Research Group Prof. Dr. Dr. h.c. Onur Güntürkün

The following Master project proposals are from year **2024**. They are currently not available but can give you an impression which kind of projects are possible in the department of *Biopsychology.*

Master Project 1: Novel object recognition in pigeons

Being able to distinguish between novel and previously experienced objects is a critical first step for many learning and memory processes. This can be difficult to assess in animals because cognitive processes can only be inferred through behavior. Novel objects can invoke fear or curiosity, since novelty could represent a new source of danger or resources necessary for survival. A behavioral paradigm to assess responses to novel objects has been established for mice and rats, but it has only recently been modified for pigeons. Preliminary behavioral results from pigeons did not show any conclusive evidence that pigeons show a consistent response to novel objects, but this may have been due to the size of the arena and limits in the responses available. The first part of this masters thesis would be conducting a modified novel object recognition task with pigeons. The second part of the masters thesis would be investigating the neural correlates of novel object recognition by staining for immediate early gene activity.

Supervision: Dr. Mary Flaim (Mary.Flaim@rub.de)

Master Project 2: Age related decline in perception and memory in pigeons

As we age, there is a decline in most cognitive abilities. This can be seen in the most fundamental aspects of cognition, namely perception, and more complex cognitive processes like stimulus-stimulus binding. This master thesis would investigate how these processes change with age in pigeons to assess their use as an animal model for human aging. While birds and mammals have physiological differences, there are similarities in the life-speed, cognitive abilities, and underlying neural correlates in pigeons and humans. This thesis would be a purely behavioral investigating age differences in the ability to distinguish perceptually similar stimuli and retain the memory of stimuli over a delay interval.

Supervision: Dr. Mary Flaim (Mary.Flaim@rub.de)

Master project 3: Spatial coding in the pigeon hippocampus

We are looking for students to participate in a study on spatial coding in the pigeon hippocampus. This study will combine behavioral experiments and electrophysiological recording to record hippocampal neurons in pigeons under free moving. In addition, the data obtained will be analyzed using MATLAB and Python to investigate the characteristics of the recorded neurons in detail. Knowledge of advanced electrophysiological methods and time series data processing is essential for this topic. Therefore, students who are willing to learn either one (Wet or Dry) or both (Wet & Dry) are suitable for this topic. Specifically, students are expected to acquire the following skills.

＜Wet Part>

- Basic handling of pigeons
- Basic understanding of electrophysiology
- Behavioral training of pigeons using custom made feeders
- Craniotomy and implantation of electrode devices using ketamine and isoflurane anesthesia
- Handling of 3D printed implantation devices
- Behavioral and electrophysiological experiments

<Dry Part>

- Basic understanding of neural signal data and time series data analysis
- Operation of wireless devices for recording electrophysiological data
- Programming, data processing, analysis, and statistical analysis using MATLAB and Python
- Handling of video data
- Improving recording and analysis using specialized software

The experimental methods used in this research continue to evolve and are improved through daily trial and error. The right student for this theme must be able to identify problems and persistently seek solutions.

Supervision: Dr. Sci. Masahiro Inda (masahiro.inda@rub.de)