

A high-angle photograph of a mountain valley. In the foreground, a river flows over dark, jagged rocks, creating white rapids. The river winds through a lush green valley floor, which is dotted with grey rocks. The valley is flanked by steep, rocky slopes covered in patches of green grass and moss. The overall scene is a beautiful representation of the Swiss Alps.

Swiss Biotech Report 2016

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Editorial



This year's report focuses on examples of technology fusion that blend technologies from several previously separated fields to create innovation.

The field of biotechnology is one of the first examples of technology fusion, integrating the core technologies of biology, chemistry and physics. More recently, the addition of mathematics, information technology, engineering, material sciences, nanotechnology, not to mention the search for cross-border solutions in medicine, has provided an enormous boost to biotechnology.

As well as combining technologies, biotechnology depends on the close interaction between academia and industry. Switzerland has a lot to offer in this respect. The country's education system and relevant industry sectors have a high level of competency in all of the key fields. Going forward they will profit from the smart technologies that will form the basis for new healthcare solutions around personalized medicine, and for the production of high-value compounds such as pharmaceuticals, food ingredients and fine chemicals.

A large, stylized handwritten signature in black ink, reading "M. Schneider-Ammann".

Johann N. Schneider-Ammann
President of the Swiss Confederation

Innovation happens between disciplines, technologies and stakeholders

Biotechnology is an interdisciplinary field and will become even more so based on high-value innovation networks that enable exciting industry cross-overs and technology fusion.

Many different technologies blend into biotechnology and may eventually lead to the evolution of novel disciplines. Mastering these technologies requires cooperation to develop the science, and innovative suppliers are needed to support new developments.

For this to happen, there has to be lateral thinking, openness towards other industries and technologies, and the ability to quickly identify areas of mutual benefit and opportunity. This commitment to cooperation at an individual, corporate and international level sits at the very heart of biotechnology in Switzerland.

Cooperation is a vital aspect of prospering in such dynamic environments. Industry has to build on the drive to optimize internal resources and it has to further promote the development or integration of new knowledge and resources into the business. The key to achieving this is to build and support networks, both local and global.

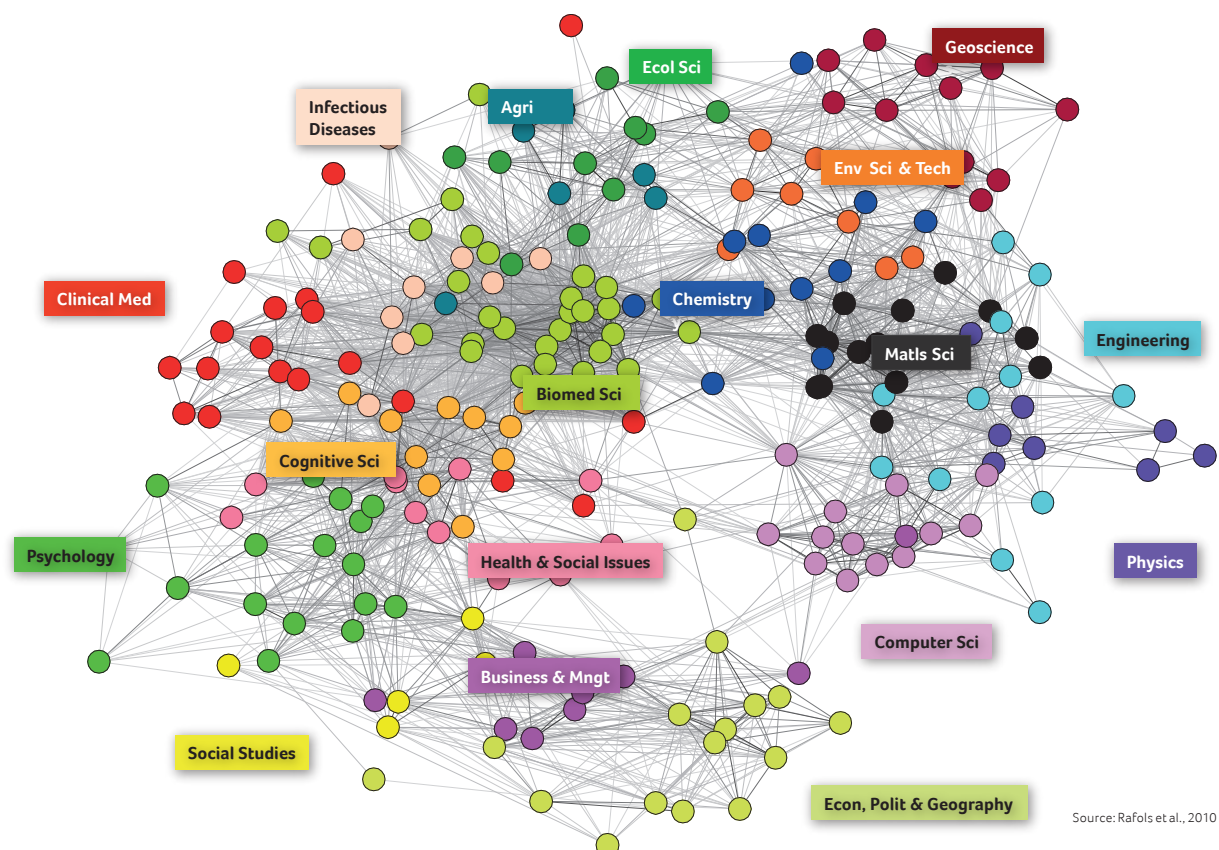
Science and technology

The life sciences industry, as the name implies, relies heavily on scientific input. And it also depends on technology. However the lines between science and technology disciplines are no longer clear cut; and in some cases they are beginning to merge and cross-over. In so doing one can begin to see a new world where the underlying principle of blending along lines of similarity occur.

A similar process can be seen at work in the assimilation and application of technologies: 'technology spill-over', 'technology integration', 'technology convergence' or 'technology fusion' are just some of the terms that describe this phenomenon. It ranges from mere adaptation of technologies to the creation of new science or technology disciplines.

From make to cooperate

We live in turbulent times caused by volatile customer needs and a landscape of international competition with rapid uptake of technical advances. The challenges are considerable. Adoption or diffusion of scientific and technological advances is a prerequisite to enabling innovation, while knowledge related to industrial know-how and practices makes it happen.



Source: Rafols et al., 2010

Global Map of Science

This global base map of science illustrates the many interdisciplinary relationships. The nodes represent web of science categories. Gray links represent degree of cognitive similarity. The darker the link, the more cognitive similarity. Colors represent similar categories.

In a complex innovation ecosystem – one which includes suppliers and customers, technology peers and sometimes even competitors along the full value chain – the categories of innovator, early adopter, lead user and sophisticated user are blurred and the need for greater cooperation is clearly demonstrated. The current pace of developments, within and between disciplines and technologies, means that no single organization is able to fully integrate all of the internationally available and required know-how and technologies, to complete the job.

High-value innovation networks

The complex value chain in life sciences requires an appropriate (hygienic) infrastructure. Key elements include high-tech lab and production equipment, high-quality raw materials, consumables and specialty chemicals. There is a need for skilled service providers who provide good practice in research (GLP and GCP) and manufacture (GMP), as well as a fundamental knowledge base in intellectual property and the regulatory environment. Being a supplier or consultant to life sciences will require in itself a highly innovative mind-set and even more challenging, the ability to operate effectively in a world where today's competitor can become tomorrow's cooperation partner.

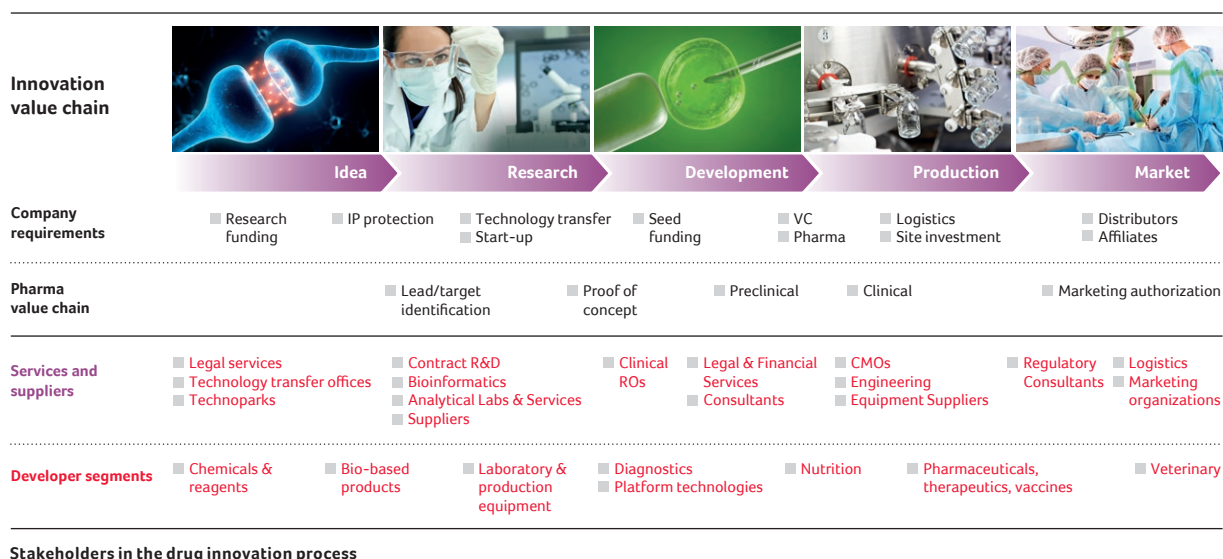
Academia start-ups tend to be the owners of state-of-the-art technologies and their business model relies on several different options: they can be vertically integrated with a large international player (brain drain); serve as 'technology broker' or they can be an external R&D partner to a variety of key play-

ers in different industries and applications (maintaining the national technology base).

In most of the key stakeholder sectors within life sciences – chemicals, mechanical engineering, informatics – Switzerland is home to excellent science and to highly innovative companies, ranging from hidden champions in the SME sector to global leaders. And because academia and these companies often serve different industry segments, innovation within one industry segment or market can spill over into other applications.

That is why it is so important that the players in the innovation ecosystem or network are not 'locked-in' their region but that they are internationally competitive and source competence on a global scale. Networks of any kind are required to manage information and knowledge flow within innovation systems or to enable working cooperation.

In this report, our network gatekeepers from academia, government and industry provide insights into the way in which biotechnology is becoming more interdisciplinary, how technologies are fusing to deliver new solutions, and how cooperation is enabling innovation. Switzerland is open for innovation and co-operation. It provides a high value innovation network that makes it possible for innovators and early adaptors to feed into the biotechnology sector, enabling real innovation now and on into the future.



Switzerland: A systemic approach to research



Florian Fisch,
Science Editor
Swiss National Research
Foundation

Historically, Swiss National Science Foundation (SNSF) has been committed to funding excellent basic research. For many years the foundation has closely collaborated with industry as well as government and it also promotes interdisciplinary and use-inspired basic research.

Since its foundation in 1952 the mission of the SNSF has been to provide funds for excellent research without any immediate commercial purpose. The quality of research is the primary criterion for evaluation. Nevertheless, the SNSF also wants to contribute to social progress, economic growth and a high quality of life by helping to come up with solutions to important and specific current problems.

Stakeholders propose projects

The focus on application is achieved through National Research Programs (NRP). These programs are commissioned by the Swiss Federal Council to deliver solutions to stakeholders in the national and cantonal governments. Anyone can propose topics for new programmes to the State Secretariat for Education, Research and Innovation. These stakeholders are closely involved when the results of research projects are synthesized into practical recommendations for policy makers. In 2015 the SNSF launched three new NRP: NRP 75 deals with big data, NRP 74 with smarter healthcare, and NRP 72 with antimicrobial resistance.

List of current biotech-relevant NRP

- NRP 72 '[Antimicrobial Resistance](#)' (2017–2022)
- NRP 69 '[Healthy Nutrition and Sustainable Food Production](#)' (2013–2018)
- NRP 68 '[Sustainable Use of Soil as a Resource](#)' (2013–2018)
- NRP 66 '[Resource Wood](#)' (2012–2017)
- NRP 63 '[Stem Cells and Regenerative Medicine](#)' (2010–2015)

The program on antibiotics simultaneously tackles the problem from different angles using a one-health approach. The program studies how resistance diffuses in microbial communities, it develops new diagnostics methods, researches old and new compounds and it also installs an antibiotics stewardship.

The NRP thereby fills a research gap in the national Strategy against Antibiotic Resistance (StAR) that involves four federal offices. By participating in the European Joint Programming Initiative on Antimicrobial Resistance (JPIAMR), the research efforts are also coordinated internationally.

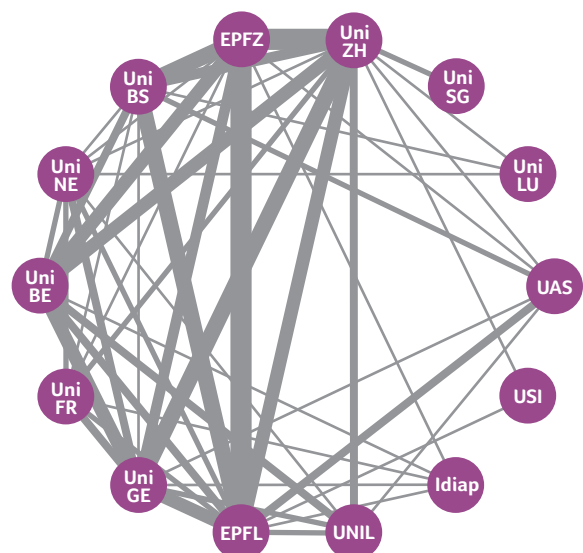
The results of the research program will interest many stakeholders, from physicians through to health insurers. The project leader of StAR will be an observer at meetings of the NRP steering committee to ensure close coordination of research and policy.

