

Biotechnet Report

Biotechnet Switzerland – Let the Future Begin!

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On behalf of Biotechnet Switzerland

In 1998, biotech specialists at Switzerland's universities of applied sciences joined forces to form biotechnet, a national network of competence designed to provide industry with an expert partner for research and development projects. biotechnet is now preparing to face the challenges of the future in response to the increasingly global orientation of the economy.

Broader horizons and an international scientific exchange are becoming ever more important, value-added chains are based on networks that transcend borders. The objective of the 'Mission 2011' launched by the Osec Swiss Business Hub and the Swiss Biotech Association was to facilitate access to the Chinese market for the Swiss biotech industry. In April 2012, a delegation from biotechnet went to visit various companies and universities in China and to sound out potential partnerships.

The Chinese Dragon – Powered by biotech

China was an obvious choice given the booming biotechnology industry in that country. The Chinese government has designated the life sciences and biotechnology as priority areas for research and development and is boosting funding from the current level of 1.5% of GNP to an impressive 2.5% in 2020. Chinese institutes such as the National Tissue Engineering Research Centre are already world leaders. Chinese scientists are nowadays publishing more academic papers than their colleagues in the USA. The country has an exceptionally active biotech landscape, with more than 100 life science parks and incubators. Figures issued by the Chinese government state that there are 55.8 million scientists and technicians working at state biotech facilities and institutions.

China has reached almost the same stage of development as established biotech countries and is facing the same challenges

and opportunities in this sector. The continual internationalization of research and China's enormous capacity to function as a global research hub are combining to generate previously unimaginable opportunities for collaboration in biotech research. At the same time, though, this means getting behind the Chinese mentality and understanding the meaning behind the words. The biotechnet delegates explicitly wanted to use their visit to introduce Chinese researchers and companies to the Swiss network, to establish personal relationships – particularly with experts who are otherwise difficult to contact – and to gather information in order to drive current research forward. The fact-finding tour took the Swiss biotechnologists to nine research institutes, companies and universities and one technology park in each of Shanghai and Hong Kong. They returned with a wealth of impressions.

Far-reaching Ambitions

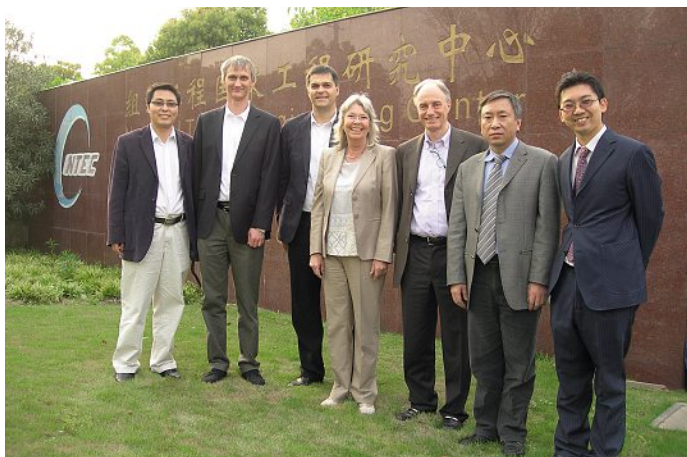
The work done at the National Tissue Engineering Research Centre at Jiao Tong University in Shanghai is a match for the science coming out of the USA and Europe. The Centre was set up by Professor Yilin Cao, who used to work at Harvard Medical School in Boston. The research centre was granted substantial funding which went into creating the infrastructure for research and development. The complex includes a research and development unit, a multi-species animal breeding facility, a hospital for translational research, clinical trials and therapy, and a manufacturing unit which covers all aspects of marketing from IP to sales. The centre is already being expanded, with a state-of-the-art GMP laboratory under construction (GMP = Good Manufacturing Practice). This concept, which brings together people from a wide range of disciplines, ensures that the entire value-added chain is covered comprehensively in a single location of a type not found in Europe.

