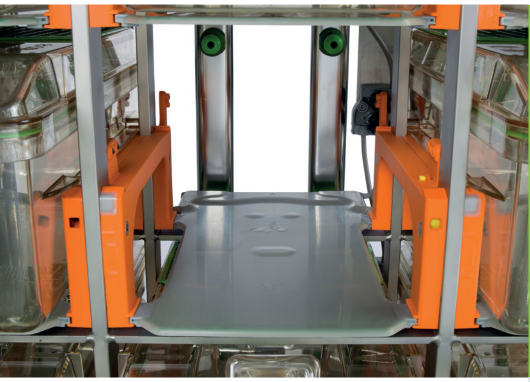
DVC ANALYTICS
SCIENTIFIC PLATFORM



NON-INTRUSIVE HIGH THROUGHPUT AUTOMATED DATA COLLECTION FROM THE HOME CAGE

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BACKGROUND AND AIMS

Automated home cage monitoring represents a key technology to collect animal activity information directly from the home cage. The availability of 24/7 cage data potentially enables more extensive and quantitative assessments of mouse behavior and activity over long periods of time than possible otherwise. When home cage monitoring is performed directly at the home cage rack, it is possible to leverage additional advantages, including, e.g., partial (or total) reduction of animal handling, no need for setting up external data collection system as well as not requiring dedicated labs and personnel to perform tests.

MATERIAL AND METHODS

In this work we introduce DVC® (Digital Ventilated Cage), a home cage-home rack monitoring system that is capable of continuously detecting spontaneous animal activity occurring in the home cage directly from the home cage rack. Three individually housed C57BL/6J mice were observed un-intrusively while kept in their home cage (Tecniplast GM500) into a DVC® rack (i.e., a Tecniplast DGM rack equipped with DVC® system) at the University of Camerino (Macerata, Italy). Animal room was subject to a 12:12 h light-dark schedule (lights on at 09:00 am and lights off at 09:00 pm) with ad libitum food and water (auto watering system). Recording was performed for up to 7 consecutive days. To validate the DVC®, we developed a home-cage camera-based monitoring system composed of a small portable computer connected to a video camera module and to the DVC® board (placed underneath each cage under test). This set up enables synchronized start and stop acquisition between the camera and the DVC® board. The camera acquires videos at 10 frames/second with a resolution of 800x600 and it is also equipped with 4 infrared (IR) LED illuminators to enable visibility in low light and dark conditions. We then present a few animal activity metrics and validate DVC®-based metrics via comparison against a video camera-based tracking system.

RESULTS

The distance covered by the mouse in each video block measured with

DVC® and video tracking are highly correlated (minimum correlation measured across the three cages is larger than $R \geq 0.9625$) indicating that the information provided by the two systems, in terms of distance walked by an individually-housed mouse, is very similar. The same considerations apply to the average speed (minimum correlation value $R \geq 0.9515$). We also assessed the DVC® activation density by comparing its measurements with video distance. Since activation density and distance are two distinct physical quantities, we plotted them normalized for their maximum value within the week-long interval. The correlation values are smaller than the ones for video distance and DVC® distance (minimum correlation value was $R \geq 0.9043$) but indicate that DVC® activation density is highly related to mice locomotion measured via video tracking distance, even though they represent different physical quantities.

CONCLUSIONS

The results show that DVC® can provide animal activity metrics that are comparable to the ones derived via a conventional video tracking system, with the advantage of system scalability, limited amount of both data generated and computational capabilities required to derive metrics.