



Swiss Biotech Report 2023

Effective solutions
for global challenges



“Effective solutions for global challenges”



“Despite challenging global conditions, the Swiss biotech industry was able to raise more than CHF 1.33 billion in 2022, with roughly CHF 0.78 billion collected by public companies and the remaining CHF 0.55 billion collected by private companies.”

Frederik Schmachtenberg
EY Global Health Sciences
& Wellness

“Through the turbulence of the past year, the Swiss life sciences index has held up well, outperforming its US benchmark with both an excess return and lower volatility. The relative strength of the Swiss capital market demonstrates its quality and stability, backed by a strong currency.”

Fabian Gerber
SIX Swiss Exchange

“Big pharma’s desire to complement its product portfolio by in-licensing and acquiring new products has been matched by a boost in Swiss biotech’s output of innovative drugs. Increasingly diverse modalities have spearheaded a broader range of therapeutic options.”

Michael Altorfer
Swiss Biotech Association

“Global sales generated by the biotechnology sector have roughly doubled over the last ten years to around USD 500 billion, driven by consumer demand for green chemicals, changing environmental policies, price per ton of CO₂ and dwindling natural raw materials.”

Hans-Peter Meyer Swiss
Academy of Engineering
Sciences (SATW)

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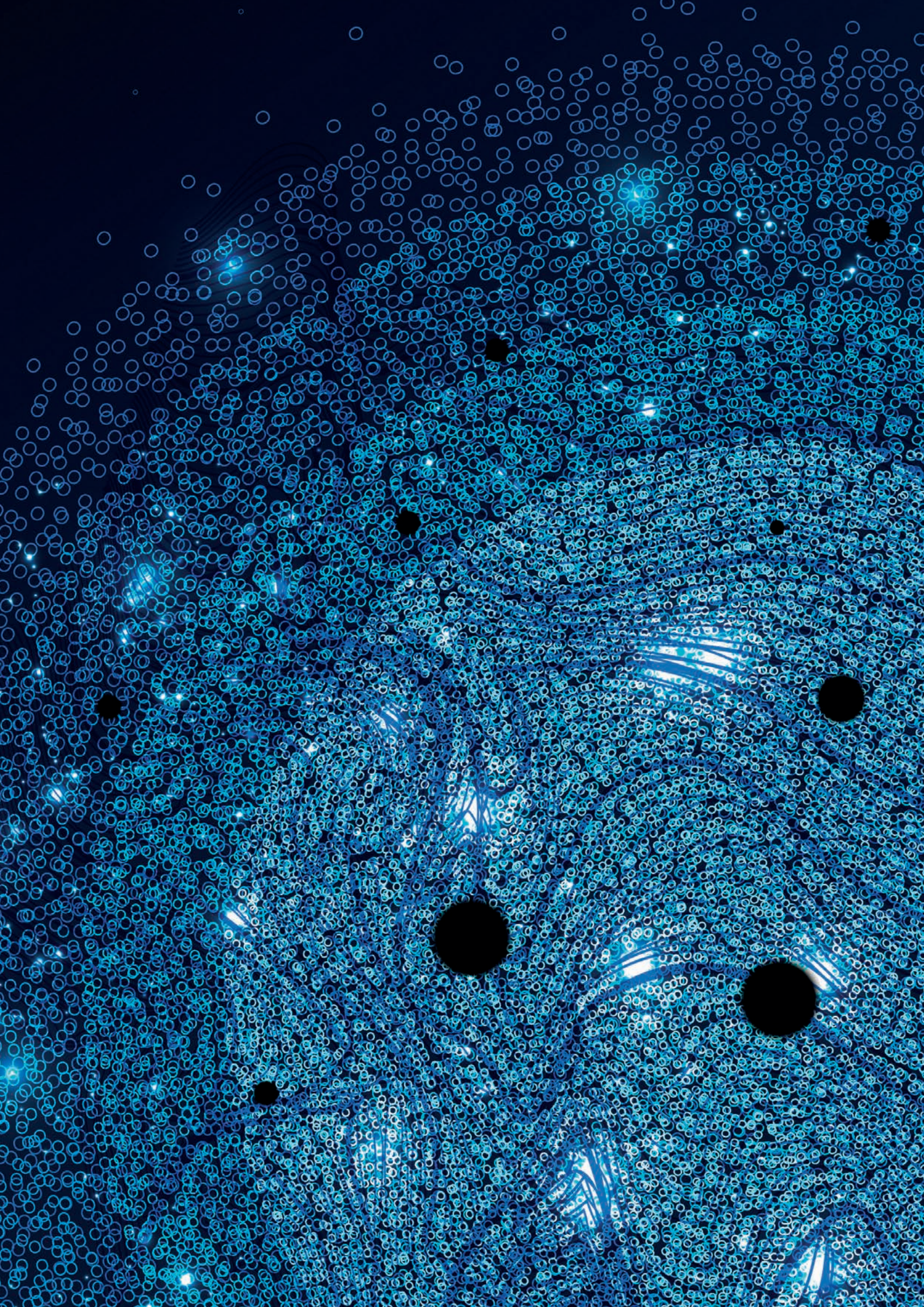
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Guest editorial



Bertrand Piccard
President and Founder of
Solar Impulse Foundation

How clean technologies can help to accomplish seemingly impossible goals

When the Breitling Orbiter 3 landed, after the first non-stop round-the-world balloon flight, just over 1% of fuel remained. It was clear that fuel was the limiting factor, and that the next round-the-world flight had to be in a solar plane, without fuel, without pollution, without CO₂ emissions. The objective of the Solar Impulse Foundation has always been to transport the message of renewable energy, not passengers.

Switzerland plays a major role in the clean technology sector and is helping to promote our message. Feasibility studies for our Solar Impulse aircraft were carried out at the Swiss Federal Institute of Technology, and a large number of Swiss SMEs participated in its construction. On reaching California after crossing the Pacific, Solar Impulse was welcomed by Larry Page and Sergey Brin, the two founders of Google – proof, if it were needed, of Switzerland’s credibility in terms of innovative technologies.

Reconciling environmental protection and profitability, and maximizing the benefits of innovation

Following the successful completion of my round-the-world flight, I launched a new challenge to find technical solutions capable of protecting the environment in an economically profitable way. 370 scientists and industrial experts have analyzed the solutions submitted so far, allowing us to award the “Solar Impulse Efficient Solution” label.

