

Master's thesis / Stage MASTER 2, Université Sorbonne Paris Nord, Villetaneuse

ANNÉE 2023-2024

Maternal age effects on offspring personality and stress neuroendocrinology in the mound-building mouse

25 September 2023

Host institution

Laboratoire d'Ethologie Expérimentale et Comparée UR 4443 / LEEC, Université Sorbonne Paris Nord - Campus Villetaneuse, Website: <http://leec.univ-paris13.fr/>

Supervision of internship

Heiko G. Rödel (Professeur) ; <https://scholar.google.de/citations?user=CYj8VnoAAAAJ&hl=en>

Cédric Zimmer (Maitre de Conférences) ; <https://scholar.google.de/citations?hl=en&user=S9M1iHkAAAAJ>

Project description

Maternal effects occur when non-genetic characteristics of the mother affect the offspring phenotype. One of these characteristics can be mothers' age. Maternal age effects on offspring traits such as on growth, health, survival or reproductive success are well established. However, maternal age effects on offspring behavioral phenotype have rarely been studied. The mound-building mouse (*Mus spicilegus*) is an interesting model to study such effects, as under natural conditions two distinct cohorts of primiparous mothers of old and young age emerge. On the one hand, as reproduction is typically paused during the winter, overwintering juvenile females start giving birth in spring at an age of around 8 months. On the other hand, females born and maturing during the same breeding season start reproducing at young age of around 3 months.

Research questions and predictions: In this laboratory-based study, we will investigate the effects of maternal age on the emergence of offspring personality in the mound-building mouse. Maternal effects can be subject to natural selection, acting to adaptively shape offspring phenotype to the prevailing environment. Accordingly, the emergence of more proactive phenotypes in offspring born during the early breeding season, which will start reproducing within the same season at young age, may be selected for. Thus, we hypothesize that maternal age, which is strongly related to seasonality under natural conditions, may be an important contributor to offspring personality. In accordance with this assumption, we would predict that offspring from older mothers will be more proactive and exploratory. Indeed, preliminary findings from our group point towards a higher exploration tendency in offspring from old compared to young mothers. Furthermore, we will study whether offspring from old and young mothers will also differ in personality-related parameters of stress neuroendocrinology.

Methods: Personality types of juvenile mound building mice born to young mothers (around 3 months old) and to old mothers (around 8 months old) will be determined by repeated standardized behavioral tests at different ages (vocalization responses after maternal separation, behavior in open field and novel object settings). Furthermore, HPA axis activity will be assessed via corticosterone metabolite concentrations in feces by ELISA, and in terms of glucocorticoid receptor expression in the brain by qPCR. The candidate will carry out and learn the following procedures: behavioral experimentation, analysis of video recordings with specific software (BORIS, ICY Image Analysis), physiological (ELISA) and genetic (qPCR) analysis, statistical analysis of the data.

Candidate: We are looking for a highly motivated student of animal behavior/behavioral ecology/ethology or from a related discipline, preferably with experience in animal experimentation. Applied knowledge of statistics, e.g., with the program R, will be advantageous. The working language will be English or French, i.e., candidates without any knowledge of French are welcome to apply.

The project will preferably start in January 2024, for a period of around 5 months. Interested candidates should contact us as soon as possible. We will pay a financial compensation ("gratification") for the duration of the project, according to French law.

Contact: Prof. Heiko G. Rödel, LEEC; Email: heiko.rodel@univ-paris13.fr

Laboratoire d'Ethologie Expérimentale et Comparée UR 4443, Université Sorbonne Paris Nord, F-93430 Villetaneuse

MASTER 2 Recherche Éthologie fondamentale et comparée

PROPOSITION DE STAGE - ANNÉE 2023-2024

In English : Alarm communication in termites

En français : La communication d'alarme chez les termites

RENSEIGNEMENTS SUR L'INSTITUTION D'ACCUEIL

Laboratoire : LEEC

Responsable : Heiko Rödel

Organisme de rattachement : Université Sorbonne Paris Nord

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RENSEIGNEMENTS SUR L'ENCADRANT

Nom, prénom : David Sillam-Dussès

Emploi et fonctions : MCF

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RENSEIGNEMENTS SUR LE SUJET (1 page maximum)

Termites have evolved specialized defensive strategies for colony protection. Among them is the alarm communication which enables workers to escape threats while soldiers are recruited to the source of disturbance. Alarm communication may be performed by vibroacoustic and chemical alarm signals. The vibroacoustic signals act as either short-range (tactile) signals or long-range signals perceived by distant nestmates through the subgenual organ. The chemical alarm signals are transmitted through the release of a volatile substance, an alarm pheromone, which warn conspecifics of danger. In spite of the crucial importance of alarm communication for termite colony survival, only fragmented reports have hitherto been published about this topic, most of which focused on either vibroacoustic or pheromonal communication of isolated species. The evolutionary trajectories of alarm signals, and their significance within complex ecological constraints across extant termite lineages, has been investigated only very recently (Sillam-Dussès et al. 2023) but still many more termite species belonging to different families and with different ecological features are missing in this study. We do not even know if these species use alarm pheromone and/or alarm vibrations for alarm communication. To fill this gap, we have recorded behavioral reactions of these termite species to different stimuli but the videos remain to be analyzed. The purpose of this internship is to analyze the videos for the presence/absence of alarm pheromone and presence/absence of alarm vibrations by measuring the difference of locomotion speed of some workers and soldiers chosen randomly before and after the stimulus application (flash of light, crushed worker head, crushed soldier head).

Reference : Sillam-Dussès D, Jandák V, Stiblik P, Delattre O, Chouvenç T, Balvín O, Cvačka J, Soulet D, Synek J, Brothánek M, Jiříček O, Engel MS, Bourguignon T, Šobotník J. 2023. Alarm communication predates eusociality in termites. *Communication Biology* 6:83.