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### A Network Sets Things in Motion: TEDD Celebrates its 5<sup>th</sup> Anniversary

**Abstract:** At the Annual Meeting at ZHAW Waedenswil on 22 October 2015, the TEDD-Network (Tissue Engineering for Drug Development and Substance Testing) celebrated its 5<sup>th</sup> anniversary. Since its foundation, TEDD has become an internationally renowned competence centre and includes currently 91 members from academia and industry. They cover the entire development and value chain.

**Keywords:** Tissue Engineering for Drug Development and Substance Testing (TEDD)

“Coming together is a beginning, keeping together is progress; working together is success”. This comment of the American industrialist Henry Ford inspired **Professor Ursula Graf-Hausner**, Head of Research of Cell Culture Technology and Tissue Engineering at ZHAW Waedenswil, when in 2010 she founded the TEDD network together with InSphero AG, Swiss leading supplier of organotypic *in vitro* 3D micro tissues for drug testing. Convinced of the TEDD concept, Gebert Ruef Foundation funded the first steps.

### A courageous step towards future

“It was clear to me, right from the start, that we have to create a win-win situation, to bring together dynamic partners and to exploit potential synergies whenever possible to attract the best talents”, Ursula Graf remembers. “For this purpose, we first had to build a climate of mutual confidence. This proved to be the basis for starting network projects, forming consortia of many interested parties thanks to TEDD financial support. One example is the core team of eight TEDD members who submitted in 2014 the project proposal ‘3D tissues – new perspective for medicine’”. In



The launch of the TEDD network in May 2011 on the occasion of a workshop at InSphero AG with the foundation group. From left to right: front: a former bachelor student, Stephanie Mathes, Ursula Graf-Hausner (ZHAW); back: Markus Rimann (ZHAW), Jens Kelm, Jan Lichtenberg, Wolfgang Moritz (InSphero).

June 2015, the State Secretariat for Education, Research and Innovation (SERI) approved this draft as one of the federal projects for the years 2017–2020. To receive the amount of 5.3 million CHF (50% contributions from universities) the consortium has to deliver the detailed project plan till end of 2015.

### The network reflected by its members

Over these years TEDD went from success to success, and **Professor Barbara Rothen-Rutishauser**, Co-Chair BioNanomaterials at the Adolphe Merkle Institute knows the reason why: “The TEDD platform bridges the gap between applied research and industrial requirements in the field of 3D tissue engineering and drug development. It is a unique platform in Switzerland and brings together highly recognized experts from very different and complementary fields. Exchanges are creative and inspiring, resulting in a lot of new national and international collaborations. Many thanks to Ursula Graf-Hausner and her team for their ceaseless initiative and boundless enthusiasm.”

**Dr. Martina Kropp** at the Laboratoire d’Ophthalmologie of the University of Geneva became aware of TEDD because of an invitation to a talk. Directly after the symposium ‘Frontiers in Personalized Medicine’ her research group became a TEDD member. “The first time I was immediately fascinated by the warmth and the flat organizational structures, improving enormously the networking. In the clinical environment hierarchical structures often inhibit efficient exchange. On the other hand, I prefer the proximity to the clinic and the patients in my daily work, since our projects are always application-oriented with the goal to develop new therapies. At this point, collaboration with companies is crucial and since that I see the approach to connect universities with the industry as the second strength of TEDD. Moreover, immediately at the first symposium we visited, we started collaboration with a company, who will in future support us with quality controls of our cell products in clinical studies.”



TEDD Annual Meeting 2012 with Prof. Dr. Ursula Graf-Hausner and Prof. Dr. Dave Grainger, University of Utah, key note speaker and Advisory Board Member (middle) and Prof. Dr. Urs Hilber, dean of ZHAW Waedenswil.