There is still a gap between science and politics. Scientists may recognize that change is possible, but many people are afraid of change. We must show that protecting the environment is an economic and political opportunity rather than a sacrifice, and ensure that innovation is welcomed not only by entrepreneurs but by environmentalists.

Hundreds of sustainable solutions already exist which are both credible and economically profitable. They come from the world of innovation, but often have more to do with common sense than deep tech. For example, recovering heat from data centers and factory chimneys, or producing building materials from non-recyclable urban waste, is as logical as it is ecological.

The hope of finding miracle solutions in the future is sometimes used as an excuse for inaction today. We invest billions in nuclear fusion instead of utilizing heat from ground sources. We continue to emit CO₂, hoping that technology will be able to reabsorb it later. We even imagine that we can artificially cool the atmosphere to compensate for global warming. Innovation can help to deliver better quality of life, but a catastrophe if it justifies wait-and-see paralysis.

How Switzerland can innovate and encourage others to become more entrepreneurial

Switzerland has the potential to lead the way by being one of the first countries to make key environmental policy decisions. We urgently need much more demanding norms and standards, which enforce energy and resource efficiency, and promote the circular economy and respect for biodiversity. We must implement solutions that already exist and deliver ever more efficient technologies.

I believe that Switzerland has what it takes to succeed. Our researchers and companies are developing and exporting high value-added clean technologies worldwide, offering practical solutions to the environmental challenges facing the world. This is a great opportunity, not only for the future of the planet, but also for our trade balance and the profitability of our companies. But to achieve this goal, politicians must take responsibility for more rigorous environmental policies.

“The Solar Impulse Efficient Solution label is the first of its kind to certify the profitability of a system, product, material, or device that protects the environment. To date, we have labeled almost 1’500 such products.”

Editorial Swiss Biotech Report 2023



Michael Altorfer
CEO, Swiss Biotech
Association

“For more than a century, Switzerland has established and expanded its role as a leading life sciences research, development and manufacturing hub, helping to develop new therapeutic treatments and establish new modalities and platform technologies to address global medical needs.”

Switzerland’s role in developing effective solutions to global challenges is not limited to the field of life sciences, as Bertrand Piccard, founder of the Solar Impulse Foundation, exemplifies in his guest editorial to this year’s Swiss Biotech Report. But Switzerland’s contribution to global innovation has certainly been particularly strong in the field of healthcare.

Given the small number of patients and size of the local market, Swiss biotech and pharmaceutical companies have traditionally focused on innovation that could benefit patients worldwide. At the same time, the Swiss R&D hub has built international networks and collaborates closely with international partners around the world. Multinational institutions such as the World Health Organization have chosen Switzerland for their headquarters.

In 2023, the Swiss Biotech Association celebrates its 25th anniversary. This provides an opportunity to look back and reflect on the highlights of the healthcare innovations that biotech and pharmaceutical companies have developed, often in collaboration with academic research partners. Whether it’s effective treatments for acute viral and bacterial infections, powerful tools for anesthesia and pain management, new ways to address chronic diseases such as diabetes or high blood pressure, and the novel approaches in oncology that harness the immune system to fight cancer cells, patients around the world are benefiting from these breakthrough discoveries.

While we used to rely on synthetic small molecules to develop new drugs, versatile antibodies now offer new therapies (see Swiss National Science Foundation article, p16), and the latest developments in cell-based treatments and gene therapies have brought us closer to the possibility of not only treating the symptoms of a disease, but potentially providing a cure. We are also moving closer to precision medicine that is highly targeted and effective for specific patient populations.

Since Swiss researchers almost always work in international collaborations, few of these advances were developed by Swiss research groups alone. As the analysis by the Swiss Institute of Intellectual Property shows, Swiss researchers contribute disproportionately to the global biotech patent pool, with the vast majority of contributions coming in the context of international patents generated through cross-border collaborations (see article, p18). Thus, many of the highlights shown on the opposite page have been the result of collaborations between Swiss academic research groups, biotech SMEs and large pharma companies as well as their international partners. And ultimately, these innovations benefit patients worldwide.

This report also highlights that Swiss biotech companies continue to attract significant capital investments which enabled them to invest CHF > 2.7 billion in their R&D projects in the past year. Thus, we are confident that Switzerland will continue to be an important partner in healthcare innovation going forward.

On behalf of all the partners of the Swiss Biotech Report 2023, I encourage you to dive into the articles in this year’s report that each address the main topic of “Effective solutions for global challenges” from a different perspective. They highlight success stories, the power of international collaboration, a spirit of sharing results and experience, and the benefits Switzerland can offer as an international hub for R&D with a rich source of talent and all stakeholders required to advance R&D projects effectively (see interview with Amit Munshi, p42). This includes global CDMOs (e.g. Bachem, SIX Swiss Exchange article, p38), an active regulator that engages in international alliances (see Swissmedic article, p40), but also many partners that explore the power of biotechnology innovation beyond healthcare (see SATW article, p26, and scienceindustries article, p30).



Celebrating 25 years of the Swiss Biotech Association

Some major achievements of Swiss biotech innovation...

1998

Monoclonal antibodies

Trastuzumab Herceptin,
Roche, breast cancer

1998

Interferon beta-1a Rebif,
Serono, multiple sclerosis

2001

Bosentan Tracleer,
Actelion, pulmonary arterial
hypertension (PAH)

2003

Kinase inhibitors

Imatinib Gleevec,
Novartis, cancer

2013

CRISPR-Cas9 gene editing

CRISPR Therapeutics using technology
to treat genetic diseases

2013

Humanized anti-CD20 monoclonal antibody

Obinutuzumab Gazyva,
Glycart/Roche, chronic lymphocytic
leukaemia

2017

CAR-T cell therapy

Tisagenlecleucel Kymriah,
Novartis, leukaemia

2023

DDM Genomics and Multimodal platform

SOPHiA
GENETICS hits milestone of One Million
Genomic Profiles analyzed by the
SOPHiA DDM™ platform

2021

Aducanumab Aduhelm,
Neuroimmune/Biogen,
Alzheimer's disease

2020

Ansuvimab-zykl Ebanga,
Humabs BioMed/Vir Biotechnology,
Zaire Ebolavirus infection

2019

Gene therapy

**Onasemnogene
abeparvovec-xioi** Zolgensma,
Novartis, paediatric spinal muscular
atrophy (SMA)

2019

Humanized single chain antibody anti-VEGF

Brolucizumab Beovu,
Esbatech/Novartis, wet-AMD

Most of these highlights were achieved in international collaboration and benefit patients around the world. They do not represent a comprehensive list but rather a selection that emphasizes the diversity of modalities that have been developed over time and the broad range of medical needs they help to address.

