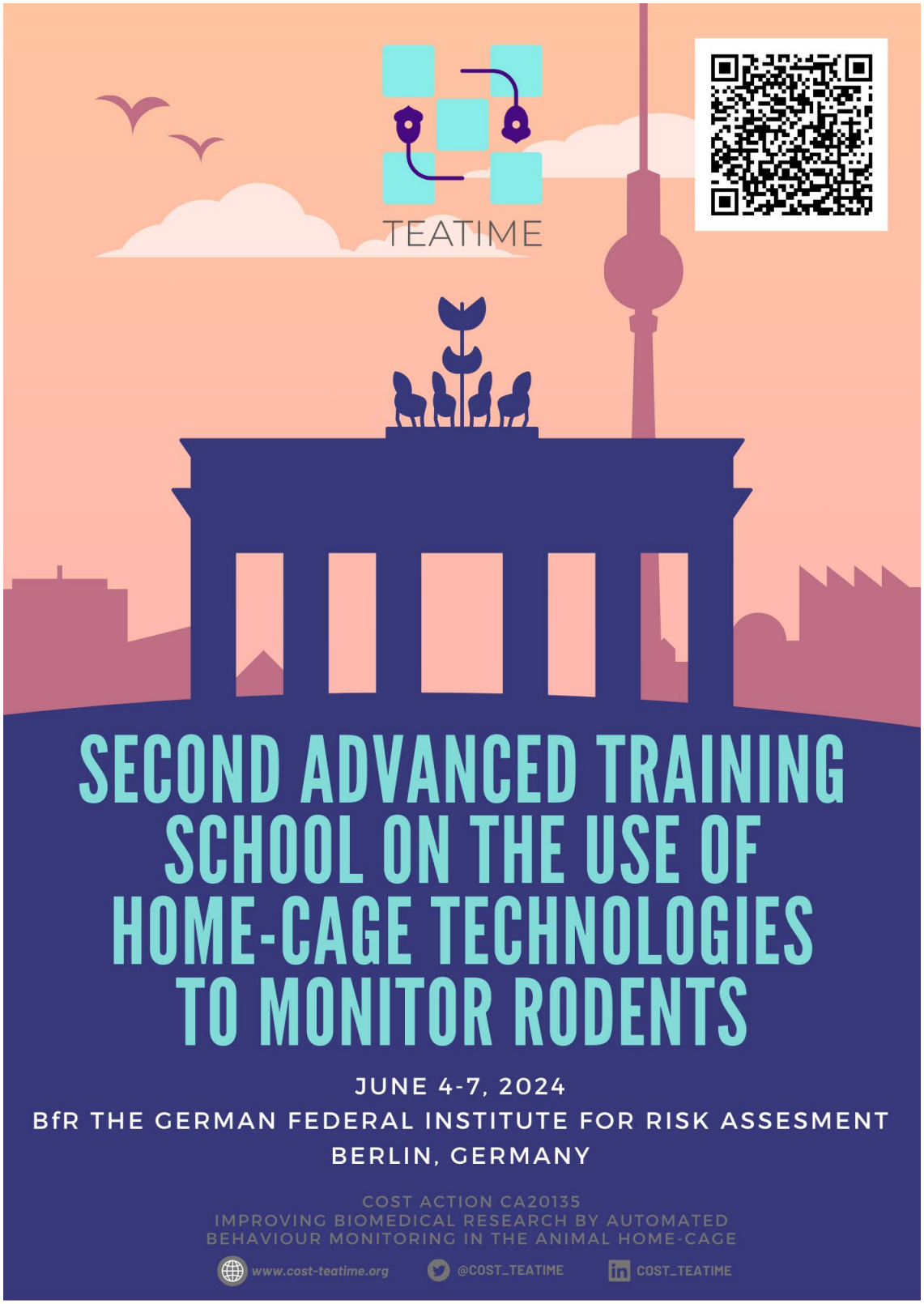
TEATIME
SECOND ADVANCED TRAINING SCHOOL ON THE USE OF HOME-CAGE TECHNOLOGIES TO MONITOR RODENTS
JUNE 4-7, 2024
BfR THE GERMAN FEDERAL INSTITUTE FOR RISK ASSESMENT
BERLIN, GERMANY
COST ACTION CA20135
IMPROVING BIOMEDICAL RESEARCH BY AUTOMATED BEHAVIOUR MONITORING IN THE ANIMAL HOME-CAGE
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CONTENT

INTRODUCTION

COST Action CA20135 (TEATIME) is funded by COST (European Cooperation in Science and Technology), which is a funding organisation for research and innovation networks in European Research Area.