Also industrial partners of the network draw a positive balance, like **Peter Girling**, founder of CELLnTEC Advanced Cell Systems AG: “The TEDD platform has brought real benefits to our company. Thanks to the TEDD meetings we have met many players in the cell culture and tissue engineering field, and had the chance to discuss in detail their specific interests and areas of expertise. These insights have allowed us to identify new ways in which we can combine complementary skills in joint projects to develop innovative and improved cell culture products.” Also big pharma companies rely on the initiative: “The TEDD network is an excellent forum for the advancement of tissue engineering in academia and industry. It was at one of their lively informal gatherings, where we initiated our ongoing exciting 3D bioprinting project”, comments **Hansjoerg Keller** at Novartis Pharma. “In collaboration with regenHU Ltd, Weidmann AG and ZHAW we generate human skeletal muscle and tendon mini tissues for drug testing at Novartis. The TEDD platform is an invaluable key factor in keeping the Swiss Biotech industry at a global leading edge position.” And the Senior Investigator at Musculoskeletal Disease Area puts it in a nutshell: “If TEDD did not exist yet, it would have to be invented!”



Lively conversation of TEDD members at a TEDD Annual Meeting 2012 with an exhibition platform for industrial partners.

For **Marc Thurner**, CEO of regenHU Ltd., TEDD is also a source of innovation: “The TEDD platform is an excellent network to keep in contact with pharma, cosmetics and biotech research as well as industry. We owe several innovative projects to TEDD.”

### TEDD scores points on several fronts

Today, the network has 91 members from universities and economy, as well as about 200 partners interested in the TEDD activities. “By combining diverse skills through integrative co-operation among our academic, clinical and industrial partners, TEDD covers the entire development and value chain and forms a powerful network”, comments Ursula Graf. The organization makes a significant contribution at the national level, but continually acquires the interest of parties on the international scene, especially in Europe, where the percentage of members is about 12%. Meanwhile successful funding proposals submitted to CTI (Commission for Technology and Innovation) and SNSF (Swiss National Science Foundation) have been initiated by TEDD and its platform has gained a more distinct profile.

One important objective in the TEDD agenda is the opportunity for participants to brainstorm and to exchange ideas, enhancing the prospects to put many new collaborative projects into action. A chance to meet adequate partners is offered by events like



A staff member of InSphero AG illustrates the Hanging-Drop Technology at the TEDD Annual Meeting 2012.



The project team Marc Thurner (regenHU), Hansjoerg Keller (Novartis) and Professor Ursula Graf-Hausner expresses its joy in view of a CTI project that just has been started (TEDD Annual Meeting 2014).

workshops, scientific symposia and visits at leading companies and research institutes, allowing a glimpse behind the scenes. Another highlight is the publication of a special issue of *Advanced Drug Delivery Reviews* (ADDR) by ELSEVIER with 19 review articles on 3D cell culture technology written by internationally renowned experts.

TEDD works closely with DECHEMA, the German umbrella association for biotechnology: TEDD members are involved in the Scientific Committee of the international ‘Symposium 3D cell culture’, held every two years. The Swiss members of TEDD can present their activities on this platform; in 2014 TEDD participants contributed around 35%. TEDD sponsors the event by financing the participation of young scientists and organized in 2014 a ‘Satellite Workshop’ on the issue of Liver Models. Also in 2014, TEDD launched a survey together with DECHEMA as to the ‘state-of-the-art’ of 3D cell culture in Germany and Switzerland. The comparisons between both countries were published in *Biospektrum 4/2014*.

### A remarkable track record

Cell culture is a key technology of the future, widely used in basic research through to industrial applications. To improve the predictive power of cell based-technologies, the physiological relevance is of decisive importance. To achieve *in vivo* like features in *in vitro* cell culture, 3D culture systems have been in-

roduced. They aim at recapitulating tissue architecture, cell–cell and cell–matrix interactions in a physiologically relevant manner. This area is one of the fastest growing experimental approaches in life sciences. “First signs of progress are evident, for instance in tumour models”, says Ursula Graf. “Currently, 3D cell culture is entering its next phase, technology maturation, with the optimization of assays, protocols and kits. This will facilitate its pre-validation and wider application.” The compatibility with automated lab equipment and the suitability for middle and high throughput screening (HTS) has been established for simple 3D models. Nevertheless, development studies have to be continued for more complex systems to achieve bio-mimetic tissue constructs that reproduce and model organotypic 3D structures with several types of cells and to combine more than one type of tissue on one chip. There is a great potential involved for the use in personalized and regenerative medicine, these application areas still require more investigation, especially in the clinical context.