Researchers invent products

With the National Centres of Competence in Research (NCCR) the SNSF provides another tool to strengthen research of strategic importance for the future of Swiss science, business and society. The NCCR centres help to establish a network of collaborations and partnerships between the universities and the private sector; maintaining links to potential users of research results. The focus lies on making a contribution to knowledge and technology transfer.

The active NCCR programs, funded until 2017, relevant to the biotech sector (see below) resulted in a total of 58 cooperations with the private sector, eight joint research projects (CTI funded), nine start-ups and 17 patents. Most prolific amongst these, in this respect, is the NCCR 'Chemical Biology' at the University of Geneva and EPFL which has been running since 2010.

Also on a smaller scale, the SNSF also funds both collaborative and interdisciplinary projects. Sinergia grants for example are reserved for two to four scientists aiming for breakthrough research on the back of complementary expertise and knowledge.



NCCR facilitate exchanges within Swiss research

List of current biotech-relevant NCCR

Chemical Biology

- Visualisation and control of biological processes using chemistry
- University of Geneva, EPFL
- Some 13 private sector cooperations, six CTI projects, eight start-ups, 11 patents (2010–2015)

Bio-Inspired Materials

- Using concepts from nature to create 'smart' materials
- University of Fribourg
- Nine private sector cooperations (2014–2015)

Kidney.CH

- Kidney control of homeostasis
- University of Zurich
- Some 15 private sector cooperations, one CTI project, one start-up (2010–2015)

MSE - Molecular Systems Engineering

- Molecular systems engineering
- University of Basel, ETH Zurich
- Five private sector cooperations, one CTI project, two patents (2014–2015)

RNA & Disease

- The role of RNA biology in disease mechanisms
- University of Berne, ETH Zurich
- Three private sector cooperations (2014–2015)

SYNAPSY

- The synaptic bases of mental diseases
- EPFL, University of Geneva, University of Lausanne
- Four private sector cooperations, two patents (2010–2015)

TransCure

- From transport physiology to identification of therapeutic targets
- University of Berne
- Eight private sector cooperations, two patents (2010–2015)

All NCCR funded until 2017.

Medical application

By supporting clinical research, life sciences are brought together with clinical practice in hospitals. The SNSF participated in the funding of Clinical Trial Units (CTU) in the university hospitals in Basel, Berne, Geneva, Lausanne and Zurich as well as in the cantonal hospital in St. Gallen.

The Special Programme for University Medicine (SPUM) funds 10 large translational, multicentric and multidisciplinary research projects in clinical neurosciences and clinical cardiovascular diseases. It comes to an end in May 2016. At the present, 11 long-term longitudinal studies for the Swiss population are supported by the SNSF.

The focus on the application is becoming ever more important for the SNSF. To reflect this reality in the evaluation of individual projects, the SNSF created a new category in 2011: Use inspired basic research.

The Swiss National Science Foundation (SNSF) is the most important Swiss agency promoting scientific research. As mandated by the Swiss Federal Government, SNSF supports all basic research in all scientific disciplines, from philosophy and biology to the nanosciences and medicine. The focus is on the scientific assessment of projects submitted by researchers. The best applicants are funded by the SNSF to the tune of around CHF 850 million each year. The SNSF supports over 3,400 projects involving 14,000 researchers annually. For further information visit www.snsf.ch.

Academia and industry interact to boost innovation



Domenico Alexakis,
Swiss Biotech Association



Daniel Gyga,
biotechnet Switzerland and
University of Applied Sciences
of Northwestern Switzerland

The National Thematic Networks (NTN) help to form contacts and projects between companies and public research institutes. Each NTN deals with a different area of innovation which is of importance to the Swiss economy.

Switzerland's Commission for Technology and Innovation (CTI) recognised eight NTN: Carbon Composites Switzerland, Inartis, Innovative Surfaces, Swiss Biotech™, Swiss Food Research, Swiss Wood Innovation Network, Swissphotonics, and Logistics Network Association. These networks started up in January 2013 and are now moving into their fourth year of operation.

Many stakeholders participate in the Swiss biotech ecosystem which supports close ties between academy and industry. All over Switzerland, there are hotspots for biotechnology. The main clusters are to be found in the cantons of Geneva, Vaud, Basel and Zurich. Swiss Biotech operates as 1Cluster1Nation.

The NTN puts a number of measures in place to foster the competitiveness of companies. These include networking events such as the NTN Swiss Biotech Innovation Day and the NTN Swiss Biotech Research Day, tailored workshops and company visits. To enhance value to members, the NTN Swiss Biotech™ makes a point of concentrating knowledge and technology around defined thematic platforms.

Round up 2014–15

There were many successful projects between industry and academia that were powered by resources from the NTN Swiss Biotech™ and CTI. A selection of stories, originally featured in CHIMIA, a journal aimed primarily but not exclusively at a scientific audience, are presented below. Scientific writer, E. Heinzelmann, wrote Swiss biotech case studies on behalf of the NTN Swiss Biotech™.



The Swiss Biotech structure of relationship for the pharmaceutical-diagnostic industry and health care

Recovering valuable phosphates

Researchers from the HES-SO Valais/Wallis have demonstrated how to extract phosphate from sewage sludge on a laboratory scale, using renewable energy sources from a microbial fuel cell. The mobilized phosphate barely contains heavy metals and can be used to produce fertilizer of marketable quality. The necessary energy comes from a sewage treatment plant and causes no additional costs.

Roche invests in customized training

In response to current needs, Roche is offering its employees an intensive course in biotechnology under the auspices of biotechnet Switzerland. Lecturers from the Zurich University of Applied Sciences (ZHAW) in Wädenswil give participants the benefit of their expertise in theory and laboratory practice. One valuable spin-off is that this extra-mural course allows participants to create a permanent network.

Applied research for innovators

The Institute of Life Technologies at the HES-SO Valais/Wallis in Sion focuses on peptide and protein technologies, life and bioresource technologies, food and natural products and diagnostic systems. With this network of complementary areas of expertise, the institute can offer industrial partners a broad spectrum of integrated solutions.

In vitro models for neurotoxicity studies

Experts met at the first TEDD Workshop, held at the HES-SO Valais/Wallis in Sion, to present innovative cell models for industrial applications. It was the first time that a TEDD event had been organized in French speaking Switzerland and it offered local network partners an opportunity to showcase their research activities.

Preventing antibiotic resistance

In order to develop new approaches for effectively combating antimicrobial resistance, universities of applied sciences, teaching hospitals and biotechnet industrial partners are working together in a National Research Consortium supported by the CTI.

Capacity of coffee!

In the 1990s we began to understand that free radical damage is involved in artery-clogging atherosclerosis and health problems like vision loss, cancer or chronic diseases. Studies have shown that the damage especially affects people with a low consumption of antioxidant-rich fruits, vegetables...and coffee. Is this just a fairy tale promoted by the coffee industry? Scientists at the Zurich University of Applied Sciences (ZHAW) in Wädenswil wanted to get to the bottom of this.

Life sciences at FHNW MuttENZ

The School of Life Sciences at the University of Applied Sciences and Arts Northwestern Switzerland (FHNW) in MuttENZ excels in molecular technology, bioanalytics and in vitro diagnostics – three very active areas of current biotech research. Cooperation with industry partners enables knowledge to be transferred to the education process and gives companies access to qualified individuals and markets. It all adds up to an innovative network of strong partners

Simple diagnosis of bowel disease

Today, the examination of one's own stool for organic bowel disease is as simple as a pregnancy test or a glucose test for diabetes. During the CTI R&D project, sponsored within the CTI special measures to mitigate the effects of the strong franc, a simpler and more cost-effective method for collecting and analyzing stools was developed. The newly developed stool extraction tube is also a success story because the whole value chain, from research through to project development, is made up of Swiss firms and institutions.

For more information please visit:

swissbiotech.org/national_thematic_network

As of 2013 the National Thematic Network Swiss Biotech™, led by biotechnet Switzerland and the Swiss Biotech Association, aims 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 235 member companies and is also a highly respected networking platform for the multinational companies active in the sector. For further information visit www.swissbiotech.org.

biotechnet Switzerland is the network of the Swiss Universities of Applied Sciences (FHNW, HES-SO, ZHAW), the research institutions CSEM, Empa and the Swiss Center for Regenerative Medicine at the University Hospital and University Zurich. 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.

Academia-industry collaboration and research on technology interfaces



Oreste Ghisalba,
Commissioner for Technology
and Innovation (CTI)

The Commission for Technology and Innovation (CTI) is active in a number of areas: R&D project funding, start-up and entrepreneurship, and knowledge and technology transfer (KTT). In the field of life sciences, the technology and business areas covered are biotech, medtech, agrotech and foodtech.

Interdisciplinary perspective

In line with the observations made in the introductory chapter of this report, we observe that the complexity and the interdisciplinary nature of many life science R&D projects and business activities are steadily increasing. Technology integration, technology convergence and technology fusion are a practical reality in life sciences and this is reflected in the CTI support activities. Due to this, a clear and unambiguous attribution of an R&D project or an intended business to one of the four tech or business areas mentioned, and in addition ICT, is often very difficult if not impossible.

Nowadays the most innovative companies – primarily multi-technology companies – and academic research institutions follow interdisciplinary technology integration strategies to create radical, disruptive innovations and hybrid technologies. Prominent examples of successful technology fusion approaches in the area of life sciences are bioinformatics, biomolecular and cellular engineering, and nanobiotechnology.

International aspects

The CTI acts as the Swiss funding organization in innovation-oriented bilateral and multilateral international European R&D cooperation programs. For further information see also earlier editions of the Swiss Biotech Report.

In FP7 (EU framework program 7), CTI was the Swiss funding agency for three ERA-Nets: ERASynBio (synthetic biology), M-ERA.NET (materials science) and WoodWisdom-Net/Net+ (wood material science). These participations provided Swiss research and implementation partners with important additional options for multilateral cooperation with European partners, in accordance with CTI funding rules.

The Swiss participation in ERASynBio was quite successful both in terms of submitted applications and granted projects for the first joint call in 2013 but unfortunately not for the second joint call in 2014. A third and last transnational joint call in the context of ERASynBio was launched in November 2015 in collaboration with ERA-IB-2 (ERA-Net Industrial Biotechnology 2) and ERA-MBT (ERA-Net Marine Biotechnology).

The classical ERA-Net funding scheme of FP7 has been abandoned by the EU and for Horizon2020 replaced by the new funding instrument ERA-Net Cofund. For biotechnology-related R&D a unified ERA-Net Cofund on Biotechnologies (ERA CoBioTech) is in preparation. A proposal was submitted in January 2016, building on the successful work of three preceding ERA-Nets under FP 7: ERA-IB-2 (industrial biotechnology), ERASysAPP (applied systems biology) and ERASynBio (synthetic biology).

The planned co-funded call (to be launched in January 2017) will focus on:

- 1) Synthetic biology approaches to design and construct new biological parts, devices, and systems;
- 2) Systems biology approaches to metabolic engineering and optimization of biological processes;
- 3) Identification and utilization of the metabolic potentials of genomic data;
- 4) Chemical and biotechnological approaches to transform bio-based molecules into molecules with high added value.

Switzerland, again represented by CTI, will participate in this ERA CoBioTech. But for the time being – due to the continuing conflicts of interest between Switzerland and the EU – it will sadly no longer participate as an EU-associated country – as in FP7 ERA-Nets – but only as a third country, together with USA, Russia and Brazil. This situation may change after 2016 if Switzerland and the EU can establish a new and viable bilateral understanding.

Special measures 2016

The Federal Council has approved additional CTI special measures on innovation promotion amounting to CHF 61 million to support export-oriented small and medium-sized businesses that are continuing to struggle owing to the effects of the strong Swiss franc. The special measures are limited to the end of 2016 and complement those introduced last year.

Swiss Innovation Promotion Agency (Innosuisse)

The importance of the CTI, which has existed for over 60 years, and the resources it has at its disposal, have grown in recent years. The CTI is currently governed as an extra-parliamentary commission in the Federal Research and Innovation Promotion Act (RIPA). Since 2011, it has had decision-making powers but experience in recent years has shown that the form of an extra-parliamentary commission is not ideal for CTI's funding activities.

The CTI's organizational structure has been addressed in various parliamentary initiatives in recent years. The analysis con-

ducted by the State Secretariat for Education, Research and Innovation (SERI) showed that there was a need to make significant improvement to governance structures. These can only be achieved by means of a thorough reform.

Following a consultation phase, the Federal Council referred the Dispatch on the Federal Act on the Swiss Innovation Promotion Agency (Innosuisse Act) to Parliament at the end of November 2015. The bill is intended to put in place the legal basis to transform the CTI into a public-law entity. The new Swiss Innovation Promotion Agency (Innosuisse) will therefore be better equipped to meet the future challenges of innovation promotion in the interests of the Swiss economy.

The Innosuisse Act will set out the structure of the new entity and will assign to it the tasks previously performed by the CTI. The bill ensures a clear separation between the agency's strategic and operational tasks. The planned organizational structure also allows Innosuisse to be coherently integrated as a funding body into Switzerland's system of research and innovation funding.