Swiss biotech 2022: Facts & figures



Frederik Schmachtenberg

EY | Partner, Global Health Sciences & Wellness Lead for Financial Accounting Advisory Services



Helena Rosa

EY | Senior Manager, Global Health Sciences & Wellness, Audit Services

In 2022, the global biotech sector, like many other sectors, was impacted by geopolitical challenges, which dried up or reduced some sources of funding. However, with the impact of the pandemic diminishing (thanks to the new mRNA vaccination capabilities) the “new world” also brought welcome relief to the healthcare sector around the globe.

Biotech IPOs suffered from these global developments with a significant drop in the number of companies going public. SPAC transactions were no longer “en vogue”, with only very few SPAC transactions in 2022 compared to 2021. Globally, the IPO class of 2022 counted only 22 IPOs (2021: 143), which generated approximately USD 1.5 billion in funds (2021: USD 19.3 billion).

17 US IPOs (2021: 99) were able to collect a total of USD 1.3 billion (2021: USD 15.7 billion).

In Europe, biotechs successfully completed 5 IPOs (2021: 44), raising USD 0.2 billion (2021: USD 3.6 billion).

Swiss biotech landscape

In 2022, the Swiss biotech industry saw new records in terms of revenues recognized (CHF 6.8 billion in 2022 compared to CHF 6.7 billion in 2021) as well as in R&D investments (CHF 2.7 billion in 2022 compared to CHF 2.6 billion in 2021). In line with this, the number of FTEs working in Swiss R&D biotech companies increased to more than 19'100 FTEs (year-on-year increase by 7.2%), which is also a new record high. Not surprisingly, and especially in view of the challenging environment for raising funds in 2022, these new records in terms of growth and R&D investments came at the price of companies needing to reduce some of their liquidity reserves (on average by 21% in 2022).

Swiss biotech financing

Despite the above-mentioned challenges, the Swiss biotech industry was able to raise more than CHF 1.3 billion in 2022, with roughly CHF 0.78 billion collected by public companies and the remaining CHF 0.55 billion collected by private companies. CDR Life with CHF 72 million raised, and ImmunOS Therapeutics with CHF 71 million raised, were the two largest private company financing transactions in 2022.

In addition, a number of successful European IPOs were announced in 2022, of which two IPOs involved either Swiss companies or used the SIX Swiss Exchange as a trading/IPO platform.

MoonLake Immunotherapeutics completed the NASDAQ SPAC transaction, which it had initiated in late 2021, successfully in early April 2022 and collected gross IPO proceeds of CHF 140 million. Kinarus went public at SIX Swiss Exchange through a reverse merger with Perfect Holding in early June 2022. VectivBio was able to gain additional funds from investors during two follow-on transactions (totaling approximately CHF 177 million). Additionally, ADC Therapeutics successfully placed a convertible bond of CHF 166 million.

PUBLIC COMPANIES	CHF MILLION
VectivBio Holding	177
ADC Therapeutics	166
MoonLake Immunotherapeutics	140
Basilea	75
BioCartis	65
Total	623

Table 1: Major 2022 public financing transactions

PRIVATE COMPANIES	CHF MILLION
CDR-Life	72
ImmunOS Therapeutics	71
Cimeio Therapeutics	46
Opna Bio	36
Anokion	35
Total	260

Table 2: Major 2022 private financing transactions

Last but not least, in late 2022, Oculis also started its preparation for an upcoming SPAC transaction on NASDAQ. This transaction was successfully completed in early March 2023.

Since equity and debt markets were more difficult to access in 2022, it is remarkable how agile Swiss biotechs were in terms of finding alternative ways of financing. For example, there have been several large licensing and collaboration transactions (e.g., Molecular Partners, VectivBio, Numab Therapeutics, Novaremed, ObsEva), but also sale and leaseback transactions (e.g., Idorsia), both of which provided significant non-dilutive financing to the sector in 2022.

M&A and collaborations

Swiss companies were involved in several significant M&A transactions:

- Creoptix joined the Malvern Panalytical team in England
- NEC acquired Vaximm's neoantigen vaccine development assets
- Ginkgo Bioworks acquired FGen and its ultra-high-throughput screening platform
- Relief signed a definitive agreement to acquire a novel dosage form of an already approved prescription drug for the treatment of PKU
- Basilea announced the sale of its preclinical oncology program to Nodus Oncology for up to CHF 242 million
- Versantis was acquired by GENFIT, combining forces to continue the development of its revolutionary therapeutics for patients with liver diseases
- Healiva acquired critical cell therapy manufacturing assets from B. Braun

Entering into new collaboration and licensing agreements was also important for several Swiss biotech companies, since some of those arrangements provided significant short-term attractive financial components. As mentioned above, these provided alternative means of funding (alternatives to equity or debt financing, which was more difficult to access in 2022). A selection of such collaboration and licensing transactions is shown below:

- Aurealis to receive up to USD 139 million in collaboration agreement with Xbiome
- VectivBio announced Japanese license deal providing up to USD 200 million for rare disease pipeline development