The TEATIME is a network of behavioural research and animal welfare scientists, manufacturers of equipment, bioinformaticians and experts in machine learning to form a collaborative, multidisciplinary consortium. Together they are addressing issues such as the diversity of equipment available, complementarity of protocols and common formats for analysis and presentation of results to enable results to be more cross-comparable. They will look what is needed for the development of new bioinformatics tools such as ontologies (a form of controlled vocabulary) to describe behaviours, analysis of large volumes of data and tools such as Machine Learning to automatically describe or quantify behaviours to reduce the need for lengthy time spent watching videos.

The ultimate aim is to be able to describe animal behaviours with a minimum impact on the animals by monitoring them in the homecages where they live, enabling them to exhibit routine behaviours in a familiar environment. The aim is to share protocols and results that are as interpretable as results currently obtained from behavioural observations of animals outside their homecage which are considered the gold standard, but can be affected by animals being in unfamiliar and sometimes variable environments. Homecage monitoring also offers welfare advantages in that animals remain in their own environments, so are not subject to stresses of being moved to testing arenas. Also the 24/7 nature of the monitoring may pick up welfare issues of animals leading to better welfare outcomes.

The **TEATIME Advanced training workshop** was designed for researchers (Masters, PhD, and post-doctoral students) with at least 2 years hands-on experience in rodent behavioural research.

The workshop will provide instruction on the use of home-cages including: experimental design, psychiatric and cognitive assessment, metabolic measurement within home-cages and the construction of a “homemade” home-cage from basic materials or existing components. There will be a particular emphasis on data analysis with two afternoon workshops devoted to this. All students will be asked to give a short presentation of their work relevant to the workshop.

The TEATIME grant awarding committee received more than 60 applications and selected 24 students (based on academic and research background and motivation) to attend the training workshop. The student participation was fully funded by COST.

TEATIME

PROGRAMME

	3rd June	4th June	5th June	6th June	7th June
9:00 – 10:00 (Lecture 1)		Welcome talk (1) what is COST (2) who are the faculty (3) aims of the school (4) importance of social networking in science (Lars Lewejohann)	Phenotyper (Lior Bikovski)	The importance of home cage systems in animal welfare and the 3Rs (Lars Lewejohann)	Hands on home made system (Davor Virag & Pia Kahnau)
10:00-11:00 (Coffee break)		**Meet the expert break**	**Meet the expert break**	**Meet the expert break**	**Meet the expert break**
11:00-12:00 (Lecture 2)		Experimental design (Nuno Franco)	IntelliCage (Pia Kahnau)	Home-made home cage systems - Smart-Kage system (Julija Krupic)	Summary talk & End of School (Lior Bikovski & Lars Lewejohann)
12:00-13:00 (Lecture 3)		Measuring behavior – calibration of behavior (Lior Bikovski)	Live mouse tracker (Elodie Ey & Nicolas Torquet)	Home made home cage systems (Nathan Marchant)	
13:00-14:30 (Lunch)		**Lunch + Meet the expert**	**Lunch + Meet the expert**	**Lunch + Meet the expert**	
14:30-15:30 (Lecture 4)		Lab tour – a set up of home cage system at the lab of Lars Lewejohann	DVC (Michael Tsoory)	Hands on home made system (Davor Virag & Pia Kahnau)	
15:30 – 18:00 (Workshops & coffee)	**Evening Reception**	Meet the students Student presentations	Meet the company (DVC, TSE, Noldus, and iMouse)		

TUESDAY 4th June

LECTURE 1 - Welcome talk

LARS LEWEJOHANN – BfR, Germany

Biography

I studied Biology and Philosophy at the University of Muenster, Germany and graduated in Behavioral Biology. Already my diploma thesis was about the evaluation of housing conditions of laboratory mice from an animal's point of view using preference tests. In my PhD-project on "Behavioral Phenotyping of Mice" I developed a test battery for murine models used in biomedical research. Before moving to Berlin, I was interim professor for Behavioral Biology at the Universities of Osnabrueck and Goettingen. Since April 2017 I am professor for animal welfare and refinement at the Freie Universität Berlin and the Head of Unit "Laboratory Animal Science" at the German Center for the Protection of Laboratory Animals (Bf3R) at the Federal Institute for Risk Assessment (BfR), Berlin. In my lab we develop new concepts of social and environmental enrichment in order to counteract animal boredom in laboratory animals. In addition, individual differences, the interplay of cognition and emotion, and the animals' point of view with regard to better housing conditions and experimental designs are among our current research topics. All our research makes extensive use of home cage monitoring.