The very good technical equipment is generally impressive, as is the high level of knowledge of the biotech researchers, many of whom have trained in the USA. Teaching at Chinese universities is usually in English, giving graduates a significant advantage in the international competitive environment. The campus atmosphere, where people live, study and work, and everything revolves around biotechnology, has a major impact on everyday life. The Confucian values of industry and ambition and imitation of older colleagues still play a role here. Yet a certain western influence on people's attitudes to work is definitely evident. Excellent training gives researchers self-confidence, encouraging them to focus on an upward career path.

One thing that struck the Swiss biotechnologists was that automation is not much in evidence in China, presumably because there is still an adequate supply of low-cost workers. However, the new GMP laboratory in Shanghai illustrates the other side of the coin, because there is no way of guaranteeing reproducibility, traceability and quality without automation!

The Land of Contrasts

The ever-present backing from the state is striking. The generous support provided in the shape of technology parks



Members of the Biotechnet Switzerland with scientists from the National Tissue Engineering Research Centre at Jiao Tong University in Shanghai. Copyright biotechnet.

supplies start-up companies with promising products with the required infrastructure and the laboratory environment they need for their activities completely free of charge for a year. At the other end of the scale, the Swiss visitors watched a large number of young people – mainly women – at a testing facility roughly comparable to Empa performing a variety of quality control tasks, such as checking, weighing and cutting goods to size, in narrow cubicles measuring just 50 × 50 cm. Most of them did not leave the workplace to eat their lunch and also had a short sleep there. It was not possible to find out what level of education these people had, but it is evidently fairly difficult to keep well-trained people on board.



The Chinese government has an aggressive policy of promoting biotechnology, particularly in Beijing and Shanghai (pictured). Large amounts are being invested in genome research and China is the world leader in bioethanol. Copyright biotechnet

The media pay a great deal of state-monitored attention to environmental protection under the guise of Green China. The situation is highly controversial, though, since no other country in the world invests so much in 'clean energy' while burning more coal than any other country to keep its economy running. China heads the global ranking for CO₂ emissions and environmental pollution, with an annual output of 8.9 billion tonnes.

A look behind the scenes of animal studies shows that there is an urgent need for action which is not currently perceived by the Chinese. It is precisely concepts such as human test models, for example of the kind developed in the TEDD (Tissue Engineering for Drug Development) Centre at ZHAW, which provide very valuable representations of the situation in the living human body and would help to reduce the number of animal studies.

Future Collaboration

A number of steps have been planned with a view to turn the contacts into successful cooperation projects in the future. For example, biotechnet was present at the sixth meeting of the Sino Swiss Science and Technology Cooperation Programme at the ETH Zurich in September 2012. The working group decided to promote 20 or so joint research projects over the next four years, including biotechnology projects. There are also plans for bachelor exchange programmes with research institutes in Guangzhou or Shanghai. It is not yet entirely clear what the visit achieved, but there is no doubt that the Chinese biotech experts are primarily interested in research findings which can be implemented rapidly.

Quo vadis biotechnet

In the immediate future biotechnet will be focusing on expanding its network to include more strong partners. A new member is Professor *Roger Marti*, Head of the Department of Chemistry and Life Sciences at the College of Engineering and Architecture. Dr. *Helmut Knapp*, Head of Microfluidics and Microhandling at the CSEM (Centre Suisse d'Electronique et de Microtechnique), is contributing his expertise in the miniaturization of specimen handling for life science applications. Professor *Simon P. Hoerstrup*, Head of the Swiss Centre for Regenerative Medicine (SCRM) at Zurich University Hospital and Zurich University, is providing biotechnet with access to the internationally acclaimed expertise of the SCRM group in the field of tissue engineering for regenerative medicine.