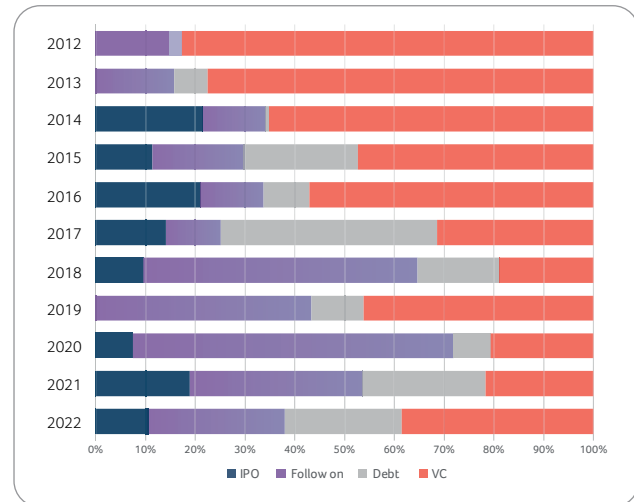


Figure 1: Biotech financing categories in Switzerland 2012 to 2022

- Neurimmune enters global collaboration and license agreement with AstraZeneca to develop and commercialize NIO06 for treating transthyretin amyloid cardiomyopathy
- Numab signed a CHF 258 million deal with Ono Pharmaceutical
- MoonLake Immunotherapeutics and Stalicia geared up for Phase II clinical studies
- Perseo pharma and Nestlé Health Sciences agreed a global partnership
- Novaremed received USD 130 million in exclusive option and license agreement with NeuroFront
- MedPharm started a collaboration with Mosanna to develop a new drug to tackle metabolic obstructive sleep apnea
- CRISPR Therapeutics and Vertex announced global regulatory submissions for exa-cel for sickle cell disease and beta thalassemia in 2022
- Tigen exercised an option to further develop and commercialize a neo-antigen T cell product from the Ludwig Institute, CHUV and UNIL
- Memo Therapeutics announced the signing of a research and development collaboration agreement with Ono Pharmaceutical
- ObsEva announced the sale of its Ebopirant license agreement to XOMA for up to USD 113 million
- SOTIO exercised an option for a novel antibody-drug conjugate from LegoChem Biosciences

Product developments

In a positive vein, 2022 saw a similarly high number of regulatory approvals compared to previous years. More specifically, the EMA approved 89 new drugs in 2022 (2021: 91 new drugs) and the FDA approved 37 new drugs (2021: 50 new drugs).

Among the new FDA approvals, there was one drug that warrants being called out separately: Idorsia gained approval for QUVIVIQ™ (daridorexant) for adults living with insomnia. This is their first drug to gain approval since their creation following the Actelion / J&J transaction in early 2017.

The level of approvals granted by Swissmedic was slightly above the previous year with a total of 47 new drugs (2021: 45).

Awards

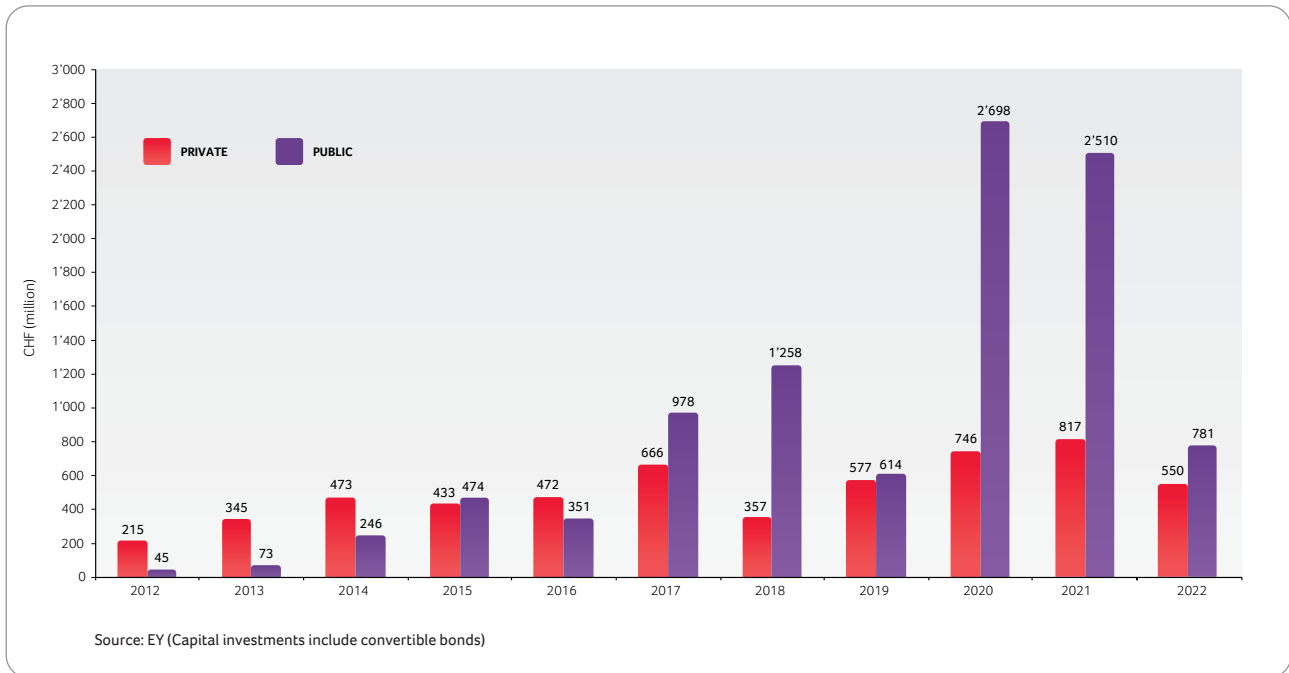
Several Swiss biotech companies received various prestigious awards throughout 2022. Noteworthy are three female laureates, which is a great testament to the success of female leaders and entrepreneurs in the Swiss biotech sector. These winners were:

- Aenne Burda award: Andrea Pfeiffer (AC Immune)
- Innovator of the year: Stefanie Flückiger-Mangual (Tolremo)
- Prix Suisse award: Martine Clozel (Idorsia)