This will affect the cooperation with the Swiss National Science Foundation (SNSF) as it will be easier to implement joint programs and initiatives due to the similar framework. Meanwhile, the interface with the State Secretariat for Education, Research and Innovation (SERI) will also be simplified, which will strengthen CTI/Innosuisse in implementing innovation promotion in particular.

The bill introduces a single new task; namely support for young talent in the form of grants for university graduates. This will give talented young researchers the opportunity to acquire practical skills in a science-based company or to deepen their specialist knowledge by carrying out applied research in a research facility. This will run alongside the SNSF scheme to promote young researchers and will contribute to tackling the shortage of skilled workers as part of the skilled workers initiative.

Similar to the SNSF, Innosuisse is to have four bodies, each of which is allocated its own specific functions and authorities:

1. The Board, which consists of between five and seven members, is the organization's highest body. It is responsible in particular for implementing the Federal Council's strategic goals and supervises the Innovation Council and Secretariat. The members of the Board will perform their roles on a part-time basis and will be appointed by the Federal Council.
2. The Secretariat is an operational body that is responsible for the administration of Innosuisse and is therefore also the point of contact for all funding applications. It puts together the decision documents and passes them on to the Innovation Council for evaluation and decision-making.
3. The Innovation Council, which consists of a maximum of 25 members, is the central specialist body for decisions about innovation funding at Innosuisse. As such, it performs Innosuisse's core activities. Like the Board, members of the Innovation Council perform their roles based on the militia system. The small number of members compared to the current CTI, coupled with the possibility of involving experts from a pool, all of whom are also employed on a part-time basis, means the necessary science and business expertise can be guaranteed in a flexible manner.
4. The Auditor checks Innosuisse's accounts on an annual basis.

According to the present planning, Innosuisse should become fully operative by January 1st 2018 after an implementation phase beginning January 1st 2017. (Source: SERI News December 15/January 16)

The innovation promotion agency Commission for Technology and Innovation (CTI) is active in three funding areas: R&D project funding, Start-up and Entrepreneurship and KTT Support. From 2013 to 2016 it is also promoting research into energy. For further information visit www.kti-cti.ch.

High-tech spill-overs and fusions: A patent perspective on Switzerland



Heinz Müller,
Swiss Federal Institute
of Intellectual Property

The merger of biotechnology with other technological fields started many years ago when devices such as PCR (Polymerase Chain Reaction) or DNA-sequencing machines were built for biotech research, development, and diagnostics. Meanwhile, the fusion of previously disparate areas of technology has spread into other areas such as nanotechnology resulting in nanobiotechnology or nanomedicine.

Another example of technology fusion, that includes biotech, is 3D printing leading to bio-printing. Some applications of this technology – such as 3D printing of teeth and bone implants or cartilage engineering – are already on the market, or close to market introduction. Other applications, such as bio-printing of cells, are still in their infancy i.e. they are in early academic development.

A third example is the fusion of cleantech and biotech. Biological treatment using an aerobic-activated sludge process has been practiced for well over a century. Nowadays, this process has been optimized and includes not only aerobic but also anaerobic bacteria and other microorganisms to remove even toxic substances. Biological systems can also be used to generate biofuel, either from plant material by fermentation or by cultivating fuel-producing microorganisms.

Patents as a source of information

Patent databases are an excellent source for monitoring these new and emerging technologies. They also provide the means to undertake a retrospective analysis of the technology development. The reason for this lies within the patent examination process. Patent applications are carefully analysed by a patent examiner at patent offices around the world. The examination process, therefore, involves much more than a granting or rejection of the patent application.

During the process, the patent examiner classifies the application according to the technology claimed in the document. Thus, all patent documents within the same technological field will be in the same patent class, i.e. for nanotech, cleantech and biotech. One document can have more than one classification assigned if the claimed technology stems from different technological fields. So for example, in order to find cleantech patents that involve biotechnologies, one only has to look for both the cleantech and the biotech classifications and define the intersection of the two technologies. For other technologies such as nanobiotechnology or nanomedicine, separate patent classes exist. This makes it relatively easy to find such documents.

Statistical analysis of patent documents from the three aforementioned fusion technologies was performed to investigate the role of Switzerland in these high tech areas. It has been established through many independent global technology and economy reports, that Switzerland's economy is high-tech oriented. Our proposition was that a survey should reveal whether this also applies to the three fusion technologies and whether Switzerland might even be a leading nation in the field of nanobiotechnology, 3D bio-printing and cleantech involving biotech.

Nanobiotechnology

During the early years of this century, a lot of excitement was generated around the medical and economic potential of nanotechnological approaches in healthcare. It was postulated that nanobiology and nanomedicine had already gained considerable economic value. However, despite the fact that a number of nanoparticle-based medical systems are on the market today, the technology has not yet led to a significant boost in the healthcare industry.

Using the patent classes described above, we were able to identify in the period 2005–2015, approximately 3,500 nanobiotech and nanomedicine patent documents in the worldwide databases. In contrast, the overall number of biotech patent documents during this period amounts to over 940,000. Thus, the nanobiotechnology share of total biotech is only 0.4%. Furthermore, the number of nanobiotechnology patent documents per year was much higher in the early 2000s. Since then it has decreased to a steady state of about 300 new documents per year.

The same trend is observed when counting the nanobiotechnology patent documents from Switzerland. However, the number of nanobiotechnology patent documents originating from Switzerland is very high per capita when compared to Germany or the US. In the period 2005–2015, the output of pertinent patent documents from Switzerland was about twice the number from the US and between five and seven times higher than from Germany.

The decrease on a worldwide scale, and the overall low number of nanobiotech patents, may be explained by the fact that toxicity issues around nanoparticles, in particular if used in medical applications, are of increasing concern to the general population. The fate of these particles in the body and their short-term and even more critically their long-term effects on biological systems are neither understood nor well documented in medical studies.

3D bio-printing

3D bio-printing is a process of creating spatially-controlled cell patterns, in which the behaviour of biological tissues can be mimicked or even reproduced. The final goal is to print viable

organs, such as skin, for transplantation. This technology was first developed and tested in academia but has recently led to a number of new start-up companies being incorporated in Switzerland and other countries. In the near future, it seems likely that more will crop up.

Most patent applications in this field are however filed by research institutions such as universities rather than by companies. This indicates that the field is still in its infancy and will only catch on in years to come. Reinforcing this view is the observation that collaborations between university research and companies are very sparse. In fact, we identified only 11 such collaborations worldwide, with none currently in Switzerland (see figure below). Despite the media hype around 3D bio-printing, the number of pertinent worldwide patent documents is very small; fewer than 1,000 documents can be found in the worldwide databases for period 2005–2015.

Swiss applicants have a share of 2.5%. When calculated per capita, Switzerland's performance is about double that of the US and about five times higher than Germany. Document numbers are however very small and therefore it is not yet clear what will be the overall outcome of the race for 3D bio-printing. Switzerland, nevertheless, seems to be in a very good starting position.

Cleantech

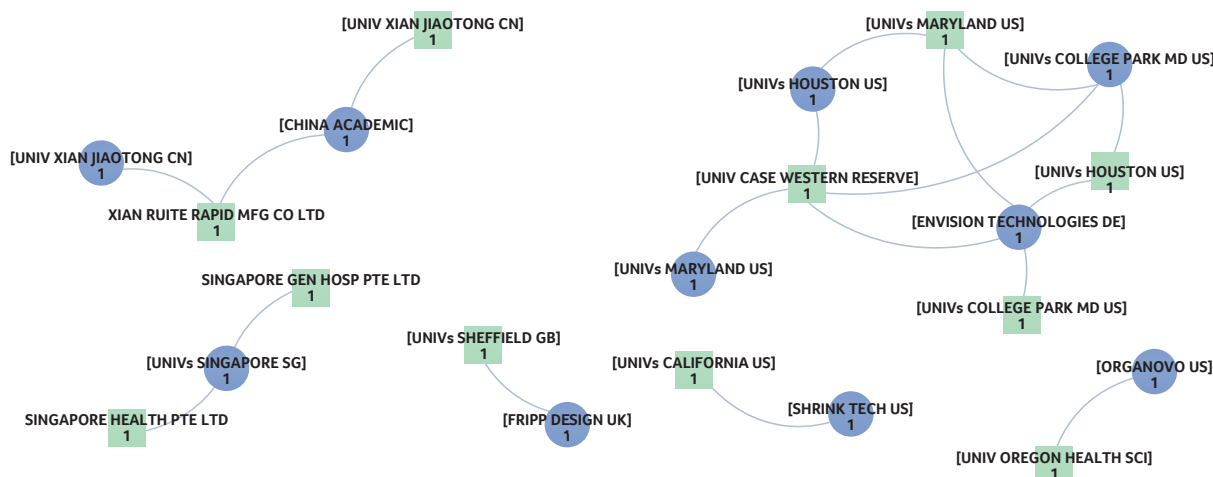
One of the more established technological areas is cleantech. Biotechnology is an ideal playground for the cleantech industry

to develop alternative energy sources, biodegradable materials or biomaterials, waste and water treatment, etc. Growing awareness of the importance of sustainability and cleantech leads to an increasing use of biotech know-how, and approaches towards an environmentally friendly or green industry.

Likewise, the number of biotech patents in the cleantech area has doubled during the last ten years. These patent documents already amount to about 6% of all biotech patent documents published and the trend is upward. Is there a next wave of biotech innovation and investment building just as the biotechnology industry appears to have passed its heyday?

Again, Switzerland is well positioned as far as inventions in the biotech-related cleantech industry are concerned. In this field, the patent output per capita in Switzerland is about three times that of the US or Germany during the past ten years. And whereas the output in the US and Germany has been stagnant over the last five years, the output in Switzerland seems to be accelerating.

In conclusion, although some of the above-mentioned fusion areas are still in their infancy, there is no doubt that in the medium to long term their economic potential is enormous. So far as patents per capita are concerned, Switzerland seems to have a head start in these high-tech areas and might therefore be expected to benefit from the expected boom in the future.



The network of university – industry collaborations in 3D bio-printing

Only a few collaborations exist, none in Switzerland. The numbers indicate the number of shared patents.

The Swiss Federal Institute of Intellectual Property is the official government body for intellectual property rights in Switzerland and is responsible for examining, granting and administering these rights. The Institute's services also include tailor-made searches for trademarks and patent information and training courses on various aspects of intellectual property. For further information visit www.ige.ch.

Wyss Zurich: Translating science into life



Michael Stucky,
Chief Operating Officer,
Wyss Zurich

Switzerland is a world leader in basic science and research. However a gap exists between the generation of an idea and the translation of this idea into commercial applications. Wyss Zurich is a new multidisciplinary translational science center at the University of Zurich and ETH Zurich that bridges this gap.

The new center was made possible by a generous donation from the Swiss entrepreneur and philanthropist Dr. h.c. mult. Hansjörg Wyss. It was established to foster translational research focused on developing treatment protocols and clinical therapies, as well as novel technologies and intelligent systems, in the emerging fields of regenerative medicine and robotic technologies. The center's mission is to ensure that knowledge from basic and pre-clinical research can be applied in practice more quickly. The objective is to achieve commercialization and clinical application through spin-offs, out-licensing deals and trade sales.

From innovation to products

In terms of the number of patents filed per capita, Switzerland figures among the top countries worldwide. This makes it one of the most innovative countries in the world. According to recent figures published by the European Patent Office, it is not just large corporations such as ABB, Nestlé, Novartis and Roche that figure among the top 25 contributors within Switzerland. The Swiss Federal Institutes of Technology in Lausanne (EPFL) and in Zurich (ETH), as well as the University of Zurich (UZH) are also represented.

While this is certainly impressive and reflects Switzerland's outstanding education system, it may not be the best indicator of how many innovations actually make it to the market. Strategic decisions in large corporations, or the lack of resources at SMEs and universities, are among the various reasons why quite a few potentially good innovations may never be commercialized in the form of new products or novel therapies.

Swiss entrepreneur and philanthropist Hansjörg Wyss is the former CEO and Chairman of medical device manufacturer Synthes which was acquired by Johnson & Johnson in 2012. He realized that there was a gap to be filled and an opportunity to help make a difference. This led to the creation of a Wyss Institute and Wyss Centers in the US and more recently Switzerland. These are embedded or closely linked to established and renowned universities.

In the US, the Wyss Institute at Harvard University (wyss.harvard.edu) focuses on the development and translation of bio-

logically inspired materials and devices to solve critical medical and environmental problems. In Switzerland, the Wyss Center in Geneva (wysscener.ch), established in partnership with the EPFL and the University of Geneva, aims to become an accelerator of science and engineering. It is providing the resources, facilities and expertise to create innovative solutions in neuro-technology for human benefit.

Finally, Wyss Zurich (www.wysszurich.uzh.ch), a center of the ETH and the UZH, focuses on the efficient translation of discoveries in the emerging fields of regenerative medicine and robotic technologies into new medical therapies and innovative products. It is bridging the so-called 'valley of death' that sits between traditional academic research and industry research.

Wyss Zurich bridges the 'valley of death'

The objective of Wyss Zurich is to identify promising projects within the ecosystem of ETH and UZH that fulfill a set of selection criteria – the Wyss Qualifying Criteria. The criteria focus on technological fit with either the regenerative medicine and/or the robotics technologies platform, the readiness for translation and very importantly, the existence of an entrepreneurial team that shares the vision of eventually starting a company.

A group of experts from academia – the Core Faculty – reviews the applications from a scientific point of view before they are assessed by the independent, industry-dominated Evaluation Board. This issues a final recommendation on whether a project should be accepted.