This applies particularly to the centre of excellence in tissue engineering and drug development. TEDD, which emerged from the biotechnet platform in early 2011, develops tissue models similar to organs which are used to develop drugs and test active substances, the longer-term aim being to replace conventional *in vitro* tests with cells combined with animal studies. Technologies which provide a physiologically relevant representation of the function and structure of healthy and diseased tissues and organs are gaining importance all the time. New analytical processes and controlled, standardized production of tissues and ways of preserving them, high-throughput (HTP) applications and quality control methods will all have to be developed before these technologies can go into routine use. Efforts are focused on 3D cell and tissue models, assay development, cryopreservation, imaging technologies, automation and molecular reporting systems.



Annual meeting TEDD2012 Wädenswil. The automation stand attracted a lot of attention because routine handling of tissue models in drug development is only possible with automated systems. The companies Tecan and Cellendes and researchers from ZHAW presented the results of their work on the automated manufacture of scaffold-based tumour tissue and its applications. Copyright ICBC/ZHAW Wädenswil

Targeted Bundling of Knowledge

Network partners presented current projects at the annual meeting of TEDD in October 2012. One of them was regenHU AG, a partner in the development of bioprinters for organomimetic skin models. This technology enables scaffolds holding cells to be 'printed' layer by layer in extrusion processes, and these can then form the basis of tissue-specific 3D models.

Dr. *Peter Wick* working at Empa is currently investigating the ways in which nanoparticles penetrate the human body. He



Annual meeting TEDD2012 Wädenswil. A visitor at the TEDD annual meeting examines the 3D Discovery from regenHU. This bioprinter prints three-dimensional tissue consisting of living cells, a scaffold made of hydrogel-like biomaterials and signalling factors. Human skin models are being printed in the ongoing TEDD network project. Copyright ICBC/ZHAW Wädenswil

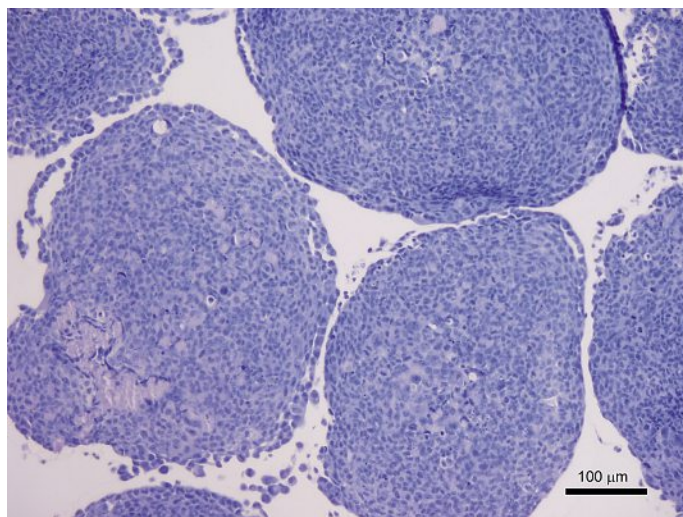
and his team are experimenting with human placental tissue into which they are inserting fluorescing polystyrene nanoparticles with a diameter of 50 nm to half a micrometre. They do not harm the tissue and are easy to identify. Measurements have shown that the tissue can hold back particles measuring 200–300 nm but that smaller particles pass directly into the circulation of the fetus.

A group working with Professor *Ursula Graf-Hausner* is collaborating with CELLnTEC and Givaudan on a CTI project to develop a 3D human epithelial skin model which is intended to predict the allergenic potential of chemical substances. The aim is to produce a 3D model which will enable hydrophobic substances to be applied to the surface dose-dependently and penetration effects to be evaluated. This in turn will form the basis of a marketable 3D skin sensitization kit.

Scientists at ZHAW have collaborated with InSphero, specialists in the growth of cell assemblies in ‘hanging drops’, to implement a deep-freezing process which enables 3D tumour microtissues to be supplied in a cryopreserved state at –80 degrees Celsius. This allows consumers to remove the quantity of tissue they need from the freezer without the functionality of



Annual meeting TEDD2012 Wädenswil. Human 3D tissue model for drug development and substance testing. Copyright ICBC/ZHAW Wädenswil.