Private & public Swiss biotech regional financing 2020-2022

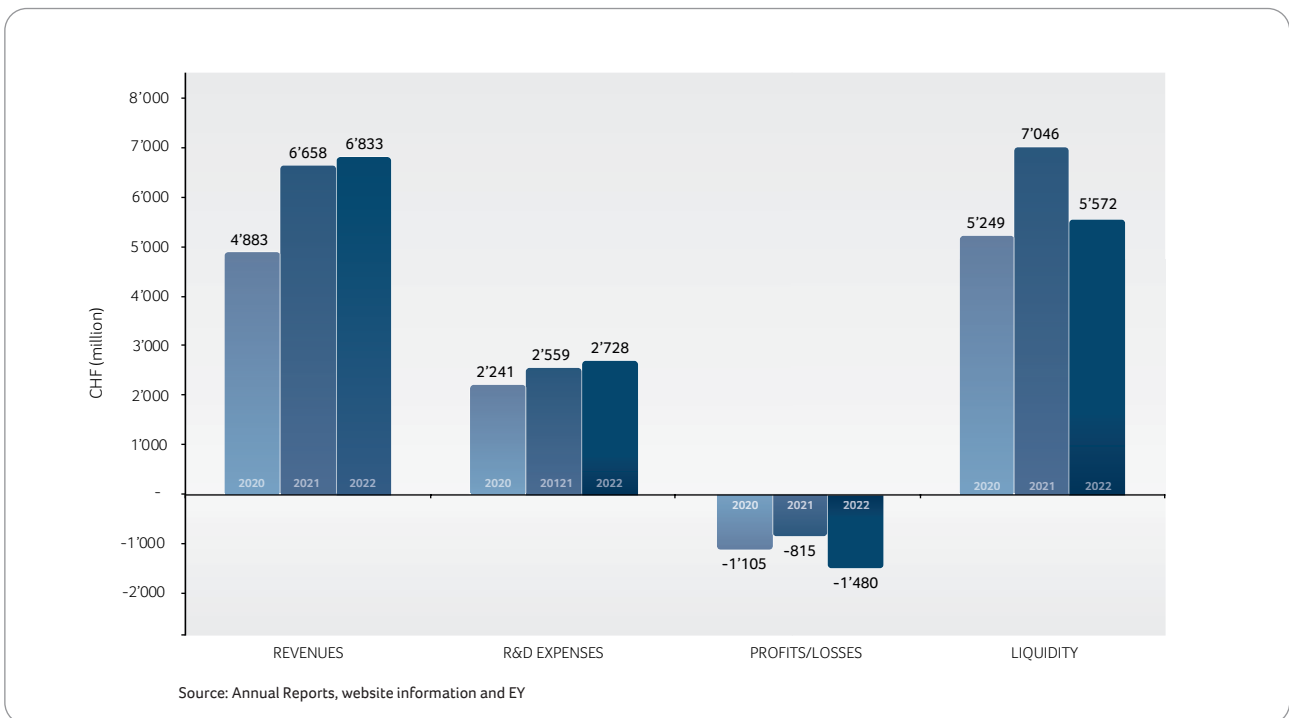


Capital investments in Swiss biotech companies 2012-2022



Revenues, R&D expenses, profit/loss, liquidity 2020-2022

Total Swiss Biotech Companies

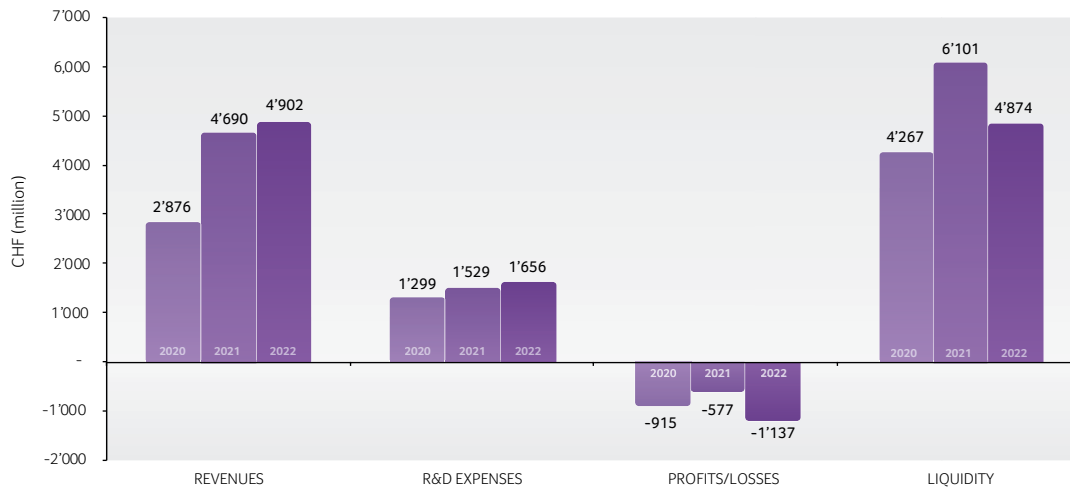


Note: The 2022 data in above tables is based on information that was available up until March 31, 2023. At this time, some of the companies had not yet disclosed their financial figures for 2022. Therefore some figures were carefully extrapolated on the basis of the latest interim data publicly available (i.e. Q3 or Q4 2022).

The year in charts

Revenues, R&D expenses, profit/loss, liquidity 2020-2022

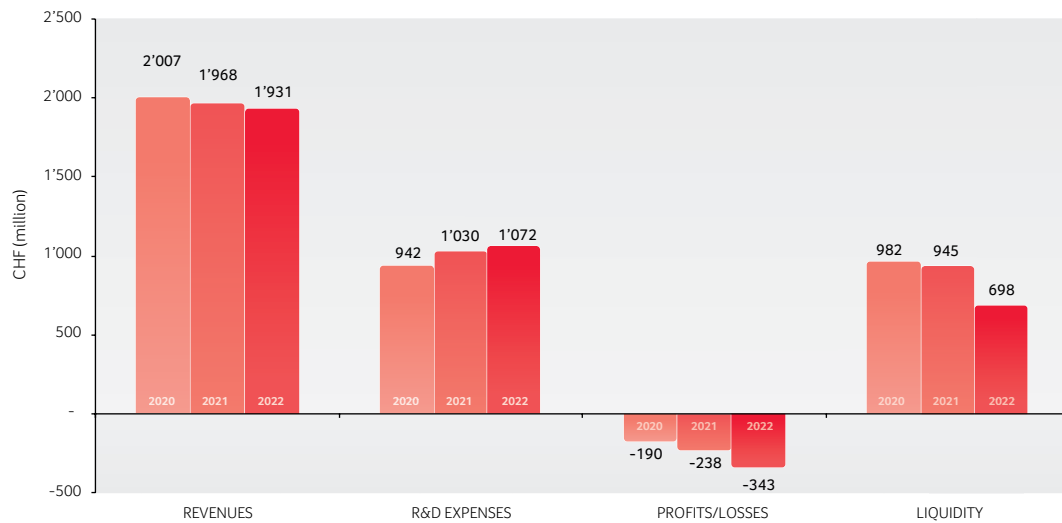
Public Swiss Biotech Companies



Source: Annual Reports, website information and EY
 Note: 2020 information restated based on public company restatement information

