Development of tools for monitoring the European hamster in the wild

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Introduction: A solid understanding of the biology of the endangered European hamster requires the monitoring of these animals in their natural environment, so that information on vital rates (survival and reproductive success), as well as behavioural aspects (burrow use, foraging movements, habitat selection) can be investigated. Unfortunately, adequate tools/techniques to achieve such studies are currently lacking. Hence, within the context of the French 'Plan National d'Action' for the European hamster (2019-2028) and within 'Action 6' of the 'Inter-Reg CRICETUS' program (2020-2023), we are developing two new research tools.

I. The « Track-Logger » monitors behaviour, energy expenditure, burrow location and movement patterns of hamsters

General approach, a hybrid device, composed of:

- a classical radio transmitter, allowing radio-tracking-based localisations and the transmission in real-time of an "alive" index;

- a data logger recording the signals of a 3-axis accelerometer (3*50Hz) and body temperature (1Hz);

How is that better than a classical radio-transmitter?

- reconstruct the behaviour and the movements energetics;

- improve the operating time thanks to specific algorithms.

Note that the behavioural data only become available only after recatching the individual or retrieving the device thank to the tracking localisation.

Time-energy budgets

Radio-transmitter

GPS

Implantation :
- no handicap
- allows for relatively large device
- needs recapture, **only if data logging**
- very labour-intensive fieldwork

External (collar) :
- possible handicap
- requires a small device
- needs recapture (ethics)
- **no additional fieldwork**
- **high resolution localisation**
- very short battery life

This approach still requires further development!

Our goal:

-1/ authorized VHF frequency compatible with hamster habitat: **27 MHZ**

-2/ reception distance (from inside the burrow or the surface) > **90m**

-3/ on board data-compression of the behavioural data, thanks to **seven** kinematic variables calculated and stored on board **every second**

-4/ adjustable, independent schedules for data logging and radio pings

-5/ adjustable operating time (thanks to 3 & 4 above), up to **14 months**

-6/ encapsulated device dimensions **28*15diam. (mm)** and mass< **7.5g**

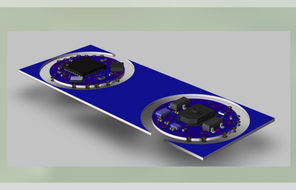
How far are we now? (Oct. 2022, end of the project: Apr. 2023):

-1 & 2: done and tested with a draft microcircuit

-3 & 4: done and positively tested with a draft macro-circuit (the true micro-circuit delivered in that early October 2022!)

-5 & 6: not yet tested with the true micro-processor, but **reachable** (according to the available batteries and the size of the chosen electronic components).:

Selected Quartz circuitry at 27 MHz



Tracking Logger design (2*12diam. mm)

A true technical challenge in that strange COVID period, with the global electronic component crisis. Some of our orders had a delivery delay of more than 1.5 year…

II. A '*Burrow-reader*', to automatically monitor presence and activities at the burrow entrances

General approach, an adjustable device composed of an RFID antenna coupled with 2 IR motion sensors, allowing to:

-1/ store the list of motion detection and RFID events (start-time, duration ON) on an SD card;

-2/ detect the passage of any animal (tagged or not), and its direction;

-3/ obtain adjustable operating times, thanks to different energy sources and antenna wake up modes (minimum 10 days);

-4/ reliable, robust, easily transportable

-5/ open source and affordable cost.

Current specifications (Oct. 2022):

-1 & 2: very efficient detection; direction not yet implemented

-3: simple device programing; 3 power options (lead, lithium, Solar+ lithium)

-4: waterproof and hamster-resistant, **1.8kg** with batteries, antenna **85mm** inner diameter (**160mm** outer), flexible iron pipe **80cm**

-5: open source **Yes**; affordable cost : **not yet: ~730€**, but with a high quality and very versatile multi-standard RFID board (440€ by itself)

Multiple tests in controlled conditions

First test in the wild in Sept. 2022

Waterproof *Pelicase* and connectors

Conclusion and perspectives:

The major objectives of these 2 tools are attainable within the deadline of the INTERREG program (Apr. 2023). We have several prototypes of the 'Burrow Reader' that are already available for testing by the Hamster user community. **mail contact: mibe@iphc.fr ; yves-jean.handrich@iphc.cnrs.fr**

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