



UNIVERSITÉ
SORBONNE
PARIS NORD



PhD position

Plastic sex allocation in hermaphrodites and beyond: oxytocin and social interactions across annelids' sexual systems

New application deadline: May 15th, 2025

Applications to: mariacristinalorenzi@gmail.com virginie.canoine@univie.ac.at

We are looking for a highly motivated and competent candidate for a 3-year PhD thesis at the Laboratoire d'Ethologie Expérimentale et Comparée - LEEC, Sorbonne Paris Nord University (Villetaneuse Campus, France) and at the Department of Behavioral & Cognitive Biology - BeCogBio, Vienna University (Austria) to study the role of oxytocin/oxytocin-like peptides in modulating social interactions and reproductive output in annelids with different sexual systems.

Background: Our understanding of the adaptive value of social behaviour, here defined in the broad sense of interactions between conspecifics, has a solid theoretical background; yet research on the mechanisms of social behaviour has proven challenging (Hofmann et al., 2014). Evidence has been accumulating in the last decades that Oxytocin (OT) or OT-like peptides play an important regulatory role in physiological and behavioural processes associated with social interactions, including cooperation, pair formation, parental care, etc. Typically, OT/OT-like peptides promote tolerance and bonding across vertebrate taxa, from mammals and birds to fish and amphibians (Donaldson & Young, 2008; Froemke & Young, 2021; Grinevich et al., 2021; Carter, 2022). Yet, OT-like peptides are evolutionarily well conserved - they appeared at least 700 million years ago – and have been detected in invertebrates (Donaldson & Young, 2008; Odekunle & Elphick 2020), where scanty evidence shows they play a role in egg-laying (Garrison et al., 2012; Oumi et al., 1996). Therefore, OT-like peptides are a candidate mechanism for investigating the hormonal control of social and reproductive behaviours in invertebrates.

Study models: Marine annelid worms of the genus *Ophryotrocha* include species which exhibit a striking diversity in sexual systems: some species are simultaneous hermaphrodites, others are sequential hermaphrodites, yet others have separate sexes; however, all species need a partner to reproduce (i.e., hermaphrodites do not self). The hermaphroditic species have a plastic sex allocation which they vary with the social context, that is, they adjust their resource investment into a more female-biased or male-biased allocation depending on mating opportunity (typically, they exhibit a relatively more female-biased allocation with low mating opportunity - such as in pair - and move to a relatively more male-biased allocation with higher mating opportunity, e.g., Scharer 2009; Santi et al., 2018). These allocation adjustments are also expressed into striking changes in the quality of their social interactions, which vary from pair bonding and sophisticated form of cooperation (reciprocity in egg exchange, Picchi et al., 2018) to overt aggression and competition (e.g., Lorenzi et al., 2006; Santi et al., 2018).

Research question: The candidate will investigate the role of OT/OT-like peptides on social interactions and reproductive outcomes in three species of the genus *Ophryotrocha* with different sexual systems (*O. diadema*, *O. puerilis* and *O. labronica*, which are simultaneous hermaphrodites, sequential hermaphrodites and separate-sexes, respectively) and will quantify OT and OT-like peptides and other potential candidate hormones using state-of-the-art methods. These data will offer valuable information on the role(s) of OT-like peptides in mediating social interactions in invertebrates and along the evolutionary transition from hermaphroditism to separate sexes, that is, along a gradient of increasingly important behavioural, physiological and hormonal sexual specialization.

Candidate: We are seeking a creative and motivated candidate with a Master in ethology, behavioural sciences or a related field, with experience in behavioural observations and animal experimentation and good statistical bases (preferably using R). The candidate should have very good English communication skills (min. B2); proficiency in French is not required.

Supervision: Joint supervision by Prof. Maria-Cristina Lorenzi (Laboratoire d’Ethologie Expérimentale et Comparée - LEEC, Sorbonne Paris Nord University, Campus Villetaneuse, France) and Dr. Virginie Canoine (Department of Behavioral & Cognitive Biology - BeCogBio, Vienna University, Austria).

The successful candidate will perform behavioural experiments at the LEEC, USPN (located at Villetaneuse, France) and hormone quantification at the BeCogBio (Vienna University, Austria).

The [LEEC](#) is a laboratory investigating different questions on social behaviour across different animal models. The LEEC worm lab hosts *Ophryotrocha* worm species with different sexual systems: simultaneous and sequential hermaphrodites and separate sexes. Being almost microscopic but easy to handle, these worms are ideal model systems for the study of the effects of the social environment on sex allocation.

The [BeCogBio](#) focuses on behavioural and cognitive traits from the multiple perspectives of mechanism, function, development and evolutionary history. This international and interdisciplinary research centre studies the endocrine and genetic control of behaviour, the influence of ecological and environmental factors on behavioural phenotypes under controlled lab- and ecologically valid field conditions.

Application procedure: Applicants should send their 1) CV; 2) motivation letter; 3) recommendation letters by referees; and 4) a written project (no more than 4 pages, including references) in a single PDF file, to mariacristinalorenzi@gmail.com and virginie.canoine@univie.ac.at by **15/05/2025 at the latest**.

The chosen candidate will then apply with his/her project to the Ecole Doctorale Galilée (Université Sorbonne Paris Nord, Villetaneuse, France) for the funding of a 3-year contract. Candidates should be willing to come in person to LEEC (USPN) for the interview by the “Ecole Doctorale” mid-June 2025. The thesis will start in September 2025.

References:

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