Annual meeting TEDD2012 Wädenswil. Scaffold-free microtissues produced with the hanging drop technology from InSphero AG are often used for drug development and substance testing. Copyright ICBC/ZHAW Wädenswil

the tissue and its sensitivity to active substances being impaired by the freeze-thaw process.

These are examples of the way in which the TEDD platform is bundling knowledge and technologies and transferring them to partners in industry through cooperation agreements, workshops and company calls. Another channel is technical meetings of the type held in March 2012 at the technology park in Zurich in conjunction with Dechema, which showcased 3D cell cultures.

The Place to Go for Single-use Technologies

The cross-border activities of Professors *Regine Eibl-Schindler* and *Dieter Eibl* have made the bioprocess and cell culture technology activities at ZHAW in Wädenswil into a centre of excellence for single-use technologies. In 2012 the platform and its main financial partners Levitronix, Lonza, Kenta Biotech, Novimmune and C-Cit acquired five projects supported by the Commission for Technology and Innovation (CTI). A successful summer school on cell expansion and protein expression was held in August with participants from all over Europe. Four articles on single-use technology have been published since the start of this year, and another five are due to appear in a special edition of the journal *Chemie Ingenieur Technik*. Preparations are already under way for an international conference on ‘Single-use Technology for Biopharmaceutical Manufacturing’ which will be held from 3–5 June 2013 in Wädenswil. It will focus on current developments in stem and mammalian cells, plant cells and micro-organisms and the first fully single-use solution for manufacturing in the biopharmaceutical industry.



ZHAW Wädenswil Summer School. Summer school students in the laboratory. The practical work included recording and discussing the results generated by experiments. Copyright ZBT/ZHAW



ZHAW Wädenswil Summer School. A visit to Bioengineering AG demonstrates the demanding design and manufacturing requirements that apply to steel bioreactors for cell culture. The visitors had a chance to show off their welding skills. Copyright ZBT/ZHAW

NTN Swiss Biotech: Strength in Numbers

In October 2012, following an evaluation process, the Commission for Technology and Innovation (CTI) recognized eight national thematic networks (NTN). Swiss Biotech™ is one of them. The biotechnet and the Swiss Biotech Association (SBA) will be working together under this established brand, which the SBA will be contributing for the duration of the programme, from January 2013 with the aim of combining their experience and skills throughout the value-added chain – from innovation through product development to commercialization.

In the past ten years, biotechnet, which is focused on research and development, has promoted more than 50 network projects between academic and industrial partners with a total project volume in excess of CHF 50 million. The SBA represents 90% of the biotech companies based in Switzerland, acting as a catalyst and promoting their business success through various activities. *Domenico Alexakis*, CEO of the SBA, says that the national industry association welcomes closer cooperation with the biotechnet: “The existing points of contact will be reinforced by the national thematic network. The biotechnet will gain additional contacts to companies, enabling it to present its academic skills to industry and develop new projects.”

In the NTN biotechnet and SBA work in defined business areas in complementary fields. Translational research and development comprises customer-specific innovation to facilitate cooperation projects between the university and private sectors, a platform to promote open innovation in biotechnology, and general support for the transfer of intellectual property (IP) from universities. The knowledge management area offers seminars, workshops and subject-specific training at national and international level. The NTN and other institutional partners (Eurostar, Euresearch, Osec *etc.*) support internationalization at the European level through consultancy services and the identification of partners in the university and industrial settings.

There are nowadays a large number of national and international support programmes designed to stimulate research and innovation in biotechnology. The challenge, however, is to turn the results of research into successful products and services even faster than before, to further strengthen the knowledge base, to provide dynamic SMEs with access to the latest research findings and to train high-quality employees. The global business landscape is changing rapidly in biotech too. We cannot afford just to keep pace – we have to set the pace worldwide!

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