Once a project is accepted, teams receive funding to cover expenses for personnel, consumables, specific equipment and other running costs, typically over a period of three years. Alongside direct funding, the project teams have privileged and free access to a unique translational infrastructure run by experts with industry experience. They also benefit from being closely embedded into the academic and clinical environment provided by both universities.

A key differentiator of Wyss Zurich, and a rather unique element in an academic setting, is the access to funding to cover expenses related to early clinical studies (first-in-man trials). These costs alone are often the reason why projects are terminated before going into the clinic and thus represent a major hurdle in the translation process.

Finally, Wyss Zurich will provide the teams with coaching and mentoring in all areas relevant to creating a startup company. It will help initiate early contacts with potential industry partners, as well as venture capitalists, in order to give the project teams the best chance of making a successful transition into the startup world. Ultimately Wyss Zurich wants to give tomorrow's entrepreneurs all the tools they will need to create successful startups that will provide novel solutions that improve people's lives.

Biotechnology and innovation in the Swiss pharmaceutical and chemical industry



Jan Lucht,
scienceindustries

Convergence and fusion of technologies are important drivers of innovation. For the pharmaceutical and chemical sector in Switzerland, the country's largest export industry, the combination of classical chemistry with biotechnology is playing an increasingly important part in R&D and the production of high-quality, high-value goods. A key prerequisite for the development of novel processes with economic and environmental advantages is efficient vertical and horizontal collaboration within the value chain.

The chemical and pharmaceutical industry faces increasing challenges to maintain or increase global competitiveness, while at the same time reducing resource and energy consumption and the overall environmental footprint. Innovative manufacturing approaches are required to become greener, safer and more cost-efficient.

One important trend is the increasing integration of chemical and biotech processes. The total synthesis of some complex molecules, especially those with intricate stereochemistry, poses great challenges to classical chemistry. The use of natural metabolites from biological sources, e.g. from medicinal plants, as precursors for chemical synthesis can offer a solution but is often hampered by a limited and unreliable supply of raw materials. The production of intermediate molecules by fermentation in pathway-engineered microorganisms, combined with chemical synthesis steps towards the final product, has enabled the large-scale production of important drugs, such as the antimalarial substance Artemisinin and the antiviral compound Oseltamivir (Tamiflu®).

A second approach – biocatalysis or biotransformation – uses isolated enzymes or whole cells to catalyse specific reactions in a multi-step synthesis that would be difficult or impossible to carry out with classic chemical approaches. Biocatalysts provide unique stereochemical activities, while often avoiding harsh chemical reaction conditions or the use of aggressive solvents. Some small-molecule, blockbuster drugs that are produced by a combination of chemical and biocatalytical synthesis are already on the market.

Over more than two decades, Switzerland has been a front-runner in large molecule (protein) healthcare biotechnology. Swiss companies are global leaders in the manufacturing of monoclonal antibodies. For small molecule pharmaceuticals and also high-value fine chemicals, biotechnological approaches have to date found more limited practical applications. Compared with large molecule/protein production, biotransformation processes are far more diverse. For many reaction steps, specific biocatalytic reaction platforms suitable for large-scale production are not yet available, limiting the options in the organic chemist's toolbox. Collaboration and the pooling of knowledge and resources is a key element in advancing the scientific base for new biocatalysis approaches and unlocking its huge potential. In 2004, Swiss companies ranging in activities from fine chemistry over pharmaceuticals to the flavours and fragrance sector, joined forces and founded a unique initiative called the 'Swiss Industrial Biocatalysis Consortium' ([SIBC](#)).

Today, Cerbios, DSM, Givaudan, Lonza, Merck, Novartis, Roche, and Syngenta count among the SIBC members, who meet regularly. The aim is to share the huge amount of knowledge and resources concerning biocatalysts, industrial enzymes, microbial strains with special properties and the associated know-how available within individual companies in a precompetitive environment, for the mutual benefit of the members.

A broad enzyme toolbox is a key element for the successful integration of biocatalysis steps into chemical synthesis pathways. And the SIBC collaboration gives Swiss industry an advantage in this field. The contribution of biocatalysis to cleaner and more efficient chemistry should be further boosted by a future Swiss program for basic and applied research in biocatalysis. The establishment of this program is firmly supported by an alliance from academia, SMEs and industry, as well as by the huge advances in genomics and functional characterisation of metabolic reactions.

Switzerland offers a supportive environment for innovative uses of biocatalysis both in the lab and in large-scale production, thereby further bolstering its position as a global biotech hotbed. This is due not only to the good horizontal collaboration within the Swiss industry but also to the well-established vertical network along the value chain; from basic research in academia through to small start-up companies, SMEs and on into large multinational companies, each with specific and complementary technology know-how.

scienceindustries – The Swiss Business Association Chemistry Pharma Biotech

scienceindustries supports some 250 member companies by fostering an innovation-friendly environment in Switzerland, a competitive production and business framework, attractive market conditions and by facilitating worldwide market access. For more information visit www.scienceindustries.ch.

Switzerland offers excellent infrastructure for modern manufacturing



Liv Minder,
Director Investment Promotion,
Switzerland Global Enterprise (S-GE)

Manufacturing practices are changing rapidly. The 'Internet of Things', additive manufacturing and cyber-physical systems are transforming manufacturing; speeding up the process and making it more efficient and smarter.

Known as 'Industry 4.0', the new methods and philosophies bring massive advantages to companies that can adapt to the new era and locate themselves in a high-tech environment that provides leading research centers, excellent infrastructure and highly skilled employees. Switzerland, a leading location for high added-value manufacturing, more than fulfills these requirements, with the added advantage of a flexible legal, fiscal and political environment.

Switzerland is one of the strongest biotechnology locations in Europe. Swiss companies are leaders in many areas and attract capital and researchers from around the world. This success is based on a close-knit network comprising research and development, with support from prestigious universities, highly specialized SMEs and strong multinational companies. As well as being an attractive place to live for international specialists and providing a highly skilled workforce, Switzerland also offers modern infrastructure and a beneficial funding environment.

As a hub for smart manufacturing, Switzerland has already attracted a number of highly successful companies in the biotech, life sciences and microelectronics sectors.

One prominent example is Biogen, one of the global leaders in biotechnology with headquarters in Massachusetts, USA. Biogen has decided to build a new production site in Switzerland at Luterbach in Solothurn. One billion Swiss francs will be invested in the facility and by 2019, about 400 jobs should have been created. This next-generation manufacturing facility will utilize cutting-edge technology, an innovative design, and an advanced operations model to deliver substantially increased productivity. In combination with Biogen's world-class process development capabilities, the facility will be capable of an output of 10 metric tons annually.

Markus A. Ziegler, director corporate affairs at Biogen, explains that various sites worldwide were evaluated before the final decision was made: "Switzerland was chosen for a number of reasons. It offers business-friendly conditions, reliable infrastructure as well as access to a skilled workforce. Moreover, the international head office of Biogen is in Switzerland."

"From first contact to ground-breaking it took only one year. This was a challenging timeframe for such a large project. First contact was made via Switzerland's trade and investment promotion agency Switzerland Global Enterprise. The agency provided time-effective support by coordinating the initial site search amongst the cantons."



"Switzerland offers business-friendly conditions, reliable infrastructure as well as access to a skilled workforce."

Markus A. Ziegler, Director Corporate Affairs, Biogen

About Biogen

Through cutting-edge science and medicine, Biogen discovers, develops and delivers innovative therapies worldwide for people living with serious neurological, autoimmune and rare diseases. Biogen is one of the world's oldest independent biotechnology companies. Patients worldwide benefit from its leading multiple sclerosis and innovative hemophilia therapies. Today Biogen employs 7,500 people in 30 countries. The organization was founded by a group of prominent biologists in Geneva in 1978. It moved its global headquarters to the US, while maintaining a presence in Switzerland.

Switzerland Global Enterprise (S-GE) works all over the world to support entrepreneurs and promote Switzerland as a business location. In its role as a center of excellence for internationalization the agency's mission is to foster exports, imports and investments, to help clients develop new potential for their international businesses and to strengthen Switzerland as an economic hub. S-GE, with a global network of experienced advisers and experts, is a strong and trusted partner for its clients, the cantons and the Swiss government. For further information visit www.s-ge.com.

Record year for funding



Seraina Benz,
Relationship Manager, Issuer Relations
SIX Swiss Exchange AG

The year 2015 has turned out to be a record year for the life sciences sector in Europe. Figures from S&P Capital IQ suggest that on European regulated markets, 28 companies raised CHF 1,062.5 million by way of initial public offerings, a 27% increase on 2014. In Switzerland, the funds raised by the listing of Cassiopea in July 2015 surpassed the transaction volume of Molecular Partners' initial public offering in November 2014 by 65%. Follow-on offerings by biotech companies on SIX Swiss Exchange in 2015 were up 320% on 2014.

Whereas three biotech companies increased their capital by an overall amount of CHF 40.1 million in 2014, 2015 saw four companies in the sector raise a total of CHF 168.2 million in additional capital. The largest chunk of this was driven by Evolva (CHF 57.4 million) and Santhera Therapeutics (CHF 54.8 million). Overall, Swiss biotech companies were able to raise 135% more capital in 2015 than in 2014. They benefited from the highly advantageous conditions prevalent in the sector during the year.

Biotechnology's transformative potential has led many SIX-listed firms, from a wide variety of sectors, to make use of biotechnological processes in the search of cross-business synergies with high commercial value.

- The major flavor and fragrance house Givaudan plans to increasingly rely on biotechnological processes to produce difficult-to-source essential oils.
- Similarly, the biotech company Evolva is developing high-value molecules for the production of alternatives for nature-grown ingredients used in the health, nutrition and wellness industries.
- Food giant Nestlé increasingly operates at the intersection of health and food, tackling illnesses such as Alzheimer's disease through the Nestlé Institute of Health Sciences and its cooperation with biotech firms.

- Finally, the biotech company Lonza unites two business segments – Pharma & Biotech and Specialty Ingredients – under one roof. By combining biotech expertise with chemical know-how it is able to tackle challenges that go beyond disease prevention. Water cleanliness, food supply, hygiene and wellness are also among the major business areas in which the company operates.

Against this background we interviewed three experts on the challenges that publicly listed interdisciplinary firms face in the life sciences space. We focused particularly on communications with investors and the Swiss financial market's ability to cater to their particular needs.

Participants:



Dr. Toralf Haag,
Chief Financial Officer,
Lonza



Jakob Dynnes Hansen,
Chief Financial Officer,
Evolva



Dr. Chandra Leo,
Investment Advisor,
HBM Partners

SIX Swiss Exchange: In what way is your company multidisciplinary or diverse?

Jakob Hansen: We view ourselves as interdisciplinary in several aspects: we apply a technology that was originally developed for pharma (red biotech) but we now use the technology in areas such as food ingredients and personal care (white biotech).

Until a few years ago, we worked entirely in the R&D area but we now gradually are into downstream disciplines such as scale-up and manufacturing (white biotech). Finally, we have several partners, like Cargill and L'Oréal who operate in very different fields.

Company Name	Molecular Partners AG (MOLN)	Cassiopea Spa (SKIN)
Listing date	5 th November 2014	1 st July 2015
Deal size	CHF 106.2 million	CHF 175.6 million
Market cap (@IPO)	CHF 459 million	CHF 373 million
Pricing range	CHF 28.00 to 35.00 per share	CHF 30.00 to 40.00 per share
Issue price	CHF 22.40 per share	CHF 34.00 per share
Lead managers	J.P. Morgan (Global Coordinator), UBS	Jefferies (Global Coordinator), Credit Suisse (Global Coordinator), Bank am Bellevue
Use of proceeds/ Rationale for the deal	Proceeds were used for funding the continued drug development and for investing in R&D activities as well as potential in-licensing	Proceeds went to the parent Cosmo which provided funding to Cassiopea in order to advance the company's lead compound to the completion of phase III trials

Source: SIX Swiss Exchange; Molecular Partners, Cassiopea

Toralf Haag: Lonza is a multidisciplinary and diverse company serving a large variety of industries using a broad range of R&D and manufacturing technologies. Today, even the use of our long-standing biotechnology expertise is multidisciplinary; not just in pharmaceutical and biotech industries, but also in the agrochemical and nutrition ingredient markets.

SIX Swiss Exchange: What kind of investors do interdisciplinary firms attract?

Toralf Haag: Interdisciplinary companies have the ability to attract a broader range of investors as they normally focus on a specific theme; for example pharma, biotech, life sciences, etc.

Jakob Hansen: We do not think investors choose us primarily because we are interdisciplinary. They like our products, the technology and the fact that the risk/reward trade-off is more beneficial than in red biotech. But some investors may appreciate that we address quite different market segments.

Chandra Leo: Interdisciplinary firms attract different types of investors: on the one hand, they are of interest to specialist investors focused on either of the individual sectors they are engaged in; on the other hand, generalist investors may view an interdisciplinary strategy as a built-in means of risk diversification.

For historical reasons, some large conglomerates – like GE, Philips or Siemens – include healthcare activities, although typically more focused on medical devices and diagnostics than pharma. Conversely, many large pharma players were also active in adjacent sectors, such as chemistry, agriculture or animal health.

Over time, many of these pharmaceutical companies have split off or sold certain non-core businesses to increase their appeal to investors. Others, for example, have embraced a combination of prescription drugs and consumer health, to reduce the impact of drug patent expirations on their overall business.

SIX Swiss Exchange: How do interdisciplinary companies most efficiently communicate with investors and what challenges do they face?

