

Signal Interface for Voluntary and Forced Exercise

Exercise is used in research to evaluate beneficial effects of sports and/or movement on health, behavior, and physiological responses. For rodents, such activity can be measured by placing a running wheel in the cage or by using a treadmill. Combining an exercise apparatus with telemetry permits physiologic assessment under stress induced conditions.

Running wheels and treadmills are available from our sister Harvard Bioscience company, Panlab.

Physiological Endpoints

Telemetry

- Heart Rate
- Blood Pressure
- Temperature
- Activity

Behavioral Endpoints

Running Wheel

- Running Wheel Counts
- Distance/Speed

Treadmill

- Foot Shock Counts

Events to Synchronize

- Number of revolutions of the wheel or treadmill
- Foot shock counts from treadmill

Use Case – Using a Running Wheel with a Telemetry System

Running wheels contain a counter which delivers an output event for every revolution of the wheel. Running wheel events may be acquired by Ponemah via the Signal Interface solution for synchronized recording with physiological signals, such as blood pressure and ECG. Use this combined solution to directly measure the effects of exercise on physiological responses.

The number of revolutions and the time between counts translates into distance traveled and speed, respectively. These measurements are used to understand the intensity of exercise performed by the rodent.

The following recent publications highlight how exercise can be combined with telemetry.



Contribution of Social Isolation, Restraint, and Hindlimb Unloading to Changes in Hemodynamic Parameters and Motion Activity in Rats

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0039923>

Perfusion Pressure Is a Critical Determinant of the Intratumoral Extravasation of Oncolytic Viruses

<https://www.sciencedirect.com/science/article/pii/S1525001616303367>

Exercise Training Attenuates the Development of Cardiac Autonomic Dysfunction in Diabetic Rats

<http://iv.iarjournals.org/content/32/6/1433.full>

Use Case – Forced Exercise using Treadmill with a Telemetry System

Forced exercise is used by researchers to induce and study physiologic stress responses, as well as assess acute and chronic adaptation to exercise in particular genetic models and/or disease states. Treadmills are the preferred method over voluntary running wheels due to the standardization across all subjects and increased levels of stress hormones and cytokines.

Treadmill events, such as foot shock, can be acquired by Ponemah via the Signal Interface solution for synchronized recording with physiologic signals, such as blood pressure and ECG. Studies are enhanced by integrating telemetry to measure cardiovascular endpoints, leading to a better understanding of the full response on the cardiovascular system, making it possible to observe stress induced cardiovascular changes in real-time.

The following recent publications highlight how exercise can be combined with telemetry.

Changes in Heart Rate and Its Regulation by the Autonomic Nervous System Do Not Differ Between Forced and Voluntary Exercise in Mice

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6055008/>

Dantrolene, a therapeutic agent for malignant hyperthermia, inhibits catecholaminergic polymorphic ventricular tachycardia in a RyR2(R2474S/+) knock-in mouse model.

<https://www.ncbi.nlm.nih.gov/pubmed/20944434>

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