Abstract

The aim of this talk is to make you feel welcome in Berlin, while at the same time trying to address some organizational matters.

LECTURE 2 - Experimental Design

NUNO H. FRANCO - University of Porto, Portugal

Biography

I am a researcher at the i3S (University of Porto) on the topics of laboratory animal welfare, animal ethics and the 3Rs, and scientific quality. I have degrees in both Animal Biology and Science Education, and a PhD in Biomedical Sciences, and I have been teaching experimental design for over a decade, in Portugal and across Europe. I am a member of the FELASA working group on experimental design education, vice-president of the Portuguese Society for Laboratory Animal Science (SPCAL) and President of the EU Education & Training Platform for Laboratory Animal Science (ETPLAS). I also sit on the i3S Animal Welfare Body and coordinate the Portuguese Network of Animal Welfare Bodies – RedeORBEA.

Abstract

Within the scientific community there has been increasing distrust regarding the reliability of scientific research, animal-based or otherwise. Lack of awareness to even the most basic requirements of reliable research – adequate sample sizes, blinding, randomization, controlling for common biases – has been identified as a main factor behind the poor reproducibility and translational value of published findings.

Course participants will be introduced to good principles and practices in research planning and experimental design, and be able to answer such questions as 'How to randomize in an experiment?', 'What is the experimental unit?', “Is my sample size large enough?”. Although it is not expected that within the time-frame allocated for this theme all types of experiments and designs can be covered, this lecture will draw attention to the main caveats to avoid, and to the conditions that must be in place to make animal experiments more reliable, robust and reproducible, while avoiding animal waste and complying with the 3Rs of animal research, with particular emphasis on Reduction and Refinement.

LECTURE 3 - Measuring behavior at the home cage – what do we know so far

LIOR BIKOVSKI - Tel-Aviv University, Israel

Biography

I finished my PhD in Psychology at Tel-Aviv University (TAU), and I have been running the behavioral core facility of the Medical school at TAU since then. As a behavioral Core Facility director I am an expert in bio-behavioral methods, providing consultation on experimental design and data analysis, as well as technical training for new users and assistance with planning experiments. My publications are in different areas of research (e.g. Brain trauma, Cancer, Schizophrenia), but my main interest is in developing methods, improving standardization, and advancing replicability. In the last few years, I am a part of several endeavors such as EQIPD (http://go-eqipd.org/), that facilitate improvements in data quality, and TEATIME Cost Action (https://www.cost-teatime.org/) that bring together European organizations developing and using automated home-cage monitoring technologies

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Abstract

Addressing the challenge of reproducibility and standardization is paramount in scientific research. This issue is critical when discussing pre-clinical animal neuro-behavioral research not only for scientific advancement of the field but also from an ethical point of view since we rely on experimentation involving laboratory animals (e.g., mice and fish). The lack of standardization in behavioral neuroscience challenges our ability to replicate results, which raises concerns regarding the potential wastage of numerous lab animals for minimal or negligible gain. In this presentation, I will discuss our experiences at the Myers Core Facility regarding the standardization of standard behavioral assays and the contribution of home cage systems in mitigating and improving our ability to replicate our results.

WORKSHOP - Meet the students

Student presentations

WEDNESDAY 5th June

LECTURE 1 - Phenotyper

LIOR BIKOVSKI - Tel-Aviv University, Israel

Biography

See Day 1

Abstract

Over the past two decades, we invested many resources into developing and incorporating diverse surveillance methodologies within home cages, recognizing the inherent limitations of conventional approaches. This integration has afforded us a deeper understanding of the phenotypic expressions of laboratory mice. By integrating conventional sampling assessment methods with the observation of "natural" behaviors within home cage environments, we have achieved a comprehensive understanding of the phenomena under investigation, addressing gaps left unbridged by standard methods.

At the Myers Neuro-Behavioral Core Facility (MNBCF), our primary tool for such investigations is the PhenoTyper cage, a versatile and fully configurable observation system tailored for measuring and assessing the behaviors of laboratory rodents. Integration of this system at MNBCF has enabled us to analyze unique home cage behaviors, including circadian patterns and feeding-drinking behaviors, in conjunction with home cage version of standard assessments of anxiety, learning, and attention processes.

