

TEDD Competence Centre Report 2019

Katarzyna S. Kopanska* and Markus Rimann*

*Correspondence: Dr M. Rimann, Head of TEDD, markus.rimann@zhaw.ch;
Dr K. Kopanska, TEDD Project Manager, katarzyna.kopanska@zhaw.ch;
Competence Centre TEDD, Institute of Chemistry and Biotechnology (ICBT),
ZHAW Zurich University of Applied Sciences, Wädenswil, Switzerland

TEDD (Tissue Engineering for Drug Development and Substance Testing) is an education, R&D and networking platform promoting the application of 3D organotypic technologies, with the core goal of replacing animal experimentation for therapy development. Based in Switzerland, TEDD is one of its kind in Europe focused on 3D for 3Rs. The community is composed of international members from academia, clinics, industry and non-profits. Training of members is achieved through regular events at the national and international level, including workshops, symposia, company visits, scientific reviews and by providing the platform to generate research consortia, projects and grant applications.

General Information

The network TEDD is embedded at the Zurich University of Applied Sciences (ZHAW) and is therefore actively involved in research and education. TEDD's ambition is a contribution towards implementation of state-of-the-art and new human cell-based *in vitro* organotypic methods into routine use leading to a significant reduction of animal experiments in research and industry. As a result, we contribute to a paradigm shift, initiated and supported by the biomedical industry, research and government, and believe that alternative methods will help to strongly reduce animal experiments in the future. 3D cell culture models are becoming widely accepted and recognized. Current research showed that human organotypic models significantly improved cell-based drug screening and addressed safety and efficacy of substances more efficient than animal models or 2D cell cultures. However, despite the considerable advancement of organotypic technologies and partial adaptation in industry, the full potential is not yet reached. Further efforts are required to boost the development progress. It is important that the companies start adapting and implementing organotypic model systems into their drug development processes. Furthermore, a joint action will help harmonizing and standardizing 3D models according to assay, scalability and usability enabling direct comparison and assessing their translational value.

The Competence Centre TEDD actively contributes to these efforts by creating a collaborative innovation platform dedicated to evaluating and validating 3D cell culture technologies and organ-like tissue models for therapy development.

TEDD was founded in 2010 by the section 'Tissue Engineering' at the ZHAW and the company InSphero AG, a leading Swiss supplier of organotypic 3D microtissues for drug testing and disease modelling. TEDD is embedded and financially supported by the research consortium biotechnet Switzerland. Until the end of 2019, TEDD was part of the National Thematic Network (NTN) Swiss Biotech. The Competence Centre is guided by experienced academic and industrial professionals with a steering committee and an international advisory board. TEDD is also a physical research centre based at the ZHAW within the Centre of Cell Biology and Tissue

Engineering. We work with pharma, biotech, food and cosmetic companies on the development of robust and cost-effective solutions to test their products. We have a broad portfolio of engineering and biofabrication technologies from spheroids to 3D bioprinting.



The 3D bioprinter training during the bioprinting workshop in 2018.

Summary of Achievements 2019

During the past nine years, TEDD built a reputation, know-how and an international network to effectively promote the adaptation of advanced cell-based technologies. The past 18 months were particularly dedicated to outreach activities and education about 3D for 3R.

The milestones we accomplished up to now are:

- Serving as initiation and maturation platform for several successful research projects. For example, TEDD members developed a platform for the production and analysis of fully functional human 3D muscle tissues. Primary human skeletal muscle cells were bioprinted into a specialized well plate and analysed by a muscle tissue analyser device that allows electrical stimulation and optical read-out of the tissues when subjected to drug treatment. This system will be able to reduce the use of animal muscle tissue in research and development (Innosuisse project No.: 27901.1).
- Acquiring 111 TEDD members from industry, academia, clinics and non-profits from entire Switzerland, Europe and USA (30% international) and therefore being able to have a large impact on developments in life sciences. The majority of TEDD partners are from industry (60%) including young innovative spin-off companies, technology enablers and world players, such as big pharma, medtech and cosmetic companies. Through its activities TEDD covers and directly influences the entire value chain of biotech R&D relevant for 3D tissue engineering.
- Organisation of TEDD Annual Meetings (annually since 2012) and satellite workshops, approved by Swiss Veterinary Office as further education in alternatives to animal testing. We cover topics relevant to biofabrication and 3D cell culture technologies: bioprinting, stem cells, personalised medicine. We feature international speakers, industry exhibition and community exchange. Our events are known for creating an

approachable and personal atmosphere between the participants. This allows for direct interaction with the goal to create long-term collaborations based on trust.

- Organisation of academic workshops and industrial visits directly on-site of the members. We highlight member institutions, where organotypic technologies are adapted and implemented to make those tools available for the TEDD community. We visit academic centres as well as enabling technology providers and end users. This allows the exchange and direct interaction of researchers and biotech professionals, speeds up the technology transfer process and leads to customer-centric developments.
- Acting as bridge between 3R organisations and our members, we are an institutional member of ALTEX Edition that issues 'ALTEX', 'ALTEX Proceedings' and the German 'TIERethik', promoting alternatives to animal experimentation and highlighting different aspects of the human-animal-relationship. We actively participate in Board Meetings shaping the journal's future. TEDD leader Dr Markus Rimann is a Foundation Board Member of Animalfree Research that supports research projects by promoting the replacement of animal experiments.



