

# Data Loggers for Measuring Activity Levels Provide a Powerful Tool for Clinical Scoring in Experimental Ferrets

L. de Waal<sup>1</sup> (corresponding author), G. van Amerongen<sup>1</sup>, B. Koopmans<sup>2</sup>, M. Loos<sup>2</sup>, Asgeir Bjarnason<sup>3</sup> and K.J. Stittelaar<sup>1</sup>

<sup>1</sup> Viroclinics Biosciences B.V., Rotterdam, Netherlands

<sup>2</sup> Sylics (Synaptologics B.V.), Amsterdam, Netherlands

<sup>3</sup> Star-Oddi, Gardabaer, Iceland

## Introduction

- Activity levels can serve as a clinical outcome in preclinical studies
- Assessment is subjective, time-consuming and prone to artefact
- Video monitoring often not suitable for studies in high containment for group-housed animals
- Implantable accelerometer-based data loggers are a useful tool to measure activity in experimental ferrets.

## Method

- **Validation phase:** performance of the accelerometer-based dataloggers (DST-Tilt) was validated using live video monitoring during an open field experiment
- **Experimental phase:** data loggers were used in an efficacy experiment using group-housed ferrets in high containment.

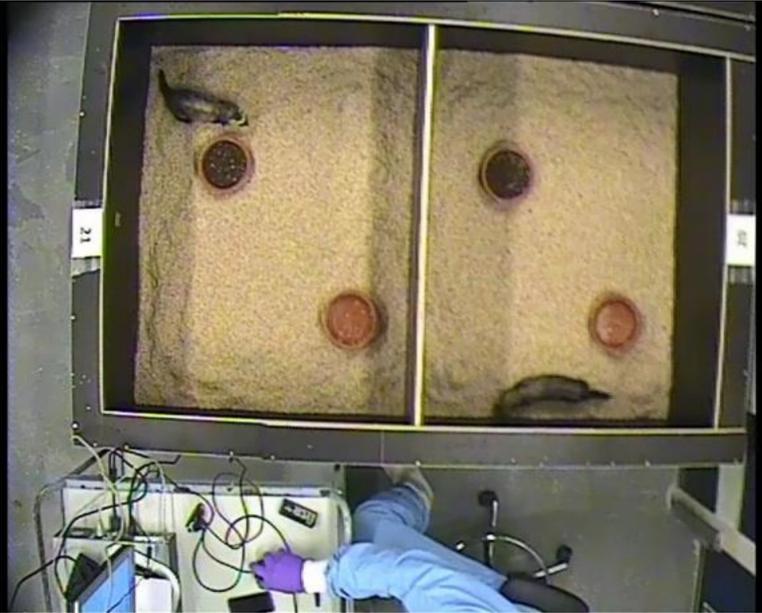


Figure 1: Open field experiment

## Validation phase

- The performance of the data logger was validated during an open field experiment (see Figure 1) with simultaneous live video monitoring.
- The loggers recorded accelerometer data at 15 second intervals for 1 minute, resulting in 4 measurements, every 5 minutes over the duration of the measurement period.
- Twelve healthy outbred female ferrets (*Mustela putorius furo*), were equipped intraperitoneally with data loggers.
- Results from the loggers were compared to observer-based video-tracking analyses (Figure 2 and 3).