Dr. Olivier Frey, Professor Biosystems Engineering at ETH, explains a newly developed technology at the TEDD Annual Meeting 2014.

### Let's reduce animal testing

The 3R-concept – replace, reduce, refine – constitutes the centrepiece of laboratory animal welfare, where cell culture systems have the capacity to reduce animal experiments. “A major focus in development is placed on 3D cell culture and organotypic models which constitute a step towards greater relevance and complexity and could mimic in future the *in vivo* situation”, explains **Dr. Stefanie Schindler** of the Animalfree Research Foundation (AfR). “Their potential to replace and reduce animal use in Life Sciences and regulatory toxicity testing can hardly be overestimated. Still, as is the case with all new and revolutionary approaches, selection of the most valuable systems, as well as their optimization, validation and widespread acceptance have to be made.” And she concludes: “The TEDD network provides an invaluable tool for meeting this challenge.”

### A unique focus: Excellence!

The ‘National Competence Center TEDD’ is in its role and impact possibly a novelty and unique. However, for Ursula Graf-Hausner, the driving force behind TEDD, the ‘raison d’être’ for the network partners is to measure themselves against the best world-wide. While significant progress has been made, there is still a huge demand for improvement, validation and implementation. For this purpose, TEDD will increasingly act as a link between partners and regulatory institutions in Switzerland and Europe, as soon as 3D cell culture technologies are ready for

validation. TEDD will also perform its role as a validation centre, testing novel enabling technologies and coordinating R&D activities between all players. TEDD aims at proactively supporting the advancement of innovative technologies such as bio-printing, microfluidics and others. This raises hope that organ-like models can be applied routinely in the future.



Scientific collaborator Sandra Laternser explains the results of the muscular tendon project she is working at in Waedenswil.

Great importance is attached to the position on the international level. TEDD has to be further developed toward an internationally recognized platform and point of contact for all issues relating to 3D cell and tissue systems. “My vision is to create a TEDD R&D center as innovation hub, financed with the help of industrial partners”, Ursula Graf has a glance to the future. “Here we could develop innovative technologies and validate them in a highly relevant manner. This creates the opportunity for Switzerland to become a globally renowned leader in this domain.” To this end, she focuses on international events and tries to build up strategic alliances: “TEDD has an intact opportunity to become the key contact in Europe for 3D cell culture, similar to the community in the Boston area”, adds the Vice-President of Swiss Biotechnet, the national network of excellence of the Swiss Universities of Applied Sciences.



Scientist Dr. Stephanie Mathes at ZHAW Waedenswil makes a presentation about 3D cell culture in the TEDD laboratories at ZHAW Waedenswil. All illustrations ZHAW Waedenswil.

### Full speed ahead for the future!

Importantly, the success of the TEDD network depends on the sharp minds of its members. “In a highly interdisciplinary field

such as tissue engineering, competence centres play a key role to move forward research and development”, judges **Prof. Olivier Frey**, Professor of Biosystems Engineering at the ETH Zurich. “The tight interaction between members is the seed for new collaborations and projects”. He is confident for the future: “With the competence centre TEDD one can continuously keep track on the latest activities in the field of tissue engineering.”

For **Dr. Jens Kelm**, CSO and President of the Board of InSphero AG, who has been co-founder and partner from the very beginning, efficient progress and innovation can only be achieved by extensive exchange of knowledge: “Recognizing early on the importance of organotypic 3D model systems, TEDD is coming of age and has progressed towards a significant think tank platform in Switzerland’s research landscape. Its strength is not only to tackle one of the most pressing issues in the development of novel drugs but its unique mixture of members including all major Swiss universities, technical universities, solution provider and end user. TEDD accelerates early information exchange of

academic and industry required to tailor and focus research and innovation to the current needs of industry and society. Being one of the two co-founders of the TEDD we are excited how the competence center evolved and would like to congratulate Prof. Dr. U. Graf-Hausner and her team for fostering Swiss innovation and looking forward to the same TEDD dynamics in the next 5 years.”

Ursula Graf-Hausner and her team are fully motivated to further advance TEDD and generate high added value for the TEDD partners as says TEDD founder: “There is still a lot left to do – but I know: we are on the right track!”

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