During my presentation, I will introduce the PhenoTyper cage system and delve into the diverse methodologies utilized at MNBCF. Drawing from recent studies, I will illustrate how the integration of standard methods with research methodologies within home cages has enhanced the diagnostic process and our understanding of the studied phenotype.

LECTURE 2 - IntelliCage

PIA KAHNAU – German Federal Institute for Risk Assessment (BfR), Germany

Biography

I completed my Bachelor's degree in Biosciences at the University of Münster. During my bachelor thesis at the Department of Behavioural Biology I investigated the influence of different social housing conditions on the behaviour and stress reactivity of juvenile male domestic guinea pigs. For this purpose I conducted behavioural tests such as direct observations and social and stress tests. During my master's thesis at the Department of Behavioural Biology at the University of Osnabrück, I investigated the influence of learning on social structure and physiological processes in male mice. To perform learning tasks, 48 male mice were housed in groups of 12 in four IntelliCages. Since 2017, I have been working at the German Centre for the Protection of Laboratory Animals (Bf3R), which is affiliated to the German Federal Institute for Risk Assessment (BfR). I completed my PhD in the working group Laboratory Animal Science of. As part of my thesis, I developed an automated and home-cage based set-up for various

behavioural tests in mice. For this set-up, I connected an IntelliCage (TSE, Germany) to a Macrolon cage via an AnimalGate (TSE, Germany). With this setup I have successfully conducted a consumer demand and cognitive bias test. We are also developing our own RFID- and home-cage based setup - the MoPSS (Mouse Position Surveillance System). The aim is to use the MoPSS in various experiments to track mice kept in groups within their home-cages.

Abstract

Home-cage testing offers the opportunity to test laboratory mice in their familiar environment, during their active phase and with minimal interference from the experimenter. The advantage is that the mice are subjected to less stress during the experiments, which can have a positive effect on the repeatability and validity of the data. The IntelliCage (TSE, Germany) allows individual data to be collected from group housed mice using Radio Frequency Identification (RFID) technology. We used the IntelliCage to study the learning behaviour of C57BL/6J mice. This is made possible by four conditioning corners within the IntelliCage. Each conditioning corner contains an RFID antenna and a presence-sensor that detects which mouse stays in which corner for how long. Different liquids (two bottles per corner) can be used as rewards, with access controlled by infrared-sensors and doors. Airpuffs can be used as a punishment. The IntelliCage is often used as a home-cage based testing system where all the mice (up to 16) are housed as a social group. To reduce mutual interference between the mice, we added an AnimalGate (TSE, Germany) and an additional cage to the IntelliCage. The gate allowed the mice to enter the IntelliCage individually and voluntarily. Doors and infrared-sensors ensured that only one mouse was in the IntelliCage at a time. In total, two different experiments were conducted in the advanced IntelliCage based test system. In the consumer demand experiment, the strength of preference/aversion for different liquids was determined by requiring the mice to do more work each day in the form of nosepokes (at the infrared-sensor within the conditioning corner) to gain access to the liquids. The cognitive bias experiment was used to assess the emotional state of the mice.

LECTURE 3 - Live Mouse Tracker

ELODIE EY – IGBMC, France
FABRICE de CHAUMONT – Institut Pasteur, France

Biography - Elodie Ey

I am a CNRS researcher with an ethology and bioacoustics background. After a PhD thesis on the adaptation of contact vocalisations in wild olive baboons in the German Primate Centre in Göttingen, Germany, I focused my interests in social communication in rodents. I am interested in unravelling the way in which mice and rats regulate the social organisation within a group. In this context, I specifically study the functions of ultrasonic vocalisations as a communicative signal. I am applying this knowledge to better adapt and interpret the behavioural phenotyping of mouse and rat models of autism spectrum disorders, which primarily affects social communication. I conducted these projects at the Institut Pasteur, Paris, in the team headed by Prof Thomas

Bourgeron, and now at the IGBMC near Strasbourg in the team headed by Dr Yann Hérault.