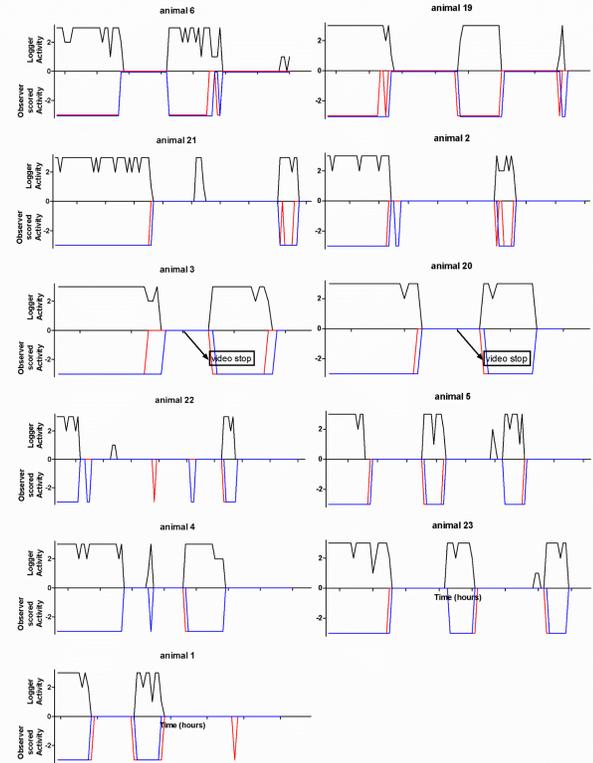


Figure 2. Activity scoring over time. The figure shows activity scores of paired ferrets, generated by the logger data analyses (black line) and by the two independent observers following analysis of the video (blue and red lines).

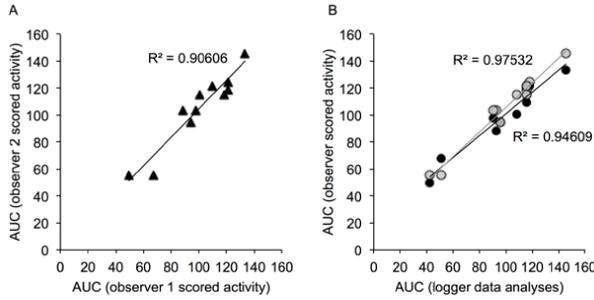


Figure 3. Correlation between activity AUC generated by video-tracking and tilt loggers. **A.** Linear correlation between activity AUC generated by the two independent observers following analysis of the video-tracking footage; **B.** Linear correlation between activity AUC generated by each of the independent observers and activity AUC generated by the logger data analyses (**observer #1:** grey; **observer #2:** black).

## Experimental phase

- Ferrets were either vaccinated or placebo treated and subsequently challenged with influenza virus.
- The loggers recorded accelerometer data at 15 second intervals for 1 minute, resulting in 4 measurements, every 5 minutes over the duration of the measurement period.
- Classical data (e.g. body weight loss, body temperature and viral shedding/load) were generated.
- Results from the loggers were compared to classical data (Figure 4).

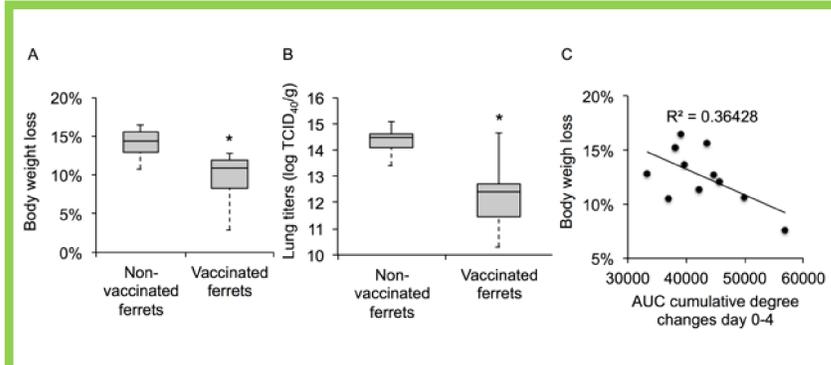


Figure 4. Non-vaccinated ferrets had greater body weight loss **(A)** and higher viral titers in the lungs **(B)** than vaccinated ferrets as determined by the one-tailed Mann-Whitney test; quantitative measures of activity recorded by the data loggers as cumulative degree changes from day 0 to day 4 post inoculation negatively correlated with body weight loss **(C)**. The coefficient of determination  $R^2$  is indicated. AUC: area under the curve

## Results

### Validation phase:

- Activity scores generated by two independent observers following evaluation of the video footage, and by the logger data analyses, plotted over time, demonstrated good overlap of the detected periods of active behavior

### Experimental phase:

- Higher body weight loss and higher viral load in the lungs were detected in placebo treated animals
- Percentage of body weight loss correlated negatively with the activity measures

## Conclusion

Activity levels, derived from implantable loggers represent a valid clinical outcome measure for preclinical studies, with added value for the refinement of animal experiment.