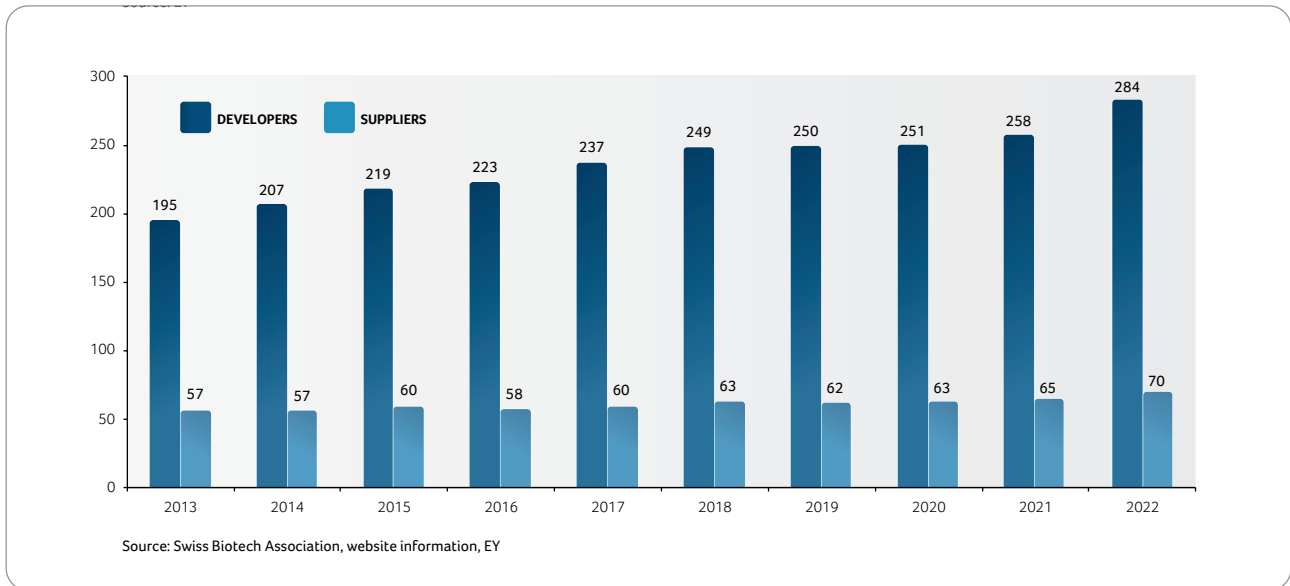
Revenues, R&D expenses, profit/loss, liquidity 2020-2022

Private Swiss Biotech Companies

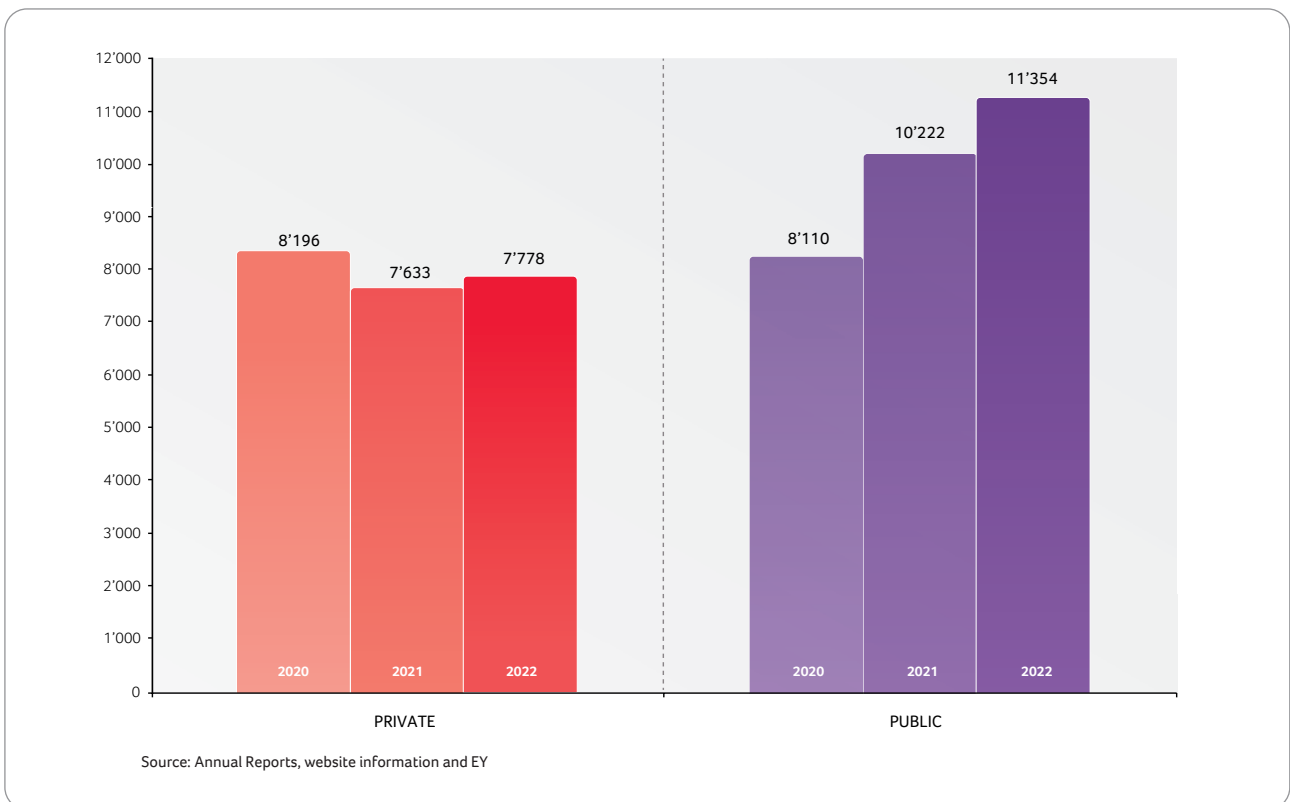


Source: Swiss Biotech Association, EY (incl. estimates and extrapolations based on prior year figures)

Number of biotech companies in Switzerland 2013-2022



Number of employees in Swiss R&D biotech companies 2020-2022



The life sciences sector as a solid foundation of the Swiss economy



Jan Lucht

scienceindustries | Head Biotechnology

The life sciences sector (pharmaceuticals, vitamins and diagnostics) represents the largest export industry of Switzerland. In 2022, it accounted for 39% of total Swiss exports and added a record CHF 109.6 billion (+0.6% over 2021) to the foreign export trade.

The sector is remarkably dynamic: while exports from all other sectors taken together grew by 61% in the twenty years from 2002 to 2022, the life sciences sector's contribution expanded by 255% over the same period (see Figure 1). In 2013, life sciences industry exports surpassed that of the longtime leading metals and machinery sector and have further extended their lead since then.

