

# Living complexity and the role of trusted networks

Life sciences deal with living organisms, which are complex self-organizing systems. This complexity increases exponentially when we take life sciences out of the laboratory and incorporate them into the world of living beings. Living beings are organized into communities that make up societies and the economies that govern the way that people and organizations trade and interact. And this applies at a local, regional, national and global level. Each new dimension provides another layer of complexity.

Complexity as such need not be a problem. On the contrary, the more complex the system, the greater the capacity for knowledge and insight. Thanks to open access and open data, scientific findings are more available than ever on a global scale. This applies to natural sciences, engineering and technology, medical and health sciences, agricultural sciences, social sciences and humanities.

Information and communication technologies provide the means to democratize knowledge by spreading and sharing information in real-time. And this is vital! Staying up to date with new developments and having access to relevant content and information is crucial in maintaining and developing a nation's capacity for innovation.

This is why the OECD scoreboard recognizes 'Empowering Society with Science and Technology' as an innovation driver with criteria such as connectivity, online devices, user sophistication and much more. These criteria complement the more traditional indicators such as R&D spend, quantity and quality of research staff, patents and publications.

However, the very technology that makes managing and sharing complexity possible, is also a potential conduit for dirty data and fake or hoax news. In this new age of fluid communications and big data, what can we trust and how do we ensure that we are not being misinformed? Could it be that the constantly increasing volume of data is not a measure of innovation and knowledge creation but rather the fuel that powers complexity at the expense of insight? The reality is that today we are exposed to more information than we can healthily digest.

To counter this, we turn to strategies that help to reduce and manage complexity. We simplify, fragment and compute data, not just in our professional lives, but also in our private lives. Increasingly we rely on search and filter algorithms to orientate ourselves within the avalanche of new data. Filter systems and search machines are becoming the central interface between science, society and economy; sometimes replacing institutional directories with open source solutions such as Google Patents. Individual and traditional experience is just not up to managing today's complex situations.

Moving forward, continuous learning and the role of intuition and instinct may continue to be part of the solution but as it be-

comes more difficult to find reliable and quality proven information, the importance of knowledge based services and research areas will increase.

The reason why we need sustainable and reliable 'knowledge networks' is clear. Only through these can we hope to cope with key developments and the vast amount of data associated with them: the increase of our scientific understanding of systems; the integration of global societies and cultural diversity; the development of the internet of things. Good knowledge can foster and enable exchange between disciplines and sectors and work at the interfaces; collecting and condensing information to support innovation.

In this year's report we have an article by the Swiss National Science Foundation, wherein scientist and author Andreas Wagner argues that complexity in living organisms usually allows for greater innovation and also creates an internal robustness to change; it tends to generate a range of alternatives like 'multiple routes to one destination'. Counterbalancing this view, we have an article by Six Swiss Exchange that calls for greater clarity to make sense of complexity within man-made organizations: "Companies that master a structured approach to reduce complexity will unlock new opportunities ... not only will they, become more effective, they will also be better understood."

The Swiss Biotech Report 2017 brings together knowledge networks in research, industry, finance and industry development to provide essential insights into the way in which the sector is evolving. The key issue is not so much managing complexity but living it! By identifying and using relevant data we can further science and technology toward innovation and on the back of this deliver relevant solutions for society.

We hope you find this a faithful report on the year past and a useful guide to the year ahead.

# Industry and research harvest the fruits of the NTN Swiss Biotech program



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The NTN Swiss Biotech™ is a unique network that supports the competitiveness of the biotech ecosystem, fueled by close ties between industry and research and sponsored by the Commission of Technology and Innovation (CTI).

The NTN (National Thematic Network) Swiss Biotech™ has set some ambitious objectives which are important when it comes to adding value to the technology value chain:

- combining core competences of absorptive companies with academic knowledge and practices;
- bringing together decentralised competences such as academic partners and industry;
- concentrating knowledge and technology around platforms;
- supporting the building up of important alliances;
- enabling access to a reliable network of capacities.

## NTN Swiss Biotech™ Research Platforms

Antibiotics

Biocatalysis and Biosynthesis

Bioinformatics

Biologics

Bioresource Technologies

In vitro Diagnostics

Regenerative Medicine

Single-Use-Technology

TEDD Tissue Engineering for Drug Discovery

The NTN Swiss Biotech™ makes use of effective instruments to implement the set objectives:

- organizes events to bring industry and research together such as the Swiss Biotech™ Day (including partnering), the Swiss Biotech™ Innovation Day, the Swiss Biotech™ Research Day at Basel Life, the Swiss Biotech™ Day Fall and specific platform events;
- provides platforms to concentrate knowledge and technology from antibiotics to tissue engineering;

- brings together decentralised competences and chaperones the phase of partner finding;
- supports international activities and participates with an exhibition stand at events such as BioEurope or BIO Convention;
- promotes events, workshops, successful R&D projects through own publications (NTN bulletins), articles in journals such as European Biotechnology or CHIMIA and website coverage ([www.biotechnet.ch](http://www.biotechnet.ch), [www.swissbiotech.org](http://www.swissbiotech.org));
- provides seed money to realize CTI projects.