Biography - Fabrice de Chaumont

During his PhD in robotics (Amiens, Berck), FdC conceived an autonomous robot designed to help disabled people, and especially paraplegics. The robot used omnidirectional vision sensor to SLAM and navigated automatically in the environment in order to follow the wheelchair of disabled people. The aim of the project was to deport heavy devices such as synthetic arm on the robot, and to make it a handy companion. He then moved to Image analysis in Institut Pasteur and created the image analysis software Icy. Then he switched to behaviour analysis and animal experimentation by creating the Live Mouse Tracker and the block system known as MiceCraft in Thomas Bourgeron's lab.

Abstract

Live Mouse Tracker and MiceCraft: Home-cage monitoring systems aim at improving the behavioural phenotyping approaches applied in rodent models by increasing data exhaustivity and optimizing animal welfare. As this approach allows to detail the individual behavioural characteristics of one animal within its social group, innovative approaches should relate these traits with individual performances in separated tests measuring e.g. cognitive abilities, anxiety, emotional perception. Indeed, the influence of the group shapes the behavioural traits of each member. Our aim is therefore to develop a living environment in which animals are continuously monitored over days and nights for both social interactions and individual performances. In the living environment, we used a real-time method for behavioural analysis of mice housed in groups gathering computer vision, machine learning and Triggered-RFID identification to track and monitor animals over several days in enriched environments. This system - Live Mouse Tracker (LMT) - extracts a thorough list of individual and collective behavioural traits and provides a unique phenotypic profile for each animal. LMT is open source, open hardware, enables closed loop experiment and we provide python libraries to extend the analysis to custom needs. We developed cognitive tests in modules that are connected to this living environment through identity-controlled automated doors. This modular system – MiceCraft- is developed in python. The full system requires specific low-cost hardware but remains then fully flexible and can be adapted to any type of tests. It is adapted to mice and on development for rats.

LECTURE 4 - DVC

MICHAEL M. TSOORY - Weizmann Institute of Science, Israel

Biography

Dr. Tsoory is a senior staff scientist, heading the Behavioral and Physiological Phenotyping Unit at the Department of Veterinary Resources, Weizmann Institute of Science. He did his B.A., M.A. and PhD in Psychology at the University of Haifa, Haifa, Israel. Where, he received his training and research experience in behavioral neuroscience combining different biological assays with behavioral assessments. For his M.A. he assessed the involvement of central monoamines in a rat model of social

cooperation and for a PhD he established a novel early life stress rat model of exposure to stress during juvenility. During his Post-Doc at the Department of Neurobiology, Weizmann Institute of Science (Rehovot, Israel) he assessed the involvement of the CRF/Urocortin systems in modulating stress responses and learning faculties-developing models of stress induced psychopathologies.
He is also active as a stakeholder in the EQIPD initiative: a European Union's Horizon 2020 consortium aimed at Enhancing Quality In Preclinical Data.

Abstract
The talk focuses on experiments conducted using the DVC® system in our facility. It describes the validation processes and the development of a "data pipeline". It will detail experiments aimed at assessing the DVC® system's capacity to detect changes in home-cage activity following induced motor impairments, nerve injury for example, and recovering from them.
Laboratory rodent models of nerve injury rely heavily on repeated assessments of motor functions away from the home–cage, where the laboratory animals are often forced to walk to allow assessments of gait and stride, for example. Such assessments lead to substantial disturbance of the animals' routine and cause them some discomfort that might mask the experimental manipulation effects. In addition, these evaluations are labor-intensive and require time-consuming post-hoc analyses.
Therefore, the described study sought a home-cage-based alternative and in a series of experiments assessed the DVC® system's capacity to detect sciatic nerve injury-induced motor impairments and recovery dynamics as reflected by changes in voluntary, spontaneous, activity in the home cage.
The home – cage activity DVC® indices data indicate dynamics of recovery processes, reflected by "return to baseline levels", that correspond to those indicated by stride and gait analyses.
Additional discussion will address the advantages and challenges of monitoring home cage activity from a core facility user's perspective. The lecture discusses in a critical manner issues of validity, reliability, scientific rigor and animal well fare.

