

# The use of Star-Oddi temperature loggers in laboratory animal experiments for pathogenesis research and evaluation of prevention and treatment of infectious diseases



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## Introduction

For developing and producing therapeutical and preventive drugs and vaccines against disease in humans, laboratory animals are required for approval by the licensing authorities.

A good animal model for human infectious disease shows a similar disease pattern when compared to that in humans.

In experiments with laboratory animals, as many data as possible are collected to monitor the disease and the subsequent effects of the treatment.

However, gathering clinical data in living animals is difficult, especially since many animal species often do not show clinical signs and clinical scoring is difficult.

For a long time, core body temperature has been used as an objective clinical sign that is mostly measured on certain time points after catching and anesthetizing the animals, which could have an impact on animal welfare and experimental outcome.

## Materials & methods

A temperature logger is placed in the abdominal cavity of an experimental animal (Fig. 1-3) prior to the experiments to provide a temperature base line profile.

The logger is programmed to measure fluctuations in the core body temperature every 10 minutes for up to 4 weeks during the in life phase.

After the experiment the logger is removed and all data are transferred to a computer.



Figure 1. Preparation of the ferret. The abdomen of the anesthetized ferret is shaved and disinfected.

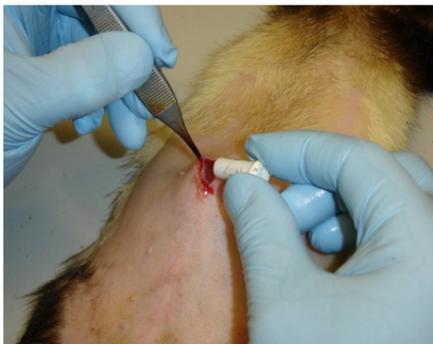


Figure 2. Implanting the data logger. By a small incision ( $\pm$  2 cm) in the median plane of the skin and peritoneum, the temperature data logger is placed in the peritoneal cavity.



Figure 3. The peritoneum and skin are sutured and the anesthesia is antagonized. Test animals should experience a minimum amount of pain or distress in order to ensure a fast recovery and no further influences on the test results.

## Principle

Temperature data loggers are used to record the body temperature of animals during preclinical experiments.

## Conclusion

Temperature loggers:  
- provide important preclinical data in animal experiments  
- contribute to reduction and refinement in animal experiments

## Discussion

Temperature loggers can be used in different animal species such as nonhuman primates, ferrets, cats.

Temperature loggers provide more accurate data since the animals do not experience stress due to handling.

Temperature loggers provide more data than when using thermometers on certain time points.

The currently used temperature loggers are smaller and more accurate than older versions (Fig. 4).

The method contributes both to reduction and refinement in the animal experiments and supplies important preclinical data.

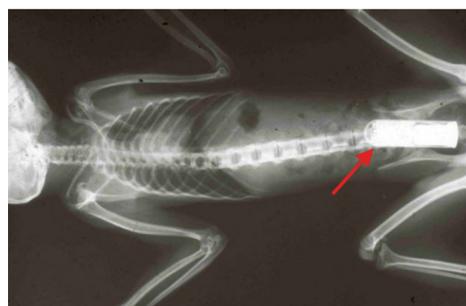


Figure 4. Macaque with a large older type of temperature logger that fills up a substantial part of the abdomen (arrow).<sup>1</sup>

## Future

The temperature loggers are getting smaller, can be used for a longer time with a larger amount of data and have more functions such as measuring heart rate.

## References

<sup>1</sup>Van den Brand, Stittelaar et al. PLoS ONE (2012) 7(8):e42343.

<sup>2</sup>Smits, van den Brand et al. J Virol (2011) 85(9):4234-45.

<sup>3</sup>Van den Brand, Stittelaar, et al. J Infect Dis (2010) 201(7):993-9.

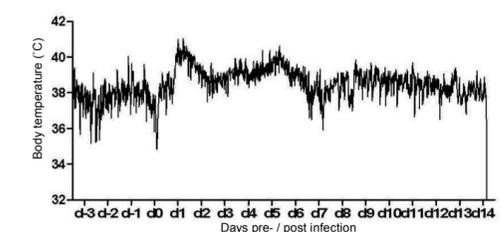
<sup>4</sup>Van den Brand, Kreijtz et al. J Virol (2011) 85(6):2851-2858.

## Results

This method has been used successfully in ferrets and macaques as animal models for different human viral infections:

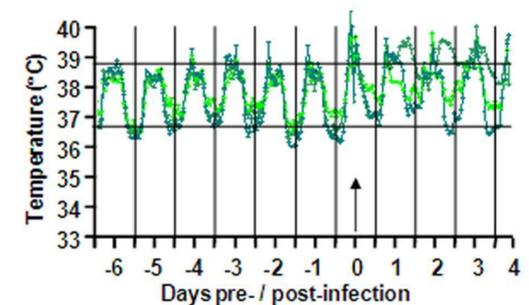
### Example 1.

Ferrets infected with pandemic H1N1 influenza virus show elevated core body temperatures from 1 to 7 days post infection.<sup>1</sup>



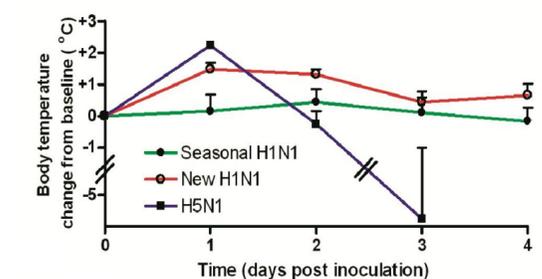
### Example 2.

African green monkeys infected with Severe Acute Respiratory Syndrome coronavirus (SARS-CoV) show fluctuations in body temperatures with higher average body temperatures from 1 to 4 days post infection.<sup>2</sup>



### Example 3.

In pathogenesis studies with ferrets, disease from pandemic H1N1 influenza virus infection is intermediate between that due to seasonal H1N1 virus and highly pathogenic avian influenza H5N1 virus.<sup>3</sup>



### Example 4.

In vaccination studies, different groups of ferrets that were vaccinated with vaccination regimes and subsequently infected with pandemic H1N1 influenza virus show distinct changes in body temperature between the groups.<sup>4</sup>

