

# Internship Proposal

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## **Project Title:**

Physiological and clinical monitoring of laboratory animals

## **Level:**

Master Student

## **Project Summary:**

We are looking for a Bioengineering, Medical Engineering or Electronic Engineering MSc student for a project centred on the development and testing of a device (based on an existing prototype) for maintaining and monitoring the temperature and clinical signs of laboratory animals. This device will have multiple applications, from helping the post-surgical recovery of mice, to providing a warm shelter to neonate mouse pups, and rescue animals from hypothermia.. The device will be designed to maintain a stable microenvironment and continuously acquire body temperature data through thermosensitive PIT tags.

Funding for the student will be sought from international grant schemes (e.g. UFAW)

## **Work to be developed by the student:**

The student will develop the thermal layer consisting of a conductive metal plate heated by a peripheral element limited to a maximum of 40°C, and implement real-time closed-loop temperature control using feedback from PIT-tag readings. The work includes selection and testing of heating elements, insulation solutions, and redundant safety mechanisms to prevent overheating.

A core task is the development of the software module responsible for real-time temperature acquisition, calibration, anomaly detection, and automated alarm generation via Wi-Fi and e-mail whenever the temperature exceeds predefined thresholds or if system stability is compromised. Bench tests will compare outputs against reference thermometers to assess accuracy, drift, and response time.

Supervision will be provided by Dr. Nuno H. Franco (i3S) and Prof. Joaquim Gabriel

Mendes (FEUP).



#### Expected student tasks

- Review of thermal-control systems, conductive heating materials, and safety constraints.
- Design and optimisation of the heating layer and insulation.
- Integration of temperature-monitoring components (PIT-tag reader and auxiliary sensors).
- Development of control algorithms to maintain target temperature.
- Implementation of Wi-Fi-based alarm transmission and automated e-mail notifications when temperatures fall outside limits.
- Laboratory testing with artificial thermal loads mimicking rodents.
- Full documentation, data analysis, and performance reporting.

#### References:

C Miranda, L Oliveira, AM Carmo, IAS Olsson, NH Franco (2025) Contactless body temperature assessment for signalling humane endpoints in a mouse model of sepsis . *Animal Welfare* 34, e13

A Bartelik, M ater, ÖS Cevik, NH Franco, V Voikar (2024) Focus on novel approaches: Home-cage monitoring of laboratory mice. . *Scandinavian Journal of Laboratory Animal Science* 50 (1)

D Moutinho (2020) "Development of an RFID based monitoring system for group-housed mice and rats" (TESE/DISSERTAÇÃO)

NH Franco, A Gerós, L Oliveira, IAS Olsson, P Aguiar. (2019) ThermoLabAnimal–A high-throughput analysis software for non-invasive thermal assessment of laboratory mice. *Physiology & behavior* 207, 113-121