

**PhenoScale: Large-scale, high-throughput automated systems**

**for phenotyping mouse models of human disease**

**www.phenoscale.eu**

In order to improve the standardisation and throughput of mouse phenotyping, PhenoScale developed a new high-throughput automated phenotyping platform in the form of 3 home cages called PSS 009. These form a highly flexible modular solution for state-of-the-art automated metabolic and behavioural monitoring of small laboratory animals. Mice can be housed in these cages for the entire duration over which data is recorded. This allows for measurements of behavioural and metabolic parameters in the home cage, as opposed to transferring mice into a separate test cage; eliminating the need for transfer between cages reduces animal stress (and associated variation in data) and time needed for acclimation, as well as increasing throughput. The modules developed in the PhenoScale project were Metabolism, Motor Skills, and Cognition & Welfare. These modules can be combined in a unique a single system to allow monitoring within a home cage.

In addition the PhenoMaster software was developed to allow easy experimental design and for recording and analysing data. The measured data can be easily exported in various formats and used further in statistic programs or databases. The PhenoMaster System can be operated with an unlimited amount of simultaneously measured home cages of different standard configurations run by the same software.

The three modules developed and tested in PhenoScale were:

***PSS 009 ME* “Metabolic”**

* Metabolic performance measured via indirect calorimetry O2 consumption & CO2 production, Respiratory Exchange Rate (RER) and Energy Expenditure (EE).
* Drinking & feeding behaviour with high-precision sensors, amounts and time patterns, up to 6 sensors per cage, controlled food or liquid access per time or amount.
* Spontaneous home cage activity via sensor frames: total activity, ambulatory and fine movements, rearing.

***PSS 009 MO* “Motor Skill”**

* Running Wheel activity (RW): measurement of voluntary wheel running on a standard wheel and a complex wheel lacking some bars with optional PC-controlled "enabled / disabled" function and workload control.

***PSS 009 COWE “*Cognition & Welfare*”***

* Two operant behavioural insert modules: Nose Poke (NP) where the mouse pokes its nose into a hole in order to gain a food reward and a Running Wheel (RW) enabled for running as a reward.

A key part of the PhenoScale project was the close collaboration between the SME-lead, TSE Systems and experienced academic research groups, namely: MRC Harwell, UK; HMGU Helmholtz Zentrum München, Germany and CNR National Research Council and IIT Italian Institute of Technology in Italy. This enabled TSE to improve the design of their modules and the academic groups to develop standard operating procedures (SOPs) to suit their requirements for high-throughput phenotyping.