MEET THE COMPANY

Thursday 6th June

LECTURE 1 - The importance of home cage systems in animal welfare and the 3Rs

LARS LEWEJOHANN – BfR, Germany

Biography

I studied Biology and Philosophy at the University of Muenster, Germany and graduated in Behavioral Biology. Already my diploma thesis was about the evaluation of housing conditions of laboratory mice from an animal's point of view using preference tests. In my PhD-project on "Behavioral Phenotyping of Mice" I developed a test battery for murine models used in biomedical research. Before moving to Berlin, I was interim professor for Behavioral Biology at the Universities of Osnabrueck and Goettingen. Since April 2017 I am professor for animal welfare and refinement at the Freie Universität Berlin and the Head of Unit "Laboratory Animal Science" at the German Center for the Protection of Laboratory Animals (Bf3R) at the Federal Institute for Risk Assessment (BfR), Berlin. In my lab we develop new concepts of social and environmental enrichment in order to counteract animal boredom in laboratory animals. In addition, individual differences, the interplay of cognition and emotion, and the animals' point of view with regard to better housing conditions and experimental designs are among our current research topics. All our research makes extensive use of home cage monitoring.

Abstract

The aim of this talk is to make you feel welcome in Berlin, while at the same time trying to address some organizational matters.

LECTURE 2 - Home made home cage systems – Amrt-Kage system

JULIJA KRUPIC – Cambridge University, UK

Biography

Dr Krupic earned her undergraduate degree in Physics at Vilnius University, followed by a Master's in Bioimaging sciences at Imperial College London where she started to apply physics to biological problems working on cerebellar Purkinje cells. She then completed her PhD in Neuroscience at UCL in Prof John O'Keefe's group, working on the medial entorhinal grid cells. Her work showed that hexagonal grid cell symmetry fundamentally depends on the geometry of the enclosures. After her PhD, she was awarded a Sir Henry Wellcome postdoctoral fellowship and moved to the Salk Institute to develop techniques for in vivo single-cell tracing in the hippocampus and entorhinal cortex. From Salk, she moved to the University of Cambridge to start her group as a Sir Henry Dale fellow, where she continued to study the basic mechanisms of entorhinal-hippocampal neural circuits and how they generate allocentric spatial maps. More recently, at the UK DRI at UCL, Dr Krupic will use her expertise in basic science to infer the early mechanisms of entorhinal-hippocampal neuron-glia circuit impairments in Alzheimer's disease. As part of her basic science program, she developed

several novel tools for measuring behviours in rodents, inclu ding the honeycomb maze to assess a rta's ability to navigate to goal location and a home-cage monitoring system (smart-Kage) for long term fully automated cognitive and behavioural assessments in mice.

Abstract

The hippocampus and entorhinal cortex are critical for long-term memory and navigation. In my talk, I will present a fully automated AI-based homecage environment (smart-Kage) for comprehensive phenotyping of hippocampal-dependent spatial and object memory in mice and an analogous testing pipeline in humans. The testing in a home cage includes a T-maze and a novel object recognition task, with the performance sensitivity comparable to analogous standard tests used outside the homecage enclosure. Importantly, we run mice in smart-Kages in two different facilities and showed that their cognitive and other behavioural measures were comparable.

LECTURE 3 - Home made home cage systems

NATHAN MARCHANT - Amsterdam UMC, The Netherlands

Biography

Dr. Group, in the department of Anatomy & Neurosciences, at Amsterdam UMC. He did is PhD in 2011 (UNSW, Sydney, Australia) and Post-doc work at the National Institute on Drug Abuse (Baltimore, USA). Throughout his career, his research has been focused on the development of novel rodent models of addiction and relapse, and studying the neurobiology underlying various addiction-related behavioural phenomena. Currently, Nathan is conducting studies to investigate alcohol self-administration in a home-cage setting, and the interaction of the home environment with social factors in the development and maintenance of addiction.

Abstract

Rodents are used to investigate the neurobiological substrates of complex cognitive functions, which are often dysfunctional in many psychiatric disorders. Rat models in particular are used to understand the neurobiology associated with these psychiatric disorders. Standard operant training conditions are useful to identify some aspects, however there are limitations to the traditional approach, including experimenter handling, setting, and limited access. To address this, we implemented a custom home-cage self-administration 'CombiCage' system, where the rats housing chamber is connected to a Med Associates operant chamber though a tunnel, and the rat can have 24-h access to operant tasks to assess cognitive functions such as impulsivity, and alcohol self-administration. I will discuss some of the challenges we faced during the initial implementation of this approach, including incorporating social housing, linking the operant chamber to a Raspberry Pi system for video recording, and challenges associated with chemogenetics manipulations. Future directions of this approach are to expand the system to include more subjects in a single setup, and to implement custom touchscreen interfaces to expand on the versatility of these approaches.