Despite the difficult economic environment (rising inflation, high raw material, energy and transport costs, increasing regulation), total Swiss exports grew by 7.2% in 2022 to an all-time high of CHF 278.6 billion. Some sectors, such as metals, machinery, chemical products, and watches, contributed especially strongly to the 2022 result. But of all major sectors, only the life sciences and chemical industry managed a sustained export growth over each of the last three years, including 2020 when the COVID-19 crisis resulted in a historic export slump for almost all industries. Both its volume and

the remarkable stability even in difficult times makes the life sciences sector a solid foundation for the Swiss economy and foreign trade.

The immunologicals subsegment that includes many biotech products like monoclonal antibody therapeutics and vaccines contributed a significant proportion to the Swiss export growth in 2022, with an export value of CHF 47.8 billion (+3.9%). A CHF 3.2 billion reduction of human vaccine exports against 2021, in part due to reduced demand after the peak of the COVID-19 pandemic, was more than compensated for by strong growth in other product categories. The importance of the immunologicals subsegment has been steadily increasing over the years, and in 2022 was 11.6 times higher than twenty years ago. The broad product portfolio of the innovative Swiss life sciences industry therefore contributes to its role as a stable pillar of the strong Swiss export economy.

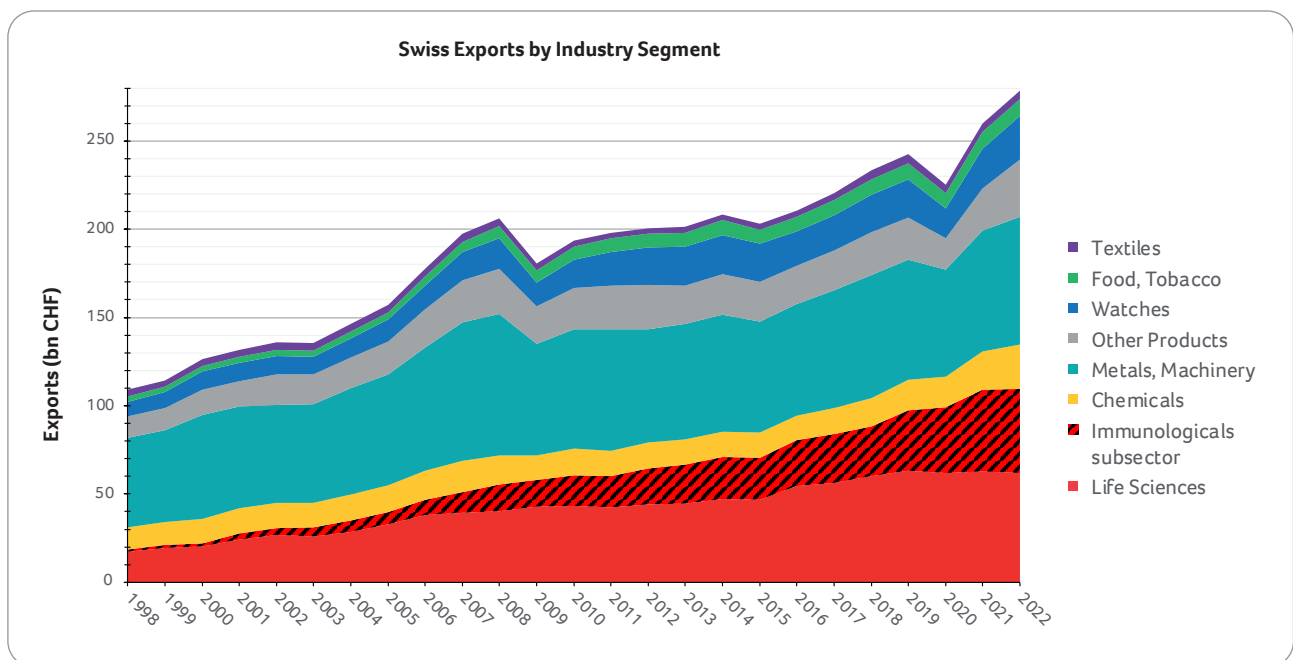


Figure 1: Annual Swiss exports according to industry sector demonstrate the increasing importance of the life sciences industries (pharmaceuticals, vitamins and diagnostics). This sector alone contributed 39% to the total Swiss exports in 2022 (Data: scienceindustries/Federal Customs Administration 2023, Swiss IMPEX database).



Why basic research is a rich – and often unexpected – source of innovation



Florian Fisch

Swiss National Science Foundation | Science editor

Virtually all of today's innovation stands on the shoulders of great scientists. Some researchers have explored an apparently inconsequential detail of a bizarre phenomenon that nobody knew about – until everybody knew about it. They carried out basic, curiosity-driven research, pushing their luck and hoping for a serendipitous discovery.

The sequence of discovery from basic research to innovation is widely accepted. Nevertheless, it is very difficult to pinpoint the basic research that was responsible for a certain innovation as the knowledge is very distributed. This is why the Swiss National Science Foundation (SNSF) has compiled a list of stories that exemplify the process.

Study the immune system, get monoclonal antibodies

One such very important discovery was how to produce monoclonal antibodies – in useful quantities. This was published in a paper with the very descriptive title “Continuous cultures of fused cells secreting antibody of predefined specificity” in 1975.

One of the researchers was Georges Köhler, who did part of his PhD at the Basel Institute for Immunology before becoming a postdoc in the lab of César Milstein at the University of Cambridge. Their joint discovery was that by fusing cancer cells, that can be cultivated indefinitely with short lived white blood

cells that have the ability to produce one specific antibody, they could get both advantages: an immortal cell culture that also produces an antibody of choice.

After two years and the publication of this now famous Nature paper, he came back to the Basel Institute for Immunology, financed by the pharma company F. Hoffmann-La Roche. The discovery of how to produce monoclonal antibodies was so important that Georges Köhler and César Milstein were awarded the Nobel Prize in Physiology only nine years later.

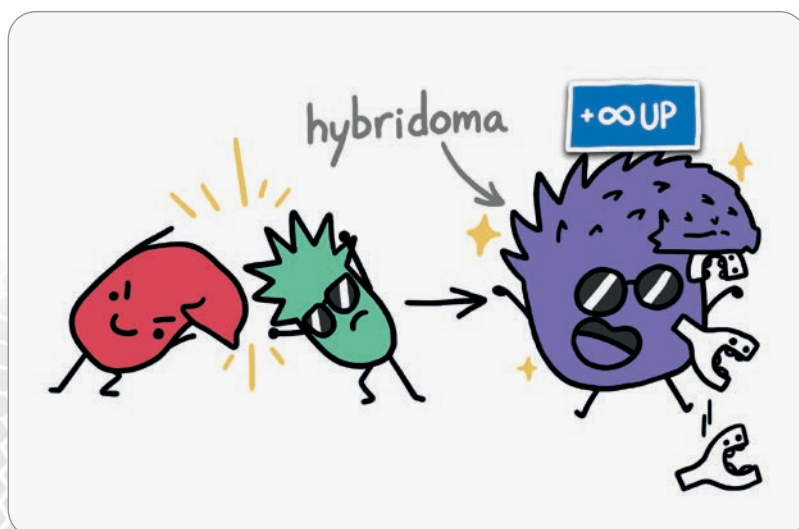


Figure 1: Fusing an antibody producing cell and a cancer cell leads to hybridoma combining both the immortality and the antibody producing capability.

Image:
Neptune Studios llc/Youtube
Screenshot
<https://youtu.be/Ap9ylkWZSlg>

The Swiss army knives of biomedicine

Köhler and Milstein's prediction in the last sentence of their article was one of the biggest understatements ever made: "Such cultures could be valuable for medical and industrial use." Monoclonal antibodies have since become the Swiss army knives of biological research and medical applications.

The key ability of the antibodies is to bind very specifically to pathogens like Coronaviruses, and their specificity can be used to precisely activate or block certain biological mechanisms. In effect, their binding force can be used to fish out the right molecules or cells from a soup of ingredients. They are also used to mark exactly the products of interest on tissues or in tests. Monoclonal antibodies can be injected into patients to combat diseases like cancers or infections that otherwise overwhelm the immune system.

The structure of the antibodies has since been dissected in the highest detail. It was found that nature has different ways of using the same building blocks and combining them. In humans there are five different types of antibodies. Highly differing variants have been found in sharks and llamas.

This flexibility has allowed biotech companies to find new, innovative ways of combining subparts of the antibodies. They are cut, linked, humanized and produced in many different ways. The smallest fragments coming from camelid antibodies are

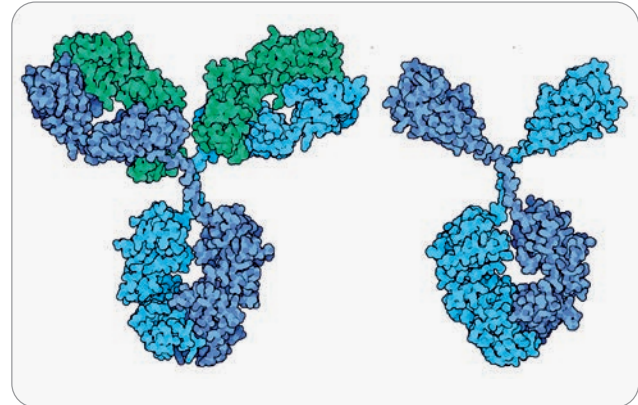


Figure 2: Two discoveries. Left: typical antibody as found in humans with 12 subdomains. Right: camel antibody consisting of only half of those domains. The two domains of the camel antibody at the top are very useful as they can be used on their own, called nanobodies. Picture: RCSB Protein Data Bank

called nanobodies. Technological advances now allow for rapid selection of synthetic nanobodies. There even exist completely synthetic scaffolds which mimic the functions of antibodies.

The number of possible applications has exploded. Even the naming convention of drugs based on antibodies had to be adapted as the universe of active agents grew too large. The following examples are of successful new applications developed by Swiss companies based on the discovery of monoclonal antibodies by basic researchers.

Lecanemab: against Alzheimer's

The latest success of antibodies is slowing down of the progression of Alzheimer's disease. The antibody was developed together with Biogen, the company that was founded in Geneva in 1978. The new drug targets precursors of amyloid beta fibrils that are a suspected cause of the disease. A clinical study published in November 2022 showed that cognitive decline was reduced compared to a placebo in nearly 1'800 patients. Whether the drug will be authorized and whether the study can be replicated remains to be seen.

Humabs BioMed: survivors' secret against infectious diseases

The spin-off from the Institute of Biomedical Research in Bellinzona is developing antibodies against infectious diseases like COVID-19, Hepatitis B and D, Influenza and others. The strategy: isolate the right antibody-producing cells from survivors of the disease. Their antibodies have proved to be effective. Humabs was acquired in 2017 by the San Francisco based Vir Biotechnology.

University of Zurich: new antibiotics

Bridge is a joint program by the SNSF and Innosuisse to enable researchers to develop their idea into a marketable product. Markus Seeger and Sebastian Hiller from the University of Zurich are currently working on specific targets on the surface of bacteria that are resistant to antibiotics. Small nanobodies from alpacas or synthetically produced ones are currently tested. Still far from the market but desperately needed.

Licaminlimab: against eye inflammation

The EPFL spin-off, Oculis, produces therapies against eye diseases. One of its agents is an antibody fragment aiming at an inflammation signalling molecule. It is currently in Phase II clinical trial and could be an alternative to steroids in treating a particular infection of the eye called uveitis. Because of the small size of the humanized antibody fragment, it can easily be applied to the eye via drops and still penetrate the tissue to reach the necessary site.

Numab: combining different binding sites

The Wädenswil-based start-up, Numab, takes only a small part of the antibodies that sticks to the target – the variable part – and joins up to six different types of it. This allows different mechanisms of action to be combined in one active agent. The intention is to use their constructs to treat cancer, and (in partnership with another company) they have one agent in Phase I clinical trials.

These examples offer a glimpse of what a single discovery can produce. There is CRISPR-Cas9 DNA-cutting machinery, interferon signalling pathways, mRNA technology and much more. Today's basic research will spawn many more innovations in the years to come, and Swiss universities will continue to make an important contribution to solving global problems.

Swiss biotech inventions: Global solutions originating from international collaboration



Christian Moser
Swiss Federal Institute of
Intellectual Property | Patent
Expert



David Rees
Swiss Federal Institute of
Intellectual Property | Patent
Expert

Inventors who are resident in Switzerland contribute disproportionately to the global biotech patent portfolio, in terms of both quantity and quality. The claim that Swiss biotech inventions provide global solutions is justified by their high impact, combining technological relevance with a broad coverage of global markets. Three out of four biotech patent applications listing Swiss inventors are international inventions. This exceptionally high rate, which applies equally to private companies and to public research institutions, illustrates the strong international collaboration network of Swiss-based inventors.

Three quarters of biotech patents of Swiