Swiss 3R Competence Centre

PRESS RELEASE

February 20, 2024

Swiss 3RCC announces recipients of the 2022 Targeted Call: Putting 3Rs methods into effective practice

The Swiss 3R Competence Centre (3RCC) will fund five research projects spanning different focuses within the 3Rs (replace, reduce, refine) at Swiss research institutions with a total of CHF 1,855,623. The projects aim to develop comprehensive strategies, with the objective of effectively implementing precise methodologies. Of the five projects, three are focussing on the implementation of replacement methods, one on a reduction approach and one on measures of refinement.

About the Swiss 3R Competence Centre

The 3RCC, a research infrastructure of national importance, focuses on research, education, monitoring and communication in promotion of the Replace, Reduce and Refine (3R) Principle for humane use of animals in research. The 3RCC strives to drive 3Rs advancement for better animal welfare and science in Switzerland. Visit https://swiss3rcc.org/ for more information.

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SWISS 3RCC TARGETED CALL 2022 RECIPIENTS

Introduction of the projects:

An automated system for the assessment of pain and wellbeing in laboratory mice

Associate Professor Johannes Bohacek, ETH Zurich
Project Number: TC-2022-005

Monitoring the well-being of mice in research labs is often overlooked, and current methods rely on subjective observations, leading to potential biases and variations between different observers. Recent advancements in machine vision and learning tools offer a solution by automating and standardizing these measures. This project aims to create an all-in-one automated platform (both hardware and software) for monitoring animal welfare. It will include 3D gait analysis, the grimace scale, assessment of ethological behaviors, and detailed analysis of behavioral patterns. This platform can be easily implemented in research labs, providing a more comprehensive evaluation of how experimental procedures, such as surgeries and analgesia, impact the health of mice. By filling a technological gap, this project enhances the accuracy and reliability of animal welfare monitoring, allowing for consistent data across different research settings. Ultimately, it supports the establishment of universally accepted standards for the care of mice undergoing various experimental procedures worldwide.

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Standardising human organoid-based drug permeability assays

Professor Johannes Mosbacher, Fachhochschule Nordwestschweiz
Project Number: TC-2022-012

With the Modernization Act 2.0 signed in early 2023, the FDA paves the way for more new drug applications without animal testing. This decision puts researcher and drug developers back into the drivers seat to quickly bring non-animal-based pre-clinical studies to a level of trust, validation and broad acceptance by the public and regulatory authorities. To meet at least a small part of this demand, this project aims to develop a validated and standardised assay based on human cells, focusing on predicting drug absorption in the gut and permeability to the brain—key aspects covered by current animal tests in DMPK (Drug Metabolism and Pharmacokinetics) studies. Based on recent advancements in human organoid in vitro assays, coupled with in silico modeling, such tests may even address patient-specific differences and enable personalised predictions of clinical outcomes. Guided by Swiss and EU regulatory authorities and pharma industry experts, the main objective for the team is to standardise a drug permeability assay on a Swiss-developed platform. We plan to create a Standard Operating Procedure (SOP) and qualify this assay using clinically validated reference drugs. To refine the model, we feed our data into in silico modeling software for in vitro – to - in vivo extrapolations and assess its predictive validity using clinically relevant parameters. This project aligns with Swiss-wide and international efforts to establish new regulatory guidelines for animal-free drug testing assays. We intend to secure additional funding from pharmaceutical industries and international consortia because we realize that this task will take co-ordinated efforts and input from all stakeholders to replace current animal testing, faster!

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A unique technology producing standardised lung cancer organoids in air/liquid interface conditions: a new alternative to animal experimentation

Dr Olivier Preynat-Seauve, University of Geneva
Dr Véronique Serre-Beinier, University of Geneva
Project Number: TC-2022-010

Lung cancer ranks among the most widespread cancers globally and is the leading cause of cancer-related deaths in Switzerland, with Non-Small Cell Lung Carcinoma (NSCLC) representing approximately 85% of cases. Researchers commonly rely on animal experiments to study NSCLC. Lung Cancer Organoids (LCO) derived from human biopsies offer a promising alternative to animal testing for research, personalized medicine, and drug screening. However, the current process of obtaining LCO is limited and challenging. Dr. Preynat-Seauve's group has patented a novel technology designed to produce organoids under air/liquid interface conditions. Basically, this technology mimics lung physiological air-liquid interface conditions by using imprinted microwells on a hemi-permeable membrane that allows media exchange by capillarity from the basal surface. Dr Serre-Beinier's group is involved and expert in the development of models mimicking LCO development for personalized medicine applications. LCO generated using this new technology were compared to those produced using the traditional immersion method. The results showed a clear improvement in the uniformity of LCO. Validating this innovative LCO technology is expected to lead to a substantial reduction in animal use per year. Finally, this research project, conducted in close collaboration with Dr. Serre Beinier and Dr. EL Harane, holds promise for advancing personalized medicine by providing valuable insights into cancer development.

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Minimizing the number of rodents used in the discovery of antimicrobials through candidate screening in zebrafish embryos

Professor Steffi Lehmann, Zurich University of Applied Sciences
Project Number: TC-2022-011

Antibiotic resistance poses a significant global health threat. A growing number of bacteria, such as multiple drug resistant (MDR) Pseudomonas aeruginosa and vancomycin resistant Enterococcus faecalis, cause life-threatening disease in humans, which cannot be treated efficiently. Bacteriophages, which are viruses infecting bacteria, and proteins derived from bacteriophages show promise as alternatives to antibiotics, demonstrating efficacy against antibiotic-resistant strains. Developing new antimicrobials typically involves testing in animal models, commonly mice. However, zebrafish embryos present a suitable in vivo model for bacterial infection. Conducting tests in early zebrafish embryos enables real-time observations of infection progression, mechanisms, and antibiotic efficacy. The project aims to establish a zebrafish embryo-based screening platform to identify innovative antimicrobials derived from bacteriophages, aiming to reduce reliance on mouse experiments. This screening platform, once established, will be offered as a service by ZHAW to both industrial and academic partners involved in discovering and developing novel antimicrobials. By doing so, we aim to create a general model for discovering new antimicrobials using zebrafish embryos, contributing to the global effort to combat antibiotic resistance.

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SWISS 3RCC TARGETED CALL 2022 RECIPIENTS

Multidimensional models for in vitro screening of endocrine disrupting agents

Dr Constanze Hantel, University Hospital Zurich
Poject Number: TC-2022-001

Endocrine disrupting chemicals (EDCs) are substances, both natural and human-made, present in everyday items like plastics, detergents, food, and cosmetics. These chemicals can adversely affect the health and development of both animals and humans. EDCs have been associated with disruptions in the endocrine system, contributing to conditions such as diabetes, cardiovascular disease, obesity, early puberty, infertility, and various cancers. Our project aims to create and analyze 2D/3D in vitro models of the adrenal and pancreas. These models will reflect in this context highly relevant signaling networks of these organs, allowing us to identify chemicals acting as EDCs. We employ human cell lines and bovinerest-tissues obtained from the slaughterhouse, repurposing the latter from waste instead forimplementation in scientific read-outs. In the 3D aspect, we employ a high-throughput platform capable of forming over 9000 spheroids/organoids in a single plate. While current EDC research often relies on animal models, especially rodents, our in vitro models of the adrenal and pancreas offer a superior alternative. These models have the potential to accurately capture complexities of the respective organs without the need for animal testing, providing a more ethical and efficient approach to studying the impact of EDCs in a high-throughput manner.

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