2nd International DIGITAL VIVARIUM FORUM

HOW TECHNOLOGY CAN SUPPORT BETTER SCIENCE

ABSTRACTS

6th - 8th September, 2022

Tecniplast Congress Centre, Buguggiate (VA) - Italy

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Improving biomedical research by automated behavior monitoring in the animal home-cage – importance of communication and networking

Vootele Voikar - Research coordinator, Neuroscience Center / Laboratory Animal Center, Helsinki Institute of Life Science, University of Helsinki, Finland

Novel and emerging technologies allow 24/7 collection of behavioral and physiological data in otherwise undisturbed animals in their familiar environment. Home-cage monitoring (HCM) can minimize the impact of unspecific stressors, such as handling or testing in novel arenas, which are known to influence data collection and animal welfare. Therefore, HCM has a potential to improve biomedical research in a wide spectrum of studies where animal models are used. However, addressing the complex problem of monitoring the full 24-hour behavioral repertoire of a rodent still presents many challenges, with each technology having its strengths and limitations. In order to keep track on the developments in the field of HCM of laboratory mice and to provide a perspective for future applications, this presentation will be emphasizing communication and collaboration between stakeholders and introduce a dedicated network of researchers, funded by COST (European Cooperation in Science & Technology) – CA20135.

Spontaneous bouts of rest, activity, and locomotion of C57BL76J mice in their home-cage

Brun Ulfhake - Department of laboratory medicine, Karolinska Institutet and ECF at Stockholms University

Using a home-cage monitoring system that records activity on the cage floor we have analysed cumulative 24/7 records of male and female C57BL/6J mice. Animals were housed at different densities from single housing up to 4 animals per cage, beginning at an age of 2-3 months and continued for 2-6 months. Rhythmicities in bouts of rest, activity, and locomotion across the circadian cycle, cycles of reoccurring husbandry routines, and across multiple weeks are described.

Validation of the Digital Ventilated Cage System for Circadian and Sleep Phenotyping

Selma Tir - PhD student in Clinical Neurosciences, University of Oxford

The study of circadian rhythms critically depends upon the study of mouse home cage behavior. The most common methods include voluntary wheel-running, beam-break, passive infrared and video tracking. On another hand, the gold standard for measuring sleep is electroencephalography (EEG) combined with electromyography (EMG), which in mice, requires invasive surgery. Absence of activity cannot be used to infer sleep, but extended immobility has been shown to correlate well with EEG/EMG defined sleep. Here, we provide new data validating the use of the Digital Ventilated Cage (DVC®) system for circadian and sleep phenotyping. The DVC® system is based upon widely used individually ventilated cages (IVCs) placed in a rack that continuously records home cage activity. Clear, red and black IVCs equipped with individual LED (Leddy) systems can be used to entrain animals to the room light cycle or individual cycles in every cage. For circadian phenotyping, mice home cage activity was recorded under 12:12 light dark (LD), constant dark (DD), constant light (LL), and phase shift from a light pulse (LP). For the sleep phenotyping, home cage activity was further recorded in parallel to EEG/EMG to investigate if prolonged immobility measured by the DVC® system was correlated with EEG defined sleep.

Detection of narcolepsy symptoms in HCRT knock out mice using the DVC® system

Birgitte R. Kornum - Associate professor, Department of Neuroscience, University of Copenhagen

Narcolepsy type I (NT1) is a chronic sleep disorder characterized by the loss of hypocretin/orexin (HCRT) signaling in the brain ultimately affecting sleep-wake regulation. Symptoms include severe night-time sleep fragmentation, excessive daytime sleepiness, and cataplexy - a sudden loss of voluntary muscle tone while maintaining consciousness. This symptomatology is also seen in the HCRT knock out (KO) mouse model. The gold standard to accurately classify narcoleptic symptomatology in mouse models is to use electroencephalography (EEG) and electromyography (EMG). EEG/EMG, however, requires invasive surgery and time-consuming state identification, which makes the technique inappropriate for large-scale investigations. We have evaluated the DVC® system for characterizing undisturbed home-cage locomotor behavior in a narcolepsy mouse model. We compared baseline activity of HCRT-KO mice to wild-type (WT) littermates across sex and age. Our data show clear phenotypic differences with HCRT-KO mice displaying the well known fragmented sleep-wake pattern. We conclude that the DVC® system is a useful high throughput tool for non-invasive monitoring of narcolepsy symptomatology in mice.

The Impact of exercise on brain structure and function. A combination of ultra-high field imaging and 24/7 behavior monitoring

Amanda Kiliaan - Professor Anatomy- Translational Neuroanatomy, head of research Anatomy Dept Medical Imaging, Anatomy Donders Institute for Brain, Cognition, and Behavior, Chair Preclinical Imaging Center PRIME Radboud university medical center

Hypertension and obesity are risk factors for cerebral small vessel disease (SVD), the most frequent cause of dementia. How SVD causes cognitive deterioration is not understood but brain network disruption may play an important role due to reduced brain perfusion. Aim: investigation of the temporal relation between reduced perfusion and network disruption via state-of-the-art ultra-high field imaging in obese mice. This provides unique information regarding the temporal relation between vascular pathological changes, MRI features and cognitive impairment. Moreover, we will investigate whether exercise (running wheels in Digitally Ventilated Cages) will inhibit development of SVD and related deterioration of brain function in an obese mouse model, using a multimodal approach with MRI, cognitive tests and DVC® monitoring of activity in running wheels and cages.

Automated home-cage for continuous activity monitoring in different mouse models

Fabrizio Scorrano - Principal Scientist, Novartis AG

In this talk it will be shown how DVC® could help to monitor the health of different mouse models during short and long experimental studies and how home-cage activity could be used as complementary read-out to integrate and explain the main scientific outcomes

Assessing the DVC® analytics capacity to detect sciatic nerve crush induced motor impairments and recovery

Michael Tsoory - Head of the Behavioral and Physiological Phenotyping Unit, Department of Veterinary Resources, Weizmann Institute of Science, Rehovot, Israel

Laboratory rodent models of nerve injury rely heavily on repeated assessments of motor functions away from the home cage (e.g.: gait and stride assessments). These assessments lead to substantial disturbance of the animals' routine and cause them some discomfort that might mask over of the experimental manipulation effects. In addition, these evaluations are labor intensive and require time-consuming post-hoc analyses.Therefore, the current study sought for a home-cage based alternative and assessed the DVC® Analytics capacity to detect sciatic nerve injury (SNI, hereafter) induced motor impairments and recovery. DVC® Activations and Distance data were collected over 4 weeks, two as base line and two more following the surgical manipulation, SNI (crush) or sham. Compared with Sham mice, SNI mice exhibited a significantly greater reduction in activity (compared to base line) and a slower rate of return to base line level. Addition data will be presented, comparing DVC® and CATWALK indices.

Phenotyping spontaneous in cage activity and place preference in inbred and outbred mice using DVC®

Sara Fuochi - GMO Data Manager, Experimental Animal Centre - Universität Bern

If animal activity is your measure, you need a good baseline against which to compare any changes following an experimental invention or a genetic modification, to understand, in example, the efficacy of a drug or the reliability of the animal model, including mutants. This presentation will provide an overview of some background strains peculiarities that may impact experimental results and data interpretation. The focus will be on the longitudinal characterisation of circadian spontaneous in cage activity, from post weaning stage to early adulthood in C57BL/6NCrl (inbred), BALB/cAnNCrl (inbred) and CRL:CD1(ICR) (outbred) mice. Strain differences can also be appreciated under different behavioural perspectives, when assessing cage change impact, space preference in the cage, and toilet position.

Digital Ventilated Cage activity monitoring uncovers rest-related phenotypes in mouse models of neurodegenerative diseases

Silvia Mandillo - PhD - Research Scientist - CNR – National Research Council - Italy

Sleep disturbances are common in the general population and even more common as symptoms and comorbidities in many neurological and neuropsychiatric disorders like Alzheimer's Disease, Parkinson's Disease, Amyotrophic Lateral Sclerosis, Myotonic Dystrophies, Autism, Schizophrenia, Bipolar Disorder, Major Depression. It is therefore crucial to develop automated instruments to detect such disturbances in models of human diseases. The DVC® activity monitoring system can be a valuable tool to screen for activity-rest cycle phenotypes in these models. As examples, data from mouse models of two neurodegenerative disorders will be presented to illustrate the potential of home cage monitoring in detecting common rest-related disturbances.

How well do you know your mice?

Sonia Bains - Neurological Phenotyping Manager and Phenotyping Technical Developer, Mary Lyon Centre at MRC Harwell

The Mary Lyon Centre at MRC Harwell is the UK's national facility for mouse genetics and the use of mouse models for the preclinical study of human diseases. We are committed to implementing the 3Rs for the benefit of mouse health and welfare, while also improving the quality of the scientific data generated. As such, we are constantly striving to develop new methodologies that benefit our capacity to model human disease and generate high quality reproducible data. Here we present a selection of systems that have been developed at the MLC that aim to build a more comprehensive insight into animal behaviour.

Establishing Homecage Monitoring in Neuroscience Drug Discovery

Eoin O'Connor - Principal Scientist euroscience & Rare Diseases, Roche Pharma Research and Early Development, Roche Innovation Center Basel, F. Hoffmann - La Roche Ltd

Multiple brain disorders are characterized by pathologies and symptoms that change over time. In this context, continuous longitudinal monitoring of rodent home-cage activity promises new insights into disease progression, and provides opportunities to validate novel therapies that aim to alter the disease trajectory. However, the large volume and complex nature of home-cage monitoring datasets can present challenges for implementation of this technology. Here, I will share our experience in establishing rodent home-cage monitoring for neuroscience drug discovery. To address challenges in data analysis and interpretation, we developed a semi-parametric Bayesian hierarchical model for home-cage data that uses a hierarchical structure of latent Gaussian processes (HGP). This new model captures both daily activity and longitudinal trends, and can flexibly model data obtained from different commercially available home-cage monitoring systems. The importance of close collaboration between lab scientists, data scientists and engineers for successful implantation of home-cage monitoring technology will be highlighted.

Proof of concept: Evaluation of a Digital Ventilated Cage (DVC®) System for Facility Management, assessment of animal welfare and potential research use cases

Michaela Socher - Principal Veterinarian and Associate Director Comparative Medicine

In recent years, technologies for rodent caging emerged that promise to enhance the 3Rs by allowing 24/7 monitoring of selected physiological data and by improving housing conditions through continuous measurement of home cage environmental parameters, both paired with intelligent software analysis. Additionally, such systems might increase study readouts by generating translationally relevant data. To learn about their pro's and con's under real-life conditions, AbbVie launched a project comparing different intelligent caging systems, one of them being the Tecniplast Digital Ventilated Cage (DVC®). Its sensitivity to detect changes in activity levels and sleep patterns was investigated in the following studies: (1) Comparison of tail vs. tunnel vs. cup handling with the aim of detecting differences in animal stress levels. (2) Housing of aging transgenic mice to detect onset of their harmful phenotype and to define humane endpoints (3) Evaluation of activity enhancing/ reducing reference compounds to mimic evaluation of drug candidates.

The Effects of Light on Mouse Physiology and Behaviour

Stuart Peirson - Professor of Circadian Neuroscience, Sleep and Circadian Neuroscience Institute (SCNi), Nuffield Department of Clinical Neurosciences, University of Oxford

Light detected by the eye exerts profound effects on physiology and behaviour. As well mediating vision, light regulates circadian rhythms, sleep, alertness, hormone production and cognitive function. Despite these widespread effects, lighting is a poorly controlled variable in many scientific studies. Furthermore, current guidelines for laboratory mouse lighting are all based on what the facility staff require, rather than what is optimal for animal physiology, behaviour or welfare. Perhaps the best example of this is that virtually all lighting measurements are based upon lumens or lux, which is measurement of perceived brightness based upon human visual sensitivity and does not reflect the differences in the sensitivity of the mouse retina. Here I will provide an overview of the non-visual effects of light and how light levels differ dramatically in many experimental studies. I will then go on to describe the considerations for lighting assessment for laboratory mouse studies, based upon recently adopted standards for human circadian lighting.

Introduction of Digital Ventilated Cages in the Central Animal Facility of UMCG

Catriene Thuring - DVM, PhD - Deputy Head Central Animal Facility, University Medical Center Groningen, The Netherlands, Designated veterinarian

The Central Animal Facility (CDP) of the University Medical Center Groningen facilitates laboratory animal research in various fields a. o. nuclear medicine, oncology and pharmacology. On a daily base the facility houses 12,000 animals approximately, the vast majority being mice. The CDP team is ambitious and continuously strives for optimization of animal health and welfare and facility procedures. Up until 2021 the CDP housing conditions of mice were not uniform. Part of the experimental and breeding mice were housed in individual ventilated cages (IVC) and the other part in open, conventional cages. The decision to substantially decrease the percentage of mice housed in conventional conditions was the starting point for exploring the DVC® housing option. In the fall of 2021 a DVC® testing room was installed; the very start of the CDP-DVC project. This presentation will cover the challenges we faced, the solutions we came up with and the pivotal role of a highly motivated team of animal caretakers.

Potential use of DVC® to detect fight events in male mice

Fabrizio Scorrano/Mara Rigamonti/Dimitri Diomaiuta - Principal Scientist, Novartis AG; Tecniplast S.p.A

Fights in male mice is a concern from welfare and scientific perspective. If not identified on time it could lead to animal injury, death and compromise our experiment. In this talk we will show preliminary data on how DVC® could help to monitor male mice anomaly activities and help the operator to take the best decision for the animal and for the scientist.

High-fat diet induced obesity in mice is secondary to the dietry induced elongation in their endogenous circadian rhythm period length

Roee Gutman - Department of Animal Sciences, Tel-Hai College; and Department of Nutrition and Natural Products, MIGAL – Galilee Research Institute, Israel

High-fat diet (HFD)-induced obesity (DIO) is secondary to HFD-induced circadian disruptions in the pattern and length (tau) of endogenous circadian rhythms. Cumulative data shows that T-cycle's deviation from tau correlates with weight gain, suggesting that energy balance is most tightly regulated under near-tau T-cycles. Indeed, we have recently demonstrated that DIO in mice under a 24-h light-dark cycle (T-cycle) is also secondary to the entrainment process to this near-tau T-cycle, as suggested by the DIO-prevention under a T-cycle oscillating at their expected tau of 23.7-h. We herein further examined this hypothesis by studying energy homeostasis of low-fat diet (LFD) and HFD-fed mice held under a T-cycle oscillating at the tau of same-age LFD-fed mice, compared with a 24-h T-cycle, a T-cycle with a period faster than tau by the tau-24-h deviation (Δtau), and under constant darkness (DD). The energy balance of LFD-fed mice was unaffected by photic regimes. DIO onset under the 24-h T-cycle resembled that under DD, preceded by HFD-induced prevention of the age-related shortening in tau. Compared to 24-h T-cycle, DIO onset under the tau-like and Δtau T-cycles was similarly delayed, underlined by a difference in energy expenditure rather than intake, and accompanied by a T-cycle-related tau-shortening (i.e., 'aftereffect'). These results highlight the centrality of the HFD-induced deceleration in tau in predisposing to DIO under a circadian desynchrony due to T-cycle with a slower-than-tau period length. Correspondingly, they suggest that enforcing a zeitgeber resonating with or slightly faster than tau, attenuating the HFD-induced deceleration, postpones DIO onset without caloric restriction. Hence, it is suggested that pharmacological, nutritional, or environmental zeitgebers that slightly shorten or enhance endogenous circadian rhythms' robustness may attenuate DIO, at least in mice, even while feeding on HFD ad-libitum.

Can DVC® technology replace standard actimetry testing in safety assessment studies?

Céline Gommet - Projects & Innovation / In Vivo Research Center France, Sanofi

It was already demonstrated that locomotor activity measured by the DVC® technology can help in detecting long term degradation of clinical status of mice, like in Oncology studies. In this new project, the aim is to target the replacement of standard actimetry testing (CNS safety endpoints) in safety assessment studies.Several reference drugs were administered in the morning or before the light is switched off, and the threshold of detection of hypo-or hyperactivity was determined. The compounds were selected to reflect previous standards published in Safety Pharmacology core battery studies, such as clonidine, theophylline, caffeine, chlorpromazine (and others). Should the outcome be convincing enough, this could lead to the adjustment of early Toxicology study designs and refine CNS endpoints evaluation. In particular, the activity could be measured 24/7, facilitating the detection of any unexpected change in locomotor activity along the diurnal cycle.

The Inspire Aging Mouse Cohort: DVC® Analytics and the measure of spontaneous /voluntary mobility

Angelo Parini - MD, PhD, Professor of Physilogy, Health Faculty - Toulouse, Coordinator of the INSPIRE animal cohort project, Institute of metabolic and cardiovascular diseases INSERM U 1297

Recent advances suggest that biological processes linked to aging are more reliable than chronological age to account for an individual's functional status, i.e. frail or robust. In this context, the INSPIRE program was built to identify the mechanisms of accelerated aging and the early biological signs predicting frailty and pathological aging. To address this issue, a cross-sectional cohort of outbred Swiss mice (1576 male and female mice) was designed, in which spontaneous and voluntary physical activity are continuously monitored from 6 to 24 months of age under either normal or high fat/high sucrose diet. At different age points (6, 12, 18, 24 months), multiorgan functional phenotyping is being carried out to identify early signs of organ dysfunction. In addition, a large biological fluids/feces/organs biobank is being generated. Importantly, this cross-sectional study design allows to carry out a large number of tests to characterize and further evaluate the onset of frailty. Of much interest, it will enable to evaluate if some organs "age" prematurely compared to others, and to presume the role of different organ dysfunction in the onset and progression of frailty.

Using Polyuria to Diagnose Sustained Hyperglycemia in a Mouse Model of Spontaneous Type 2 Diabetes

Thomas Svava Nielsen - Senior Scientist, Novo Nordisk Foundation Center for Basic Metabolic Research, University of Copenhagen

In humans, excessive urination (polyuria) is a key symptom of a sustained elevation in blood glucose and is often one of the first signs of developing type 1 and 2 diabetes. Likewise, in mouse models of diabetes, like the ob/ob and db/db strains, polyuria is a well known manifestation of the hyperglycemic phenotype to the extent where several weekly changes of bedding is often required, even for individually housed animals. Given the relationship between elevated blood glucose and polyuria, we designed a study to explore if the bedding status metric in the DVC® system can be used as a diagnostic tool to identify the onset and progression of hyperglycemia in the TALLYHO strain, which is a mouse model of spontaneous development of type 2 diabetes.

Exploitation of DVC®'s data collection to support scientific questions

Sebastian Brachs - Head of Research Lab, Department of Endocrinology and Metabolism Charité – Universitätsmedizin Berlin

Awareness of the importance of 3R is rising since several years and implementation of refinement approaches for animal welfare is advantageous primary for laboratory animals but also for research results. New monitoring systems e.g. for animal housing conditions generate a lot of data on animal welfare. However, aside from the 3R aspect, could research projects - not only burden-intensive experiments - benefit from their utilization? We investigated whether the housing monitoring can be beneficial for our metabolic research and, therefore, aimed to exploit the DVC® parameters to support our science. Hence, we analyzed the recorded activity data in several experimental mouse cohorts feeding maintenance chow versus high-fat or western diet over several weeks. We compared those data with our locomotor activity measured after completion of the dietary intervention and observed an early phenotype, we would have missed otherwise.

Food Intake Monitoring in Techniplast DVC® Cages

Soo Min, Judith Altarejos and Jason Mastaitis - Senior R&D Specialist, Director of Obesity Metabolism & Muscle Disease, Senior Staff Scientist, Regeneron Pharmaceuticals Inc.

Assessing food intake in mice has long required using specialized cages which can take up significant vivarium space separate from housing. In addition, mice need to be acclimated to these new cages before data is acquired, further lengthening study time. Thus, being able to passively assess feeding data in addition to activity would be of great benefit to groups interested in assessing energy balance. Here we present data from prototype weighing scales which can be added to Tecniplast DVC® cages to assess food intake alongside locomotor activity in obese, leptin-deficient mice (ob/ob), singly-housed on a chow diet and treated with either 1mg/kg recombinant human leptin or a saline control. Sensitivity and accuracy of the scales will be discussed, as well as the ease of extracting and formatting of the data.