Jakob Hansen: That can indeed be a challenge. Investors and analysts often want to put a company in a clearly defined box to enable comparison with other companies. For interdisciplinary companies that's not so easy. So we have to repeat over and over again exactly what we're doing and why.

When we were a biopharmaceutical company, analysts and investors knew exactly how to value us based on their clinical NPV models. When we moved into food ingredients and personal care, people were struggling.

To give an example of this complexity: some investors may put us in the 'Food' box and compare us with Givaudan and Nestlé. However, this doesn't make sense as these are so much larger and profitable. Other may put us in the 'Pharma' box and compare us with Basilea who focuses on drug development and has a very different risk reward profile.

Over the last few years, we have fortunately been able to make most investors and analysts understand and appreciate our interdisciplinary profile.

Chandra Leo: It is important for companies to clearly explain to investors which – offensive or defensive – benefits arise from their interdisciplinary positioning. A key question is whether the interdisciplinary activities create real synergies, for example in research and development or on the commercial side.

Toralf Haag: Interactions with investors on a daily basis is of the essence. Interdisciplinary companies of a certain size attract investors on a global basis rather than nationally. Roadshows to the main financial markets globally, the attendance of specific investor conferences and the constant/daily contact via telephone is of high importance.

SIX Swiss Exchange: Does the Swiss market have the analyst know-how needed to fully comprehend your firms' diversity?

Toralf Haag: Yes, the Swiss market has experts and these sell-side brokers have the ability to fully understand multidisciplinary companies.

Jakob Hansen: In my view it's hard to give a general answer. Interdisciplinary companies may operate in many different areas. As such, it may be difficult for analysts to assess all the possible opportunities. In our case, we are generally quite pleased with the quality of our analyst coverage.

Chandro Leo: There is currently a small number of publicly listed Swiss companies that embody an interdisciplinary approach; companies such as Lonza and Evolva. Other firms are active at the intersection of healthcare and IT. In so far as Swiss analysts possess a deep understanding of the healthcare and life sciences space, they will be able to grasp the value of such interdisciplinary businesses.

SIX Swiss Exchange: How does being listed help you make use of your cross-business synergies and what are the benefits of being listed as a cross-sector company?

Toralf Haag: In Lonza's business cross-business synergies are coming more from the expertise developed over decades, the diverse technologies and manufacturing capabilities, and the market orientation, rather than being a listed company.

Jakob Hansen: I think investors like our business model and diverse products. The fact that we happen to be interdisciplinary is not key.

SIX Swiss Exchange: In your view, when does a spin-off of a division make sense and what is required for it to be positively viewed by investors?

Toralf Haag: A spin-off makes sense when a subdivision has no or little synergy with the core business. A concentration on the core business is always positively viewed by investors.

Jakob Hansen: In my view, the key conditions for a successful spin-off are that it has a sufficient size and that it offers a good equity story.

Chandra Leo: One can distinguish between two scenarios. On the one hand, a split-up or break-up is the separation of two large established businesses operating under the same roof. Such a maneuver should provide more visibility to the individual businesses, more transparency to investors and thus lead to a higher combined valuation of the parts.

On the other hand, a spin-off in the stricter sense 'sets free' a smaller unit that may face difficulties thriving within a larger entity. Optimized incentive systems, a different corporate culture and a new set of investors can carry such spin-offs to success. The fact that corporate spin-offs already come with experienced management teams as well as industry-grade assets and processes sets them apart from many start-ups with academic roots.

SIX Swiss Exchange: Have the Swiss capital markets and SIX Swiss Exchange been able to accommodate your needs at the time of, and after, your listing?

Jakob Hansen: Since we went public in 2009, we have raised a total of CHF 130 million in equity capital on SIX Swiss Exchange in three rounds. As we do not have access to debt financing, these funds are crucial to finance our operations. In addition, our stock has been a currency to do four bolt-on acquisitions which strongly benefited the execution of our strategy. So SIX Swiss Exchange has been an excellent platform for our corporate development.

Toralf Haag: Lonza has been listed since 1999. In the past years Lonza has been able to issue bonds at very favorable conditions. All financial market instruments have been in good shape.

Chandra Leo: HBM Healthcare Investments (HBMN) is a holding company invested in an international portfolio of innovative private and public companies from the biotech, specialty pharma and medtech sectors. The listing on SIX Swiss Exchange gives HBMN's shareholders the unique opportunity to participate in the medium-and long-term value generation of the underlying companies, while retaining a daily liquidity of their investment. With investors having a good general understanding of health-care and life sciences, the Swiss capital market provides an ideal environment for HBM Healthcare Investments.

SIX Swiss Exchange

SIX Swiss Exchange is the leading independent exchange in Europe. It offers outstanding liquidity in trading of Swiss securities and connects companies from around the world with international investors and trading participants. The self-regulatory regime enables it to create particularly market-oriented framework conditions for listing and trading in its highly liquid segments Equities, Bonds, ETFs, ETPs, Sponsored Funds, Sponsored Foreign Shares and Structured Products. SIX Swiss Exchange multiplies the locational advantages of the Swiss financial marketplace with first-rate services and is an ideal listing location for companies of every origin, size and sector. It distributes its own range of indices, including Switzerland's most important blue-chip index SMI®. With the world's most advanced trading technology X-stream INET as well as a wide array of connectivity options and interfaces, SIX Swiss Exchange offers excellent trading conditions. It maintains a close dialogue with both its domestic and foreign customers, to create optimal conditions for their success. Furthermore, SIX Swiss Exchange offers them access to a strong global network which includes SIX Structured Products Exchange Ltd, the Swiss exchange for structured products, the market data provider SIX Exfeed Ltd and the fund database Swiss Fund Data.

SIX Swiss Exchange is part of SIX which offers first-rate services in the areas of securities trading, clearing and settlement, as well as financial market information and payment transactions on a global scale.

SIX Swiss Exchange Ltd, Selnaustrasse 30, P.O. Box 1758, 8021 Zurich,
T +41 58 399 5454 | F +41 58 499 5455 | www.six-swiss-exchange.com

Year in review: selection of events in 2015

Trigger	Company/Institution	Description
January 2015		
Acquisition	Redbiotec	Pfizer acquired a controlling interest in Redvax, a Germany-based spun out of Redbiotec.
License agreement	Cytos (CYTN)	Cytos exclusively licenses its VLP platform for the treatment of hepatitis B infections to OnCore Biopharma.
Research agreement	Addex Therapeutics (ADXN)	Addex and National Institute on Alcohol Abuse and Alcoholism enter collaboration to evaluate ADX71441 in alcohol use disorder.
Financing	Genkyotex	Genkyotex secured CHF 20 million in Series D financing.
Fast Track designation	Debiopharm Group	FDA grants Fast Track designation to Debiopharm Group's antibiotic Debio for acute bacterial skin and skin structure infections.
Milestone	Evolva (EVE)	Evolva announces the successful completion of the first part of its R&D collaboration with L'Oréal.
License agreement	AC Immune	AC Immune enters into an exclusive worldwide license and collaboration agreement for Alzheimer's disease therapeutic anti-Tau vaccines with Janssen Pharmaceuticals.
Agreement modification	Debiopharm Group	Novartis returns Alisporivir (DEB025) to Debiopharm Group including all rights for HCV and other indications.
Financing	EffRx Pharmaceuticals	EffRx Pharmaceuticals raised CHF 2.3 million in an equity round of financing from existing shareholders.
Financing	Debiopharm Group	Debiopharm Diagnostics leads investment round in GenePOC, a Canadian company which has developed a MDx platform for the detection of infectious diseases.
Research agreement	Addex Therapeutics (ADXN)	Addex and Dystonia Medical Research Foundation announce partnership to explore the therapeutic use of dipraglurant in the treatment of Dystonia.
Positive opinion	ARIAD Pharmaceuticals	Ariad announced that the European Commission (EC) has endorsed the final opinion adopted by the Committee for Medicinal Products for Human Use (CHMP) on Iclusig® (ponatinib).
Financing	ProteoMediX	ProteoMediX has announced the second closing of a Series B financing round of CHF 1.0 million, bringing the total amount raised in this round to CHF 4.2 million (EUR 4.2 million).
February 2015		
Milestone achievement	GlycoVaxyn	Promising phase I interim data for ExPEC vaccine program triggers first milestone payment in clinical co-development with Janssen.
Acquisition	GlycoVaxyn	GSK acquires GlycoVaxyn and its biological conjugation platform. GSK has today paid USD 190 million to purchase the remaining stake in the company.
Manufacturing agreement	Lonza (LONN)	TiGenix and Lonza sign agreement for the manufacture of Cx601, a stem cell-based treatment of complex perianal fistulas in Crohn's disease
License agreement	Lonza (LONN)	Lonza and arGEN-X announce a multi-product GS Xceed™ license agreement for therapeutic antibodies.
Financing	Prexton Therapeutics	Prexton raises USD 10 million in a Series A round, co-led by Sunstone Capital and Ysios Capital. MS Ventures, the company's founding investor, will also participate.
March 2015		
Certification	Hutman Diagnostics	The company was successfully certified as EN ISO 13485:2012 + AC: 2012 and ISO 13485:2003 compliant, covering: 'Design and development of molecular biology-based kits and related systems for in vitro diagnostics'.
License agreement	Genedata	Pfizer licensed the Genedata Biologics enterprise platform for use at Pfizer biopharma research and development sites in the US and Europe.
NDA acceptance	Actelion (ATLN)	Actelion's New Drug Application for selexipag (Upravi) in the treatment of pulmonary arterial hypertension is accepted by the FDA.
Product approval	Basilea Pharmaceutica (BSLN)	Basilea reports US FDA approval of isavuconazole for the treatment of invasive aspergillosis and invasive mucormycosis. Partner Astellas will market the drug as CRESEMBA® in the United States.
Financing	Addex Therapeutics (ADXN)	Addex raises CHF 2.8 million in a private placement and extends cash runway.

Milestone achievement	Evolva (EVE)	Ajinomoto project moves into the next phase triggering a milestone payment to Evolva.
License agreement	Gour Medical	Gour entered into a definitive worldwide license agreement with Actelion Pharmaceuticals for the veterinary development of one of Actelion's early-stage clinical dual orexin receptor antagonists.
NDA filing	ADC Therapeutics	ADC Therapeutics submits its first IND for a novel antibody drug conjugate against lymphomas with the US Food and Drug Administration.
Collaboration agreement	Numab	Intarcia and Numab sign a multi-asset collaboration to develop therapies in diabetes, obesity, and autoimmune indications.
Financing	APR Applied Pharma Research	HBM Partners has acquired a minority stake in the Swiss company APR Applied Pharma Research for an undisclosed amount.
Financing	Actelion (ATLN)	Actelion announces commencement of share repurchase program of 10 million shares over 3 years.
License agreement buyout	Cytos (CYTN)	Novartis buys out CAD 106 license agreement for CHF 4 million.
Product approval	Actelion (ATLN)	Actelion receives marketing approval for Opsumit (macitentan) in pulmonary arterial hypertension in Japan.
Collaboration agreement	Evolva (EVE)	Evolva and Valent BioSciences have signed an exclusive agreement to co-develop and commercialise a class of high-value active ingredients for use as next-generation agricultural bioactives.
Study results	Galderma	Galderma announced a positive outcome of the European Decentralised Procedure (DCP) for SOOLANTRA® (ivermectin) Cream 10mg/g for the once-daily topical treatment of inflammatory lesions of papulopustular rosacea in adult patients.
Financing	NBE-Therapeutics	NBE-Therapeutics has completed a CHF 3.0 million series A financing round led by Boehringer Ingelheim Venture Fund as lead investor.
License agreement	THERAMetrics Holding	THERAMetrics and Centurion Pharma announced that they have signed a final licensing agreement for Aviptadil, THERAMetrics' drug candidate for Sarcoidosis.
April 2015		
License agreement	Basilea Pharmaceutica (BSLN)	Basilea entered into a exclusive license agreement for panRAF kinase inhibitors to develop, manufacture and commercialize the inhibitors originating from the research conducted at The Institute of Cancer Research
Regulatory authorization	Santhera Pharmaceuticals (SANN)	Santhera receives FDA Fast Track Designation for Raxone®/Catena® (idebenone) for the treatment of Duchenne Muscular Dystrophy (DMD).
Product launch	MD Biosciences	MD Biosciences launched NeuroFreeze for preserving primary neurons.
Start-up	Incyte (INCY)	Incyte Corporation (Nasdaq:INCY) will establish the new headquarters of Incyte Europe S.a.r.l in Geneva, Switzerland.
Study initiation	Humabs	MedImmune starts phase I clinical trial to investigate an antibody developed under a collaboration with Humabs for the treatment of Influenza A.
Research grant	Mymetics	Mymetics-led consortium awarded EUR 8.4 million for development of thermo stable and cold-chain independent vaccines.
Milestone achievement	Evolva (EVE)	Evolva completed the transfer of GC-072 contract to Emergent BioSolutions Inc. Emergent had acquired Evolva's anti-bacterial programme, the EV-035 series in December 2014.
Study results	Basilea Pharmaceutica (BSLN)	Basilea presented data on the antifungal isavuconazole and the antibiotic ceftobiprole obtained from two phase III clinical trials in adult patients with invasive fungal infections.
Financing	CRISPR Therapeutics	CRISPR closed a Series A and Series B financing totaling USD 89 million, including USD 35 million of new funding in the Series A and USD 29 million in the Series B.
Acquisition	Galderma	Galderma enters the nutraceutical market through the acquisition of certain assets of Inneov Group.
May 2015		
Collaboration agreement	Lonza (LONN)	Lonza and Nikon announced an exclusive collaboration in the field of cell and gene therapy manufacturing.
Capital restructuring	Cytos (CYTN)	Cytos Biotechnology Ltd. has announced the completion of convertible bond restructuring resulting in 77.49 million newly issued shares in exchange for convertible bonds.
Acquisition	Selexis	Ligand Pharmaceuticals has acquired a portfolio of potential future milestone and royalty payments for 15 biologic development programs from Selexis for USD 4 million.
Award	Cerbios	Cerbios has been awarded second place at the biannual Swiss Venture Club Prix 2015 based on its continued innovation and sustainability.