Dr Markus Rimann presenting TEDD to the participants of Sino-Swiss Workshop on Tissue Engineering in October 2019.

Activities 2020

31. January 2020	TEDD University Visit: Adolphe Merkle Institute, Fribourg, Switzerland	TEDD visited the BioNanomaterials group at Adolphe Merkle Institute (AMI). Scientists presented ongoing research projects: i) how to investigate the hazard of aerosolized nanomaterials such as carbon nanotubes with lung tissue, ii) the interaction of micro- and nano-plastic particles with a novel intestine model, iii) the effect of diesel exhaust particles on skin properties using a reconstructed epidermal model, iv) as well as 3D bioprinting technology for the design of an omental model to study the dynamics of cancer cells.
12–14. May 2020	Dechema 3D Cell Culture 2020, Freiburg, Germany Postponed to 5.–7. May 2021	TEDD co-organises 3DCC2020 with the topic 'From bench to applications: Get updated about 3D cell culture as predictive model systems and the translation from models to applications'. The conference highlights newest developments and translation of models to applications, success stories, trends, innovative technologies. The exhibition will showcase practical applications, products and solutions and further stimulate discussions between researchers, solution providers and users.
25. June 2020	TEDD company visit: Tecan Group Ltd., Männedorf, Switzerland	TEDD will visit Tecan, a leading global provider of automated laboratory instruments and solutions. Our systems and components help people working in clinical diagnostics, basic and translational research and drug discovery bring their science to life. The event will feature talks and company tour.
25.–27. August 2020	Biointerfaces International (BIC 2020), Zurich, Switzerland. Postponed to 17.–19. August 2021	TEDD co-organises the translational debate session during the conference entitled: "Progress in cell-based in vitro assays for drug development, substance toxicity testing, and regenerative medicine – supporting 3R initiatives". The debate brings together all the important stakeholders from industry, science, society and politics.
8. September 2020	TEDD University Visit: University of Applied Sciences and Arts Northwestern Switzerland (FHNW) Muttenz, Switzerland	FHNW conducts research along the entire healthcare value creation chain. The spectrum ranges from the development of medical products and drugs, technologies and production processes through to their production and market launch.
21.–22. October 2020	TEDD Annual Meeting 2020, Wädenswil, Switzerland	TEDD Annual Meeting brings together experts from diverse fields with a shared interest in advanced 3D models. Join us for this meeting to celebrate another fruitful collaboration year with new perspectives ahead. At this two-day event we feature: <ul style="list-style-type: none"> • 1-day Workshop for innovative start-ups and companies • 1-day Symposium with international and national speakers • 2-day Exhibition during Workshop and Symposium

Previous TEDD leader and ZHAW Centre's head Prof Michael Raghunath is Executive Board member of the national Swiss 3R Competence Centre (3RCC). 3RCC promotes the 3Rs principle in Switzerland and facilitates its implementation in life sciences, focusing on research, education and communication.

- Promotion of organotypic cultures as alternatives to animal testing among professionals and public by regular media appearance and events. We are increasingly recognised as the experts in the field. TEDD is regularly active in dissemination by giving interviews for local newspapers and taking part in several popular science programs in the national Swiss TV. We also participated in the debate about animal use in science in the frame of "Pint of Science", a science festival that aims to communicate contemporary scientific developments to the public by bringing scientists to the pub and other accessible places.



Core team during TEDD Annual Meeting 2019: from the right – Prof Christian Hinderling, Dr Katarzyna Kopanska, Dr Markus Rimann, Prof Ursula Graf-Hausner and Dr Markus Ehrat.



Prof Zhongze Gu describing science and activities at the Southeast University of China in the framework of the Sino-Swiss Workshop on Tissue Engineering in October 2019.

Vision and Future

TEDD is currently a matured platform, and our ambition is to bring it to the next level. It is a crucial time in Switzerland to make a change, as the public is more and more engaged and aware of ethical concerns of animal testing. Furthermore, in 2020 the Swiss public will vote for different initiatives concerning animal experimentation in research and drug development. These votings should raise the awareness that more financial resources

need to be made available in order to accelerate the implementation of alternative methods in routine industrial applications. Furthermore, joint efforts of academia and industry with regulatory agencies will enable developing guidelines for the validation and harmonisation of organotypic models.

In all these activities, TEDD sees its role in promoting the use of organotypic model systems and bringing the different stakeholders together.

At TEDD, we would like to establish ourselves, in addition to the regular activities, as a Swiss education centre for the dissemination and use of organotypic methods for therapy development and for replacement of animal testing. The goal is to introduce and train members from industry and academia in using organotypic technologies, including the teaching of methods and latest innovations, but also stimulating the discussions on how to validate and successfully implement them into the drug development pipeline. We believe it is important that academia and industry are becoming aware of the available organotypic methods and using them daily but also understanding what the prerequisites are in developing novel organotypic model systems for a given application.

Received: April 16, 2020