Home cage-based phenotyping from improved animal welfare monitoring to better science

Oliver Stiedl - Chairman of the Animal Welfare Body VU University Amsterdam and VU University Medical Center

My intention is to present data on the upcoming DVC® experiments for comparing performance of singe and group-housed mice in DVC® and under open-cage like conditions. We hope to be able to show the lack of difference on general activity under these two housing conditions base don our current experimental plans at the VU and further indicate that potential 'disturbance' from persons entering the housing room will have a lower impact on DVC® (IVC) housing as compared to open cage housing. If this project will not be finished in time, I will go back to some conclusions about limited translational validity of freezing as index of fear for mouse models of human psychopathology. In addition, I would like to indicate some conceptual ideas about how to contribute to the mandatory characterization of new mouse lines in F1/F2 generations as required by stricter animal welfare requirement by the governmental authorities in the EU/NL to determine and/or exclude potential discomfort of newly generated mouse lines.

Automated identification of pups delivery by using novel in-cage microphones

Marcello Raspa/Marco Garzola - PhD - Technology Executive (CNR-IBBC), Head of Biological Resources at the CNR European Mouse Mutant Archive and National Centre for Phenogenomics (EMMA/Infrafrontier/IMPC)

Pups delivery estimation is typically not conducted in real-time and births can be identified even with a delay of 1-2 days. This can be a problem and an experimental variant for many studies, especially when the births happen on the weekend. Here we present preliminary data of a novel in-cage set of microphones to identify birth of animals/pups delivery in real-time. The results are promising and could indicate the time of delivery and the birth of new offspring.

Deciphering the genetics of healthspan through life-long monitoring of a large murine genetic reference population

Giacomo Von Alvensleben - Scientific Assistant in the Laboratory of Integrative Systems Physiology (LISP) EPF, Lausanne, Switzerland

Automated cage-monitoring offers enormous benefits for the improvement of experimental reproducibility and animal welfare. Additionally, when coupled with other phenotyping assays, these systems allow to derive non-invasive activity-based digital biomarkers of health status. Sleep fragmentation and night-activity onset are two representative parameters that can be computed with this approach. We present here an unprecedented life-long animal monitoring study carried on ~660 mice from 83 strains in a new Genetic Reference Panel (GRP) containing Collaborative Cross, BXD and laboratory inbred strains. Overall, these mice were housed for more than 18 months in the Digital Vivarium Cage (DVC®) system along with extensive phenotyping and tissue collection, to build a resource designated as Healthspan Diversity Panel (HDP). We found strain-specific activity patterns correlating with age. The combined phenome, augmented by the continuous monitoring, will allow to estimate health scores that can be used in association studies to decipher the genetic basis of healthspan.

The DVC® system for the automated detection of abnormal repetitive behaviors

Daniela Pollak - Professor for Behavioral Biology - Medical University of Vienna, Austria

Conventional husbandry systems can impair animal welfare, as housing conditions are often poorly aligned with the physiological needs of the animals. By consequence, abnormal behaviors are frequently observed, reflecting poor welfare, stress and homeostatic disruptions. Barbering and other abnormal repetitive behaviors (ARBs) have a high occurrence in laboratory mice and therefore exert a significant impact on biomedical research, by compromising experimental outcomes based upon these animals, in terms of validity, reliability and replicability. A prerequisite for the implementation of strategies to improve animal welfare and by consequence, reduce the occurrence of ARBs, is an automated systems that allows for the high-throughput detection and evaluation of ARBs in routine mouse husbandry. We examined the application of the DVC® system for the unsupervised recognition of ARBs in the home cage environment. To this, locomotor activity patterns revealed by the DVC® system were compared by video recordings of the same cages which were evaluated by a trained observer and screened for the occurrence of ARBs. Male and female wildtype C57Bl/6N mice were used for the study and the emergence of ARBs within the 12 weeks observational period was contrasted in cages with single housed mice versus cages containing two or three animals. We propose the DVC® system as tool to support animal care takers, veterinarians and welfare officers for the routine supervision of the welfare status of mice within the experimental research setting.