Since it was established in 2013 the NTN Swiss Biotech™ has stimulated exchange and interaction between industry and academia. These are a selection of successful R&D projects:

## High added-value diagnostics

BÜHLMANN Labs is a sound source of innovation. Within the CTI Special Measures for the strong Swiss franc, the team, together with two Swiss companies and the FHNW, created CALEX®, a stool extraction device that enables stool extracts to be prepared for biomarker tests outside medical laboratories; for example in POC settings or for self-testing (two patents pending). The MIAMI project in the 7<sup>th</sup> Framework Program with Swiss and European partners generated IBDoc®, the first IVD CE marked self-test to help with the therapeutic monitoring of diagnosed IBD (inflammatory bowel disease) patients.

## Member competences in NTN Swiss Biotech™

At HES-SO Valais-Wallis, Prof. Fabian Fischer has specialized in microbial fuel cells for novel applications that meet the challenge of producing renewable energies. He and his team possess a unique expertise in bioelectric energy vector generation, phosphate extraction and the testing of antimicrobial surfaces.

Peptides are small proteins typically containing a chain of up to 100 amino acids. In our bodies, they are produced every day in vast quantities and perform highly specific biological activities. As there is an increased interest in peptides for pharmaceutical applications, the HES-SO Valais-Wallis created a research group to focus on peptide and protein technologies.

For the first time, researchers from MCI Innsbruck and the University of Salzburg have manufactured and purified a plant-based allergen in a green algae and opened the door to a specific immunotherapy against allergies. Their vision is to replace unpleasant injections with oral administration, as its production is both simple and cost effective.

In summer 2016, Michael Raghunath from the National University of Singapore (NUS) took over the professorship from Ursula Graf-Hausner in cell culture technology and tissue engineering at Zurich University of Applied Sciences (ZHAW), Life Sciences and Facility Management. He intends to boost 3D tissue engi-

neering with his core technology of macromolecular crowding and spur on the development of bioink for bioprinting. He will introduce metabolic tissue engineering as a research theme in Switzerland with the aim of making an impact at national and international level.

### Networking events by NTN Swiss Biotech™

The NTN Swiss Biotech™ Innovation Day demonstrates the potential of industry-academia collaborations for innovation in life sciences. Program highlights were the keynote by Dr. Peter Grunenfelder of Thinktank Avenir Swiss, and the presentations of current CTI life sciences projects and their strategic role for the industry and academic partners, as well as the poster exhibition in the networking area.

During the Basel Life Science Week from 19 - 23 September 2016, four international speakers presented their topics on the theme of 'Molecular Diagnostics brought by NTN Swiss Biotech™.

In a world of dwindling fossil-based energy, global air pollution and warming, biocatalysis may be a perfect problem solver. It has the potential to deliver sustainable raw materials and energy from biomass, and enables chiral and highly functionalized compounds to be produced ecologically for the chemical and pharmaceutical industry. At ZHAW Life Sciences and Facility Management on 20 June, the Competence Center for Biocatalysis (CCBIO) headed by Dr. Rebecca Buller, gave European experts the opportunity to present the latest findings from science, research and practice in the future oriented field of biocatalysis.

### Life long learning and formation of the next generation

In response to current needs for advanced professional training, Roche offers its employees an intensive course in cell cultivation and downstreaming under the auspices of biotechnet Switzerland. In 2016, lecturers from the ZHAW, Life Sciences and Facility Management gave participants the benefit of their expertise in theory and laboratory practice. One valuable side effect is the creation of a permanent network of specialists.

Since 2013 the National Thematic Network Swiss Biotech™, led by biotechnet Switzerland and the Swiss Biotech Association, has made it a goal to foster transfer activities in biotechnology.

The Swiss Biotech Association (SBA), founded in March 1998, is the national industry association of small and medium-sized enterprises active in all areas of biotechnology. It has some 200 member companies and is a highly respected networking platform. For further information visit [www.swissbiotech.org](http://www.swissbiotech.org).

biotechnet Switzerland is the network of Swiss and Austrian Universities of Applied Sciences (FHNW, HES-SO, ZHAW, MCI), the research institution CSEM, the Swiss Center for Regenerative Medicine at the University Hospital and University Zurich and the Competence Center Personalized Medicine UZH/ETH. The biotechnet Switzerland is the one-stop shop for innovation in technology where companies, especially small and medium-sized ones, can easily access relevant specialists for their development work. For further information visit [www.biotechnet.ch](http://www.biotechnet.ch).

### 11<sup>th</sup> Summer School on Advance Biotechnology

The 11<sup>th</sup> biotechnet Summer School on Advanced Biotechnology 2016 was held in the Orto Botanico of the University of Palermo. Students (bachelor, master and PhD), researchers and teachers from Italy, Switzerland and Austria met to discuss important topics of biotechnology.

#### Platform events organized or co-organized by NTN Swiss Biotech™

Visit of the Clinical Chemistry Laboratories of the Inselspital Bern, 25 April 2016, Bern

Industrial Biocatalysis: 8<sup>th</sup> Wädenswil Day of Life Science. 20 June 2016, Wädenswil

Second Antibiotics Platform meeting, 20 June 2016

Polyphor Ltd., Allschwil

Latsis Symposium ETH Zurich on Personalized Medicine, 29 June 2016, Zurich

Retreat Competence Center–Personalized Medicine.

30 October 2016, Kartause Ittingen

Biopharmaceutical Manufacturing and Single-Use-Technologies. 5 September 2016, Wädenswil

The comprehensive program of activities by NTN Swiss Biotech™ and its partners biotechnet and Swiss Biotech Association has been recognized with funding by the CTI KTT program until end of 2018.