Abstract

The System for Continuous Observation of Rodents in Home-cage Environment (SCORHE) was developed to quantify activity levels and behavior patterns for mice housed within a commercial ventilated cage rack. The SCORHE in-rack design provides daytime and real-time monitoring with the stability and consistency of the home-cage environment. The dual-video camera custom hardware design makes efficient use of space, does not require home-cage modification, and is animal facility user-friendly. Given the system’s low cost and suitability for use in existing vivariums without modification to animal husbandry procedures or housing setup, SCORHE opens up the potential for wider use of automated video monitoring in animal facilities. SCORHE potential uses include day-to-day health monitoring, as well as advanced behavioral screening and ethology experiments, ranging from assessing short- and long-term circadian rhythm studies to evaluation of mouse models. When used for phenotyping and animal model studies, SCORHE aims to eliminate concerns often associated with many mouse monitoring methods, such as circadian rhythm disruption, acclimation periods, lack of nighttime measurements, and short monitoring periods. Video analysis methods have been developed to accurately track the head and tail position of the mouse. The algorithms also automatically detect the following nine distinct behaviors: eating, drinking, grooming, foraging, climbing, walking, resting, supported rearing, and unsupported rearing. Preliminary results comparing day/night activity and behavior profiles for C57BL wild-type mouse are presented.

Objectives

Video-Based Mouse Monitoring

- **Long term**: Multiple full diurnal cycles, possibly months
- **Scalable**: Simultaneous monitoring of a large number of cages
- **Space efficient**: No customization of cages and/or racks. No requirement for extra real-estate.
- **Analyzed automatically**: Detailed time-resolved mouse behavior profiles
- **User friendly**: Easy to setup and use both by scientists and animal care staff
- **Non-invasive**: Requires no special marking of mice to facilitate tracking

Method

**Maintain Diurnal Cycle**

- Cage is illuminated in the day and darkened around the day/night cycle for the mouse. Video inside the SCORHE rack: day, cage internal ambient lighting will follow the external light cycles. Light cones (with a red filter on the front) will be placed over IR emitters to avoid disruption of the day/night cycle.

**Easy Cage Access**

- Mouse cage can be easily inserted to and removed from the rack. Researchers and animal care staff can easily inspect the mice while seated located in the SCORHE rack without disturbing the animals or monitoring.

**Space Efficient**

- Even with adjacent rack slots occupied, the cage internal ambient lighting will follow the external light cycles. Light cones (with a red filter on the front) will be placed over IR emitters to avoid disruption of the day/night cycle.

**Designed and Built**

- SCORHE prototypes designed to meet: fur, tail, and nose needs.

**Video Processing**

- Automated Behavior Detection
- Video Analysis
- Behavior Detection
- Video

References


Collaboration/Contact

scorhe.nih.gov

Future Work

- a. Thorough validation of behavior detection
- b. Accurate 3-D construction of mouse head/tail
- c. Extension of methods to different mouse coat colors
- d. Extend development to multiple mice per cage

Results

- Automated Behavior Detection
- Social Interactions
- Behavior Detection
- Video Analysis
- Video Processing

Methods

- System for Continuous Observation of Rodents in Home-cage Environment (SCORHE)
- Video-based mouse monitoring
- Automated behavior detection
- Space efficient
- Non-invasive
- User friendly

Significance

- SCORHE aims to eliminate concerns often associated with many mouse monitoring methods, such as circadian rhythm disruption, acclimation periods, lack of nighttime measurements, and short monitoring periods. Video analysis methods have been developed to accurately track the head and tail position of the mouse. The algorithms also automatically detect the following nine distinct behaviors: eating, drinking, grooming, foraging, climbing, walking, resting, supported rearing, and unsupported rearing. Preliminary results comparing day/night activity and behavior profiles for C57BL wild-type mouse are presented.