Milestone achievement	Evolva (EVE)	Evolva reaches third milestone in Roquette collaboration.
Study results	Debiopharm Group	Debiopharm completed the non-comparative phase III study with triptorelin embonate (pamoate) 22.5 mg 6-month formulation in 44 patients (39 girls and 5 boys) with central precocious puberty.
Change in share-holding pattern	Evolva (EVE)	Evolva CEO, Neil Goldsmith, increased his shareholding in the company by exercising options that he held to acquire 3.8 million new Evolva shares.
Financing	Auris Medical (EARS)	Auris Medical closed its previously announced public offering of 5,275,000 of its common shares at a public offering price of USD 4.75 per common share.
Research grant	Selexis	Selexis and Merus received an EUR 2.1 million EUREKA Eurostars grant "BiSECT" to develop bispecific antibody combination products for the treatment of colorectal cancer.
Study completion	Xeltis	Xeltis successfully completed the first-ever feasibility clinical trial on Endogenous Tissue Growth (ETG).
Study results	PIQUR Therapeutics	PIQUR announced positive phase I study results and the start of phase II of PQR309. The study confirms that PQR309 is well tolerated and shows promising signs of clinical antitumor activity.
June 2015		
Award	PIQUR Therapeutics	PIQUR wins Hightech/Biotech award at Swiss Economic Forum.
License agreement	Numab	Tillotts Pharma and Numab announced an exclusive development and licensing agreement for TNF-alpha blockers as drug candidates for inflammatory bowel disease.
Milestone achievement	Humabs	Humabs received a milestone payment from its licensing agreement with Novartis.
Study results	Anergis	Anergis presented clinical data as well as in vitro and in vivo safety and immunogenicity data on AllerT an immunotherapeutic to treat birch pollen allergies.
Collaboration agreement	BioVersys	BioVersys became a member of the newly launched BEAM (Biotech's from Europe innovating in Anti-Microbial Resistance) alliance of European biotech firms.
Acquisition	Debiopharm Group	Debiopharm acquired FibroTrap sample processing technology from Spinomix. Debiopharm will further develop the technology and launch it in the market.
Capacity expansion/Facility improvement	Lonza (LONN)	Lonza announced the plan to construct a new state-of-the-art 100,000 square foot facility so as to meet the increasing demand for viral therapy products.
Collaboration agreement	GeneData AG	Genedata and IntelliCyt entered into an alliance wherein Genedata Screener® software are integrated with the IntelliCyt iQue® Screener system.
Collaboration agreement	Lonza (LONN)	Lonza and Octane Biotech have collaborated for technology evaluation of the Octane Cocoon™ cell production platform, an autologous cell therapy technology.
Start-up	Actelion (ATLN)	Actelion has announced creation of a start-up Vaxxilon in collaboration with Max Planck Society. The new company aims to discover, develop, and commercialize synthetic carbohydrate vaccines.
IND approval	Stemedica	FDA grants IND approval for phase IIa clinical trial using Stemedica's itMSC therapy to treat Alzheimer's Disease.
MAA authorization	Santhera Pharmaceuticals (SANN)	CHMP recommends granting a marketing authorization for Santhera's Raxone® for the treatment of Leber's Hereditary Optic Neuropathy (LHON).
July 2015		
Financing	EVA	Cantonal Banks of Basel-Stadt and Basel Landschaft increased their investment in EVA, the Basel life sciences start-up agency.
Agreement modification	Lonza (LONN)	Lonza signed a contract to expand its existing manufacturing agreement with Alexion. Lonza will construct and launch a new suite dedicated to Alexion manufacturing.
Capacity expansion	Biogen	Biogen will invest one billion Swiss francs in Luterbach in the canton of Solothurn in a new production plant. Up to 400 new jobs are expected to be created starting 2019.
Patient enrolment	Molecular Partners (MOLN)	First patient enrolled in phase III study of abicipar and triggered USD 15 million milestone payment.
Acquisition	Cerbios	Cerbios increased its participation as shareholder in Lipidor, a move that further strengthens the existing partnership between the two companies regarding the innovative and versatile topical drug delivery system, AKVANOÖ.
Financing	InSphero	InSphero secured CHF 20 million series C financing.
Collaboration	Lonza (LONN)	Lonza reached an exclusive agreement with TAP Biosystems to distribute the company's RAFT™ (Real Architecture For 3D Tissue) 3D Cell Culture System.
Financing	PIQUR Therapeutics	PIQUR announced the closing of an oversubscribed CHF 18 million (USD 19 million) round of Series A2 financing.

Patent issued	THERAMetrics Holding	The European Patent Office has granted a patent to Therametrics for a pharmaceutical kit for the targeted treatment of Idiopathic Pulmonary Fibrosis.
Patient enrolment	Santhera Pharmaceuticals (SANN)	Santhera announced that the first patient in the CALLISTO phase I study assessing the pharmacokinetics, safety and tolerability of oral omigapil in patients with Congenital Muscular Dystrophy (CMD) has been dosed and all participating patients have been recruited.
Collaboration agreement	Molecular Partners (MOLN)	Allergan strengthens DARPin development and discovery alliance with Molecular Partners. The alliance covers abicipar, multi-DARPin VEGF/PDGF and other research programs. Allergan will pay USD 35 million in accelerated milestone payments.
Patient enrolment	Addex Therapeutics (ADXN)	Addex initiated patient enrolment and the first subjects have been dosed with dipraglurant (ADX48621) in a receptor occupancy study in healthy volunteers.
Milestone achievement	AC Immune	AC Immune receives milestone payment from Genentech for crenezumab moving into phase III clinical development in Alzheimer's disease.
Study setback/Discontinuation	Basilea Pharmaceutica (BSLN)	Basilea Pharmaceutica announced that the phase III ACTIVE study did not meet its primary objective of demonstrating non-inferior efficacy of isavuconazole.
Financing	Memo Therapeutics	The Swiss biotech company closed a series A financing round of CHF 2.3 million to develop and validate its MemoMAB antibody discovery platform.
August 2016		
Refinancing	Therametrics (TMX)	THERAMetrics completed the acquisition of 38,500,000 of its own shares from its shareholders Pierrel and Fin Posillipo.
Acquisition	Lonza (LONN)	Lonza announced the acquisition of research-focused chemical company Zelam which will lead to strengthening of Lonza's Agro Ingredients and Wood Protection businesses.
Financing	Santhera Pharmaceuticals (SANN)	Santhera completed the sale of 300,000 registered shares of common stock yielding an aggregate income of CHF 27.7 million (USD 28.3 million).
QIDP drug designation	Basilea Pharmaceutica (BSLN)	Basilea announced that the FDA designated its investigational drug ceftobiprole as a Qualified Infectious Disease Product (QIDP) for the treatment of community-acquired bacterial pneumonia and acute bacterial skin and skin structure infections.
License agreement	Cytos (CYTN)	Cytos granted exclusive access of its clinically validated product candidate CYT003 as well as its VLP platform and of technology related to oligonucleotide synthesis to Checkmate Pharmaceuticals LLC.
Financing	Inflamalps	The biotech start-up Inflamalps raised CHF 1.8 million.
Financing	Lonza (LONN)	Lonza Swiss Finance announced the pricing of its dual tranche CHF 325 million straight bonds. Lonza will apply for the listing of the bonds on the SIX Swiss Exchange.
Orphan drug designation	Santhera Pharmaceuticals (SANN)	The U.S. Food and Drug Administration (FDA) has granted rare pediatric disease designation for Santhera's lead orphan drug candidate, idebenone, for the treatment of Duchenne Muscular Dystrophy (DMD).
Product launch	Evolva (EVE)	Evolva launched nootkatone, a highly prized citrus flavour and fragrance (F&F) ingredient.
Financing	Kuros Biosurgery	Kuros closed a financing round of CHF 15 million. An additional investment is expected in a second closing later this year.
September 2014		
Start-up	LimmaTech Biologics	LimmaTech started its operations with headquarters and research facilities in Schlieren near Zürich, Switzerland.
Financing	ADC Therapeutics	ADC Therapeutics raised USD 80 million through a private placement of equity. New investors include leading European and US-based investors alongside founding investor Auvex Therapeutics and participation from AstraZeneca.
Start-up	Santen	Santen inaugurated its new European Head Quarters in Geneva, Switzerland. The new European HQ will lead the growing commercial network, manufacturing and R&D activities.
Research grant	Evolva (EVE)	Evolva made a donation to the University of Toronto Faculty of Dentistry in Toronto, Ontario, Canada to support a novel research initiative aimed at managing periodontitis using resveratrol.
License agreement	Relief Therapeutics	Relief Therapeutics finalized an in-licensing agreement from Merck Serono, giving the worldwide exclusive rights to develop and commercialize atexakin alfa.
Collaboration agreement	Addex Therapeutics (ADXN)	Pierre Fabre Pharmaceuticals and Addex signed early-stage agreement in the Central Nervous System (CNS) field. Addex grants option to license mGlu3 receptor program to Pierre Fabre to conduct chemistry, pharmacology and ADME.
Collaboration agreement	Debiopharm Group	Debiopharm and Solid Biosciences announced a collaboration to explore the use of Alisporivir (Debio 025) in muscular dystrophy.
Financing	Evolva (EVE)	Evolva announced the results of its rights offering. Evolva was able to raise CHF 57.4 million of new capital.

MAA authorization	Santhera Pharmaceuticals (SANN)	Santhera received European Marketing Authorization for Raxone® in Leber's Hereditary Optic Neuropathy (LHON).
Collaboration agreement	Gour Medical	Gour Medical and SolMic Research signed an exclusive cooperation agreement to manufacture and commercialize Cannabidiol (CBD) products for a use in animal healthcare.
Collaboration agreement	AC Immune	AC Immune signed a collaboration agreement with Nestlé Institute of Health Sciences to develop Alzheimer's disease diagnostic.
Award	Helsinn Group	Helsinn has earned the prestigious Global CEO Cancer Gold Standard™ accreditation for its worldwide commitment to reducing cancer risk.
Patent issued	InSphero	The United States Patent and Trademark Office (USPTO) has officially granted InSphero full protection of its GravityPLUS hanging drop technology.
October 2015		
Award	CRISPR Therapeutics	CRISPR Therapeutics was named by FierceBiotech as one of 2015's Fierce 15 biotechnology companies.
Product launch	Santhera Pharmaceuticals (SANN)	Santhera Pharmaceuticals launched Raxone® for the treatment of Leber's Hereditary Optic Neuropathy (LHON) in Germany. LHON is a rare inherited mitochondrial disease that usually leads rapidly to profound and permanent blindness.
Award	Molecular Partners (MOLN)	Molecular Partners has been honored with the EUROPEAN BIOTECHNICA AWARD 2015. The award honors one company that has established a truly disruptive, pioneering technology in biotech or life sciences.
License agreement	Octapharma	Octapharma invests EUR 80 million to acquire an exclusive worldwide license to certain IP of Glycotope's recombinant technology and to become a minority shareholder of Glycotope.
CE approval	APR Applied Pharma Research	APR Applied Pharma Research was granted the Class III European CE mark approval of Nexodyn AcidOxidizing Solution (AOS)™.
Acquisition	Voisin Consulting	Voisin Consulting acquired US based B&H Consulting Services.
Distribution agreement	Basilea Pharmaceutica (BSLN)	Basilea signs exclusive distribution agreement for Zevtera® (ceftobiprole medocartil) in the Middle East and North Africa with Hikma Pharmaceuticals.
Filing	Basilea Pharmaceutica (BSLN)	Basilea announced filing of registration statement for a proposed offering in the United States.
Approval	Basilea Pharmaceutica (BSLN)	The European Commission approved Basilea's isavuconazole (CRESEMBA®) as a treatment for invasive aspergillosis and mucormycosis in the European Union.
Study results	Santhera Pharmaceuticals (SANN)	Santhera and Parent Project Muscular Dystrophy (PPMD) announced results of benefit/risk survey in patients with Duchenne Muscular Dystrophy (DMD).
Orphan drug designation	Basilea Pharmaceutica (BSLN)	Basilea announced that the European Commission maintained isavuconazole's orphan drug status.
Start-up	1abtik	1abtik has been founded with the sole focus to develop a game-changing antibody-based therapy for sepsis.
Refinancing	Therapeutics (TMX)	THERAMetrics signed a CHF 3.3 million fully-subordinated convertible loan agreement with Fin Posillipo and Bootes.
Award	InSphero	Dr. Jan Lichtenberg, CEO and co-founder of InSphero AG received the Ernst & Young Entrepreneur of the Year™ 2015 award in the category 'Emerging Entrepreneur'.
Milestone achievement	Evolva (EVE)	Evolva successfully completes Roquette collaboration, triggering a fourth milestone payment. The project focussed on an ingredient with important applications in food products.
November 2015		
Study results	Debiopharm Group	Debiopharm presented positive preliminary results from phase I trials in the development of the IAP inhibitor Debio 1143.
Research agreement	CRISPR Therapeutics	Vertex Pharmaceuticals and CRISPR entered into a strategic research collaboration to discover and develop potential new treatments aimed at the underlying genetic causes of human disease.
Collaboration agreement	Selexis	Faron entered an agreement with Selexis to progress development of novel cancer immunotherapy Clevegen.
Study completion	Santhera Pharmaceuticals (SANN)	Santhera completed comparative analyses of the respiratory outcomes for patients in its successful phase III DELOS trial with data from a natural history DMD patient cohort collected by the Cooperative International Neuromuscular Research Group (CINRG).
Orphan drug designation	Genkyotex	Genkyotex was granted Orphan Drug Designation for GKT137831 for the treatment of systemic sclerosis from the US Food and Drug Administration (FDA) and the European Medicines Agency (EMA).
Study initiation	Turing Pharmaceuticals	Turing dosed the first group of subjects in the TUR-004 single ascending dose study, the first clinical study in a comprehensive program aimed at obtaining approval for the treatment of epileptic encephalopathies.

Financing	Kuros Biosurgery	Kuros raised an additional CHF 5 million in a fully subscribed second closing of its financing round.
Research agreement	Turing Pharmaceuticals	Turing announced a sponsored research agreement with the University of Toledo to discover and develop new treatments for Canavan Disease.
Collaboration agreement	ObsEva	ObsEva and Kissei Pharmaceutical announced a global agreement to develop and commercialize KLH-2109 for the treatment of endometriosis.
Research grant	Addex Therapeutics (ADXN)	Addex has been awarded a CHF 666,240 grant from the Swiss Commission for Technology and Innovation (CTI) to advance the characterization of allosteric modulator therapeutics for neurodegenerative and psychiatric diseases.
Financing	ObsEva	ObsEva closed CHF 60 (USD 60) million in series B financing.
Collaboration agreement	Addex Therapeutics (ADXN)	Addex entered into an agreement with the National Institute of Neurological Disorders and Stroke (NINDS) to submit ADX71441 to the Anticonvulsant Screening Program (ASP) for evaluation in preclinical models.
Acquisition	Clariant (CLN)	Clariant closed a strategic alliance with Beraca acquiring 30% of its shares in Health & Personal Care Division.
December 2015		
Research agreement	Human Brain Project	The European Commission and the Human Brain Project have signed the Horizon 2020 Framework Partnership Agreement.
License agreement	GeNeuro	GeNeuro entered into a strategic partnership with Servier to develop and market GNbAC1 in Multiple Sclerosis (MS).
Financing	Santhera Pharmaceuticals (SANN)	Santhera completed share placement and raised CHF 54.8 million. Santhera launches placement of up to 500,000 new shares through an accelerated bookbuilding procedure.
Acquisition	Cytos (CTN)	Cytos Biotechnology took over Kuros Biosurgery. The combined entity will then trade under the new name Kuros Bioscience. Each Kuros share will convert into about 27 newly issued Cytos shares.
Study initiation	ADC Therapeutics	ADC Therapeutics has received clearance from the US Food and Drug Administration (FDA) to begin clinical trials with ADCT-402, a novel antibody drug conjugate targeting CD19.
Capacity expansion	Addex Therapeutics (ADXN)	Addex moved its R&D operations to the Campus Biotech, a new life sciences center of excellence located at the former Merck Serono site in Geneva.
Study initiation	ARIAD Pharmaceuticals	ARIAD Pharmaceuticals initiated a randomized phase III trial of Iclusig® (ponatinib) in second-line patients with chronic myeloid leukemia (CML) in the chronic phase (CP).
Orphan drug designation	Debiopharm Group™	The European Medicines Agency (EMA) has granted Debiopharm Orphan Drug Designation to Debio 1143 for treatment of Ovarian Cancer affecting around 154,000 people in the European Union (EU).
Financing	Basilea Pharmaceutica (BSLN)	Basilea successfully launched CHF 200 million senior convertible bonds. The F-1 filing has been withdrawn.
Award	Molecular Partners (MOLN)	Molecular Partners has achieved a top 3 ranking in the category 'Most Innovative Newcomer' at the European Small and Mid-Cap Awards 2015 in Brussels.
Research grant	Addex Therapeutics (ADXN)	Addex has been awarded a CHF 440,762 grant from the Swiss Commission for Technology and Innovation (CTI) to advance the characterization of novel tyrosine receptor kinase subtype B (TrkB) positive allosteric modulators (PAM) in preclinical models of neurodegenerative diseases.
License agreement	Gour Medical	Gour Medical has entered into an exclusive license agreement with IDEXX Laboratories to continue the development of a recombinant monoclonal antibody for therapeutic use: anti-IgE chimeric antibody for the treatment of canine allergy.
FDA approval	Actelion (ATLN)	Actelion received US FDA approval of Upravi (selexipag) for the treatment of pulmonary arterial hypertension.
License agreement	CRISPR Therapeutics	Bayer and CRISPR Therapeutics join forces to discover, develop and commercialize potential cures for serious genetic diseases. Bayer is investing USD 335 million through new Bayer LifeScience Center unit.
Milestone	Evolva (EVE)	Evolva achieved another technical milestone in its partnership with Cargill, to commercialise EverSweet™ triggering the payment of USD 0.5 million by Cargill.

Disclaimer:

This information was selected and compiled on the basis of publicly available information only. We therefore cannot guarantee that all events are included in the above summary for 2015.

Swiss biotech at a glance



Jürg Zürcher,
Partner,
Assurance Services,
Biotechnology Leader EMEA,
Ernst & Young AG



Jörg Schmidt,
Executive Director,
Assurance Services,
Ernst & Young AG

Biotech was 'en vogue' in 2015. The FDA approved 45 new products as compared with 41 in 2014 and the EMA accepted 93 new medicines well up on the 82 accepted in 2014. A total of 78 biotech companies launched an IPO in 2015, whereof 45 US-based companies raised USD 3.8 billion and 33 European companies raised USD 1.4 billion.

The total amount of capital raised globally via IPO was below the record year of 2014 which may to some extent be traced back to statements regarding the healthcare industry made by some American politicians in light of the upcoming presidential elections. These had a certain impact on overall valuations. The going public activities of Swiss biotechs remained at a low level – one IPO in 2015 versus two in 2014 – which was influenced by these global trends. Nevertheless, total funds raised by Swiss biotech companies achieved a new high.

Revenue

The Swiss biotech industry achieved total revenue of CHF 5.1 billion. Given the current economic situation this result is remarkable and is partly based on the increase of the number of revenue-generating biotech companies. Furthermore, Actelion passed the CHF 2 billion revenue line which is noteworthy because the last time this marker was reached was roughly ten years ago before Serono was acquired by Merck Germany.

Products approvals, clinical development

Actelion's selexipag was approved by the FDA just before Christmas 2015 and was already available to patients in January 2016. Earlier in the year, Basilea's isavuconazol (Cresemba®) and Santhera's Raxone® were approved by EMA. Both companies saw those approvals reflected in initial sales in 2015 and it can be expected that those revenue streams will increase in the future.

The bio-ingredients company Evolva was also very active and launched valencene, a highly prized orange flavor and fragrance. Shortly before this launch, Cargill unveiled EverSweet™, the great tasting, next-generation stevia sweetener, co-developed with Evolva.

A series of positive study results were communicated by companies such as AC Immune, Anergis, Genkyotex, Molecular

Partners, ObsEva and Piquar Therapeutics. Some of those study results triggered double-digit milestone payments from their collaboration partners for the Swiss biotech companies. Other companies had to digest some setbacks i.e. the discontinuation of Polyphor's collaboration with Roche.

Financing reached a new record height

The Swiss biotech community was able to collect almost CHF 907 million in total which is about CHF 22 million more than in the Swiss record year 2007. Public companies raised approximately CHF 474 million and private companies harvested CHF 433 million.

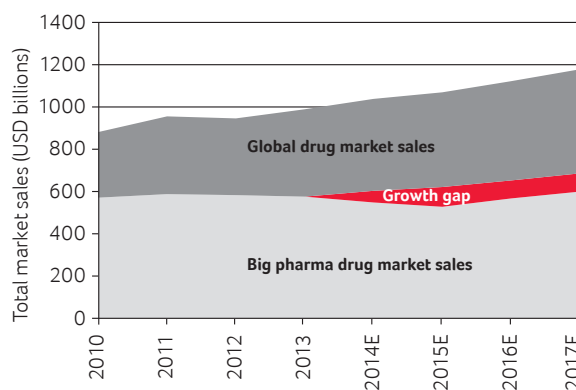
It is worth noting that a handful of recently funded biotechs were able to attract capital in the early stages of existence. This seems to be a positive signal for the industry as early financing has been rough in the past few years. The only IPO noted was the one from the Swiss-Belgian company Biocartis which took place at the Belgium stock exchange and was one of the top European IPOs, raising a total of CHF 104 million.

In early Q4/2015, Basilea Pharmaceutica filed an F-1 with NASDAQ to launch a secondary offering. However this intention was withdrawn a couple of weeks later and fresh capital received through a CHF 200 million convertible bond at SIX Swiss Exchange.

Also SIX-listed Cytos Biotechnology and privately held Kuros Biosurgery announced in early December 2015 plans to combine their activities to create Kuros Biosciences. This move wasn't unexpected as Cytos signaled earlier in 2015 its willingness to enter into a capital-market transaction. The transaction was completed in January 2016. A similar transaction was also announced by THERAMetrics Holding AG with the intention to combine its operations with Relief Therapeutics SA.

M&A and collaborations

Big pharma's need for new growth opportunities (see growth gap below) has been discussed in depth in EY's Firepower analysis in



Source: EY, Capital IQ, IMS Health, and company financial data.

Global pharma sales trends and outlook

The growth gap is the difference in the sales growth of a biopharma company or bio-pharma sub-sector (e.g., big pharma) relative to overall drug market sales.

early 2016. Some of the impacts for the Swiss biotech landscape are described below in more detail.

In January 2015, GlycoVaxyn in Schlieren was acquired by GSK for a total amount of CHF 200 million. This transaction again provided proof of the excellence of Swiss-based scientific research, considering the fact that GlycoVaxyn also had collaborations in place with J&J as well as the Wellcome Trust. This acquisition also led to the creation of LimmaTech Biologics. All employees from GlycoVaxyn were transferred into this new company which will exclusively continue the work from GlycoVaxyn.

Also in January 2015, Pfizer Inc. announced that it had acquired a controlling interest in Redvax GmbH, a spin-off from Redbiotec AG, a privately held Swiss biopharmaceutical company, also based in Schlieren. This transaction provides Pfizer access to a preclinical human cytomegalovirus (CMV) vaccine candidate, as well as intellectual property and a technology platform related to a second, undisclosed vaccine program.

Servier, a French pharma company, agreed to become a minority shareholder in GeNeuro and to finance a global phase III development program with an upside potential worth an additional USD 355 million to the Swiss biotech.

Crispr Therapeutics AG was identified as one of the world's 15 most promising biotechs by Fierce Biotech. And that was before it announced a collaboration with Vertex with an upfront payment of USD 105 million and additional upside potential. Right before year-end another collaboration with Bayer AG was communicated with a minimum deal value of USD 335 million. Both collaboration partners agreed to invest a minority equity stake in this company which is only two years old.

More Swiss-based science results can be expected in the future from two newly opened locations. Campus Biotech in Geneva is a new initiative that aims to drive forward the biotechnology sector in the Lake Geneva region, creating new opportunities for scientists and entrepreneurs.

The Wyss Translational Center Zurich (also called Wyss Zurich) is a multidisciplinary research and development center of the University of Zurich and ETH Zurich (Swiss Federal Institute of Technology Zurich). It was made possible by a generous donation from the Swiss entrepreneur and philanthropist Hansjörg Wyss.

2015 was overall a very positive year for the Swiss life sciences industry. The industry achieved substantial progress in many development areas. The positive news flow is a confirmation of the maturity of the sector as a whole. The future potential in the development pipeline of the companies will provide more good results to the public in the future.