Use of activity measurement for severity assessment

André Bleich - Director of the Institute for Laboratory Animal Science and Central Animal Facility & Animal Welfare Officer of the Hannover Medical School

Severity Assessment is a major task to ensure welfare of animals undergoing procedures and is required according to EU-regulation. However, objective criteria to enable evidence based severity assessment are scarce and still under investigation. We have recently described methods that allow objective evaluation of research animals in various model systems. In many of these models, activity measurement has been identified as a reliable parameter for assessing the animals. Activity can be recorded in various ways, e.g. by using impedance technology. In the given presentation we exemplify the use of activity measurement in respect to the given aim of welfare assessment.

A multicentre study on spontaneous in-cage activity and micro-environmental conditions of IVC housed C57BL/6J mice during consecutive cycles of bi-weekly cage-change.

Hervé Lerat - Director of the "hTAG" Core Facility, University of Grenoble Alpes.

Mice respond to a cage change (CC) with altered activity and disrupted sleep. Thus, a bi-weekly cage change is preferred over a shorter interval. However, the build-up of ammonia (NH3) during this period is a potential threat to the animal health. Using a multi-center design, we have examined longitudinally in-cage activity, animal health and ammonia levels across the cage floor with C57BL/6 mice housed in IVC and changed every other week. CC induce a marked increase in activity, especially during daytime. Female, but not male, mice preferred to have the latrine in the front of the cage. Male mice allocate more of the activity to the latrine free part of the cage. Female mice used the entire cage floor the first week while during the second week activity in the latrine area decreased. Measurement of NH3 revealed x3 higher values for the latrine area compared with the opposite area. Histopathological analysis revealed no correlation between mouse upper airways, NH3 ppm or bacterial load. We conclude that housing of four C57BL/6J mice for 10 weeks under the described conditions does not cause any overt discomfort to the animals.

The use 24 hour activity monitoring to determine whether male C57BL/6J mice are more social compared to female C57BL/6J mice

Joanna Moore - Investigator and Named Information Officer Laboratory Animal Medicine, UK
IVIVT, Research, GSK

This study aimed to look at whether giving the mice more space and monitoring their activity would give a good indication of whether male mice are more or less social with their conspecifics than female mice housed in the same conditions. Four compatible groups of C57BL/6J, including each sex of adult mice housed in trios (total of 12 male mice and 12 female mice) were sourced from CRUK and were 9-10 weeks old at the start of the study. We used a purpose build set-up of three connecting cages kept on the Digital Ventilated Cage system (DVC®) with a video monitoring system (Tracksy) to enable us to monitor the activity and location of the mice. Our aim was to investigate whether male mice will spend more time together compared with group housed female mice if they were given more space. All animal studies were ethically reviewed and carried out in accordance with Animals (Scientific Procedures) Act 1986 and the GSK Policy on the Care, Welfare and Treatment of Animals.

Which construction works are likely to influence mouse behavior? An approach to the problem.

Markus Brielmeier - DVM, Head of Core Facility Laboratory Animal Science (CF-LAS) at Helmholtz Munich

Construction activities (demolition, soil compaction, drilling into concrete…) can cause stress in laboratory animals and therefore distort data. We have extensive construction work coming up in the next few years, and we want to minimize the damage to animals and science. Noise mitigation planning, vibration attenuation, and documentation of (expected) disturbance could help, but the data on this is very thin. It has been shown that the circadian movement pattern of mice is a sensitive indicator of stress that can be recorded fully automatically around the clock. We purchased such DVC® systems and sought the expertise of immission protection specialists. Results: Unexpectedly, background noise and vibration during normal operation of the animal house were more pronounced than disturbance from construction activities outside the animal house. Metal object handling (>90dbA) and slamming of massive fire doors (>1.4mm/s) were the strongest noise and vibration measured. In contrast, the amplitudes of most construction activities are not perceptible in this background noise.

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THE AGENDA

3 thematic days dedicated to discover how the digital technology solutions already improved some research areas, affected the entire facility and positively impacted on animal welfare management.
The Digital Vivarium becomes more and more the best solution to drive our pre-clinical industry to the next stage.

SOME TOPICS

- Circadian rhythms
- Ageing
- Neuroscience
- Impacts of environmental variables
- Animal Welfare
- Automate Human end-points
- Ammonia impacts

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