2021. For additional information about the project, please contact James Ord via email.

Earning options:
From time to time, student jobs are available at the FIWI. Kindly enquire with Professor Adrian-Kalchhauser for more information.

City of Bern:
The University of Bern is closely associated with the Swiss capital city of Bern. Located on the bend of the River Aare, the city is the country’s political center and a popular tourist destination. Academic excellence has earned Bern an international reputation. A large variety of education, sport and cultural opportunities as well as high living and environmental standards make Bern an attractive place for students and researchers.

References:


Rossteuscher, Stefanie; Schmidt-Posthaus, Heike; Schäfers, Christoph; Teigeler, Matthias; Segner, Helmut (2008): Background pathology of the ovary in a laboratory population of zebrafish Danio rerio. In Diseases of aquatic organisms 79 (2), pp. 169–172. DOI: 10.3354/dao01893.