WORKSHOP - Design and print a home-cage system

DAVOR VIRAG & PIA KAHNAU

Biography – Davor Virag

I am a PhD student researching circadian dysrhythmia and the effect of ADHD drugs on a rat model of Alzheimer's disease at the University of Zagreb School of Medicine's Dept. of Pharmacology. I got into research at my current lab as a medical student by stumbling into a use for my electronics/programming hobby, which has enabled me to develop open-source research instruments to gain insight into more facets of our animals' behaviour. These include PASTA (Platform for Acoustic STArtle, a hacked kitchen scale), MIROSLAV (Multicage InfraRed Open Source Locomotor Activity eValuator for home-cage circadian rhythm measurement), and VlaDiSLAV (a home cage conditioning apparatus).

Biography – Pia Kahnau

See Day 2

Abstract

The number of open devices built by researchers and published for researchers is growing like never before. Beginner-friendly open-source electronics platforms like Arduino enable us to replicate existing systems, modify and extend them according to our needs, or build our own prototypes from scratch and get biological insight without any formal electronics/programming education. In this workshop, self-taught biological researchers will help you learn the basics of building a home-cage system so you can return to your lab with a prototype of your own!

Friday 7th June

WORKSHOP - Design and print a home-cage system

DAVOR VIRAG & PIA KAHNAU

Biography & Abstract

See Day 3

LECTURE 1 - Summary talk

LIOR BIKOVSKI - Tel-Aviv University, Israel
LARS LEWEJOHANN – BfR, Germany

STUDENTS

First name	Last name	Organisation	Country
Alice	Melloni	Istituto Italiano di Tecnologia	Italy
Alina Cristina	Marin	King's College London	United Kingdom
Arpana	Hanumantharju	University of Tartu	Estonia
Aurora	Hämäläinen	University of Helsinki	Finland
Daniela	Domingues	Paris Brain Institute	France
Dmytro	Nesterenko	Free University of Berlin	Germany
Francesca	Tozzi	F.Hoffmann-La Roche	Switzerland
Hamid	Taghipourbibalan	UiT The Arctic University of Norway	Norway
Jemima	Becker	University of Oxford	United Kingdom
Jenice	Linde	RWTH Aachen University	Germany
Lauri	Elsilä	University of Helsinki	Finland
Léa	Ceschi	Paris-Saclay Institute of Neuroscience (NeuroPSI)	France
Liya	Niv	Hebrew University of Jerusalem	Israel
Marianna	Samà	Istituto Superiore di Sanità	Italy
Mila	Kazavchinsky	Tel-Aviv University	Israel
Mor	Yam	Tel Aviv University	Israel
Morten	Malmberg	University of Copenhagen	Denmark
Nastasia	Mirofle	Paris-Saclay Institute of Neurosciences (NeuroPSI)	France
Özge Selin	Çevik	mersin university	Türkiye
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FACULTY

First name	Last name	Organisation	Country
Lior	Bikovski	Tel-Aviv University	Israel
Lars	Lewejohann	German Federal Institute for Risk Assessment (BfR)	Germany
Davor	Virag	University of Zagreb School of Medicine	Croatia
Elodie	Ey	IGBMC	France
Fabrice	de Chaumont	Institut Pasteur	France
Julija	Krupic	University of Cambridge	UK
Michael	Tsoory	Weizmann Institute of Science	Israel
Nathan	Marchant	Amsterdam University Medical Centre	The Netherlands
Nuno	Franco	University of Porto	Portugal
Pia	Kahnau	German Federal Institute for Risk Assessment (BfR)	Germany

SUPPLEMENTARY INFORMATION

Background and additional information suggested by speakers

Speaker	Suggested literature/links to other useful resources
Nathan Marchant	Bruinsma et al., (2019) Psychopharmacology https://doi.org/10.1007/s00213-019-05189-0
Julija Krupic	Ho H, Kejzar N, Sasaguri H, Saito T, Saido TC, De Strooper B, Bauza M, Krupic J. A fully automated home cage for long-term continuous phenotyping of mouse cognition and behavior. Cell Rep Methods. 2023 Jul 13;3(7):100532. doi: 10.1016/j.crmeth.2023.100532. PMID: 37533650; PMCID: PMC10391580.

ACKNOWLEDGEMENTS

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COST (European Cooperation in Science and Technology) is a funding agency for research and innovation networks. Our Actions help connect research initiatives across Europe and enable scientists to grow their ideas by sharing them with their peers. This boosts their research, career and innovation.

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