About the global EY organization

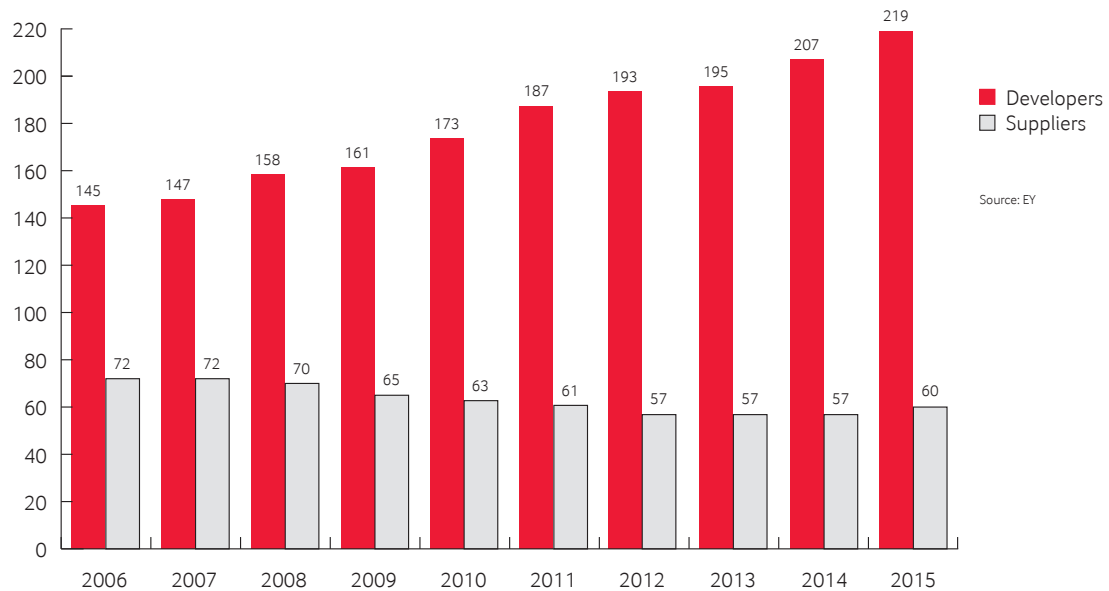
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About EY's Global Life Sciences Center

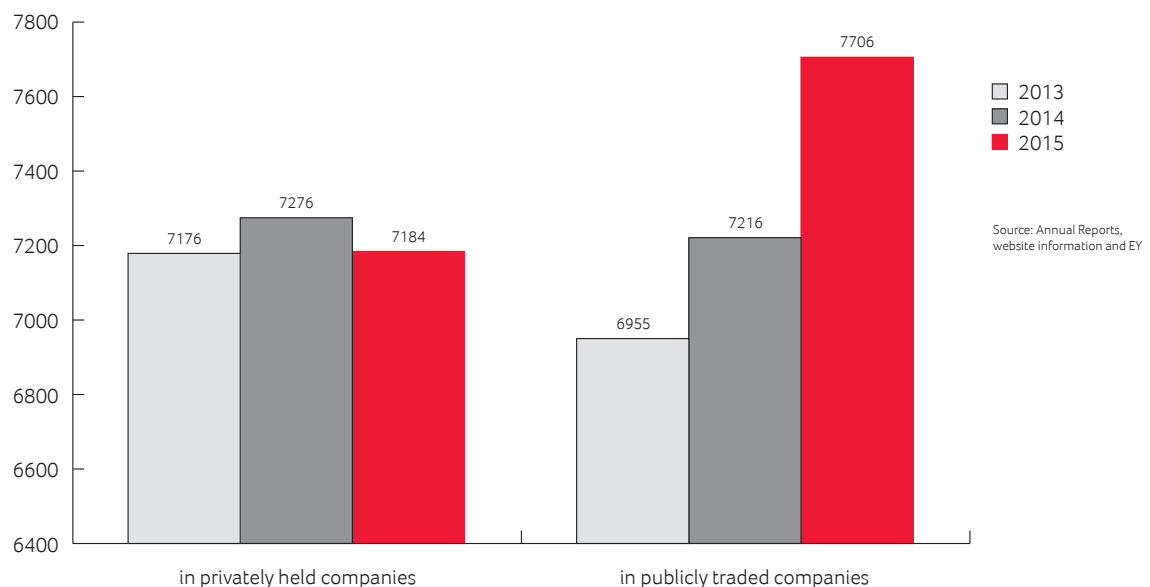
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Facts & figures

Number of biotech companies in Switzerland



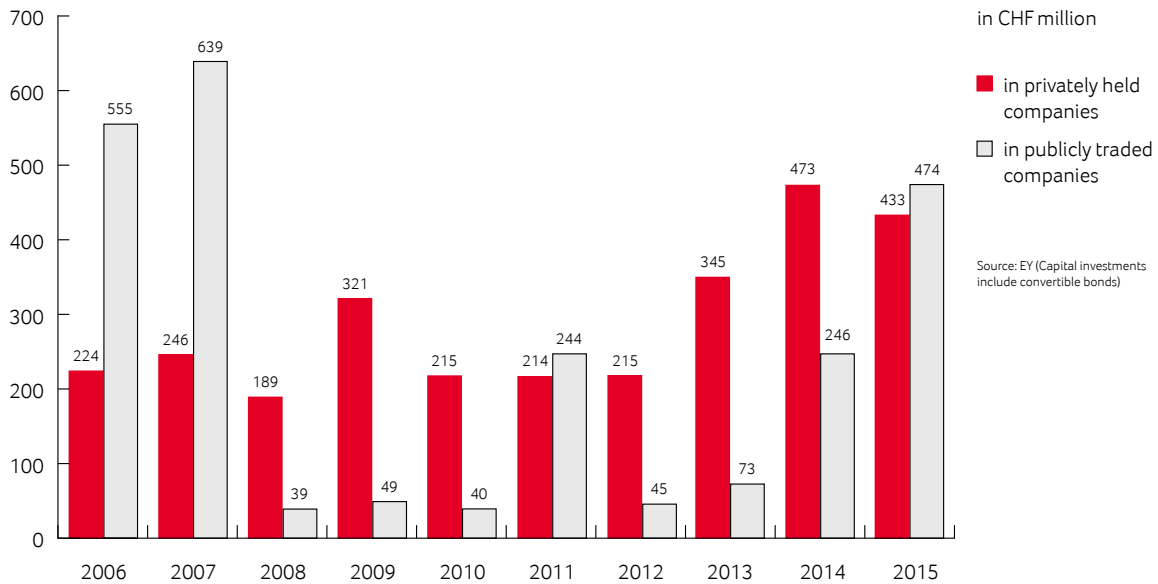
Number of employees



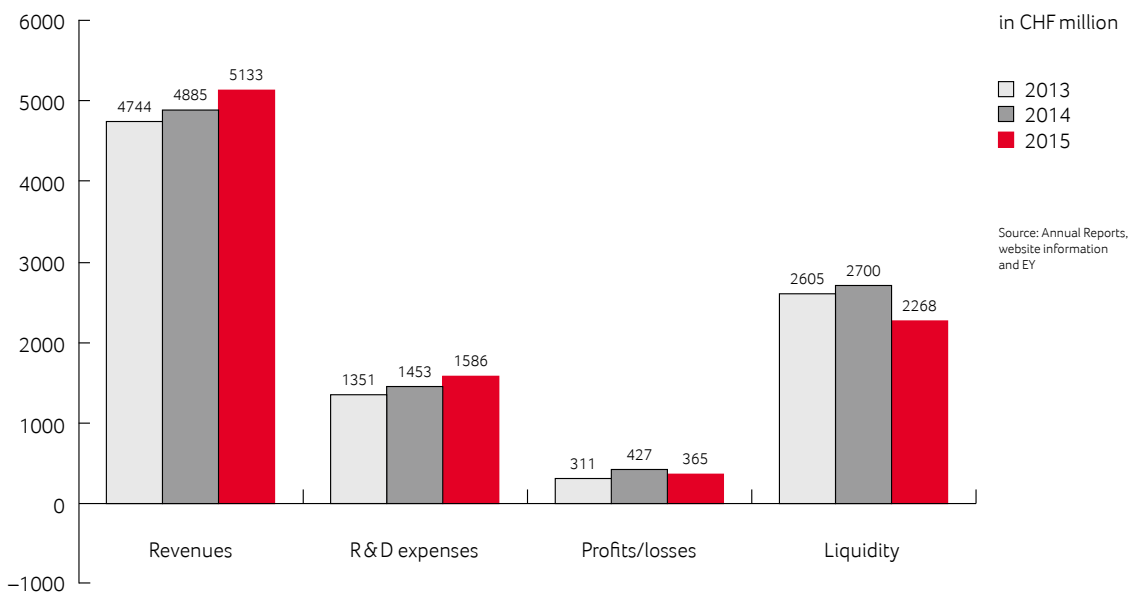
Notes

- The 2015 data in this table is based on information that was available up until March 2016 when this report was compiled. At this time, some of the companies had not yet disclosed their final financial figures for 2015. Therefore, some figures were carefully extrapolated on the basis of the latest interim data publicly available (e.g. Q3 2015).
- Selected financial figures for biotech activities of Lonza's business segment "Pharma & Biotech Market Segment", which has been established as part of the reorganization at Lonza, are included for 2015. For the previous periods presented, Lonza's "Bioscience" and "Biological Manufacturing" are included based on actual figures publicly available or careful estimates. Lonza's "Pharma & Biotech Market Segment" respectively "Bioscience and Biological Manufacturing business sectors" are presented due to Lonza's transformation into a life sciences company and its inclusion into the ICB Biotech Sector and the SXI LIFE SCIENCES® and SXI Bio+Medtech® indices at the SIX Swiss Exchange.

Capital investment in Swiss biotech companies

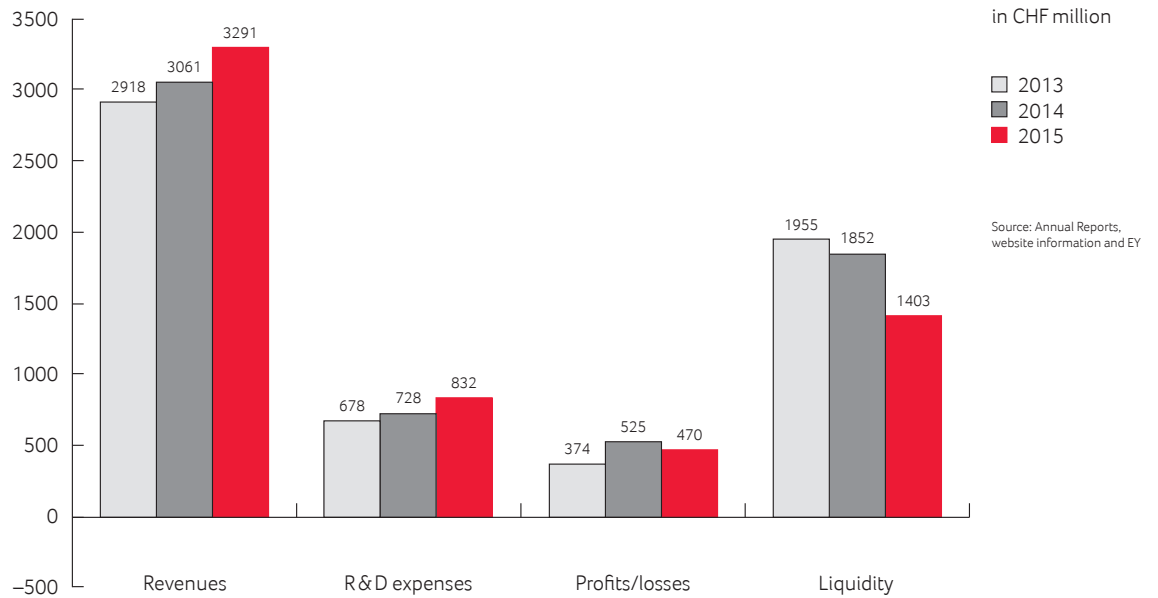


Total Swiss biotech companies

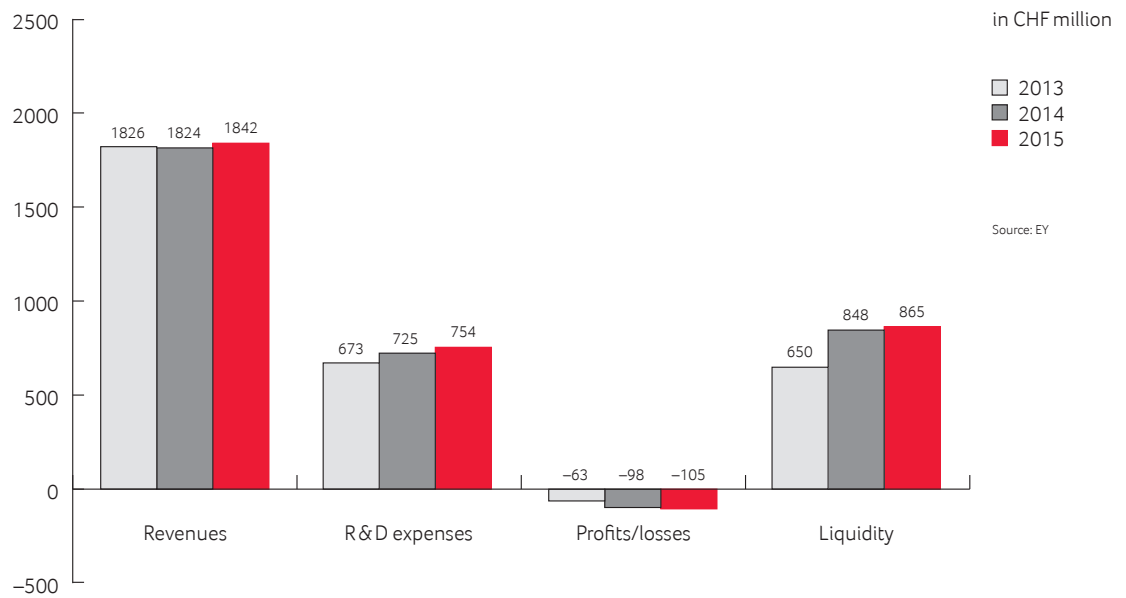


- As some privately held companies do not disclose financial figures, the figures above represent EY's best estimate.
- All figures are headquarter-counted and do not include data from pharma companies such as Novartis and Roche.

Publicly traded Swiss biotech companies



Privately held Swiss biotech companies





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Jan Lucht, scienceindustries, Zürich
Liv Minder, Switzerland Global Enterprise, Zürich
Heinz Müller, Swiss Federal Institute of Intellectual Property, Bern
Jürg Zürcher, Ernst & Young AG, Basel

Further partners

Daniel Gyax, biotechnet, Muttenz
Michael Stucky, Wyss Zürich

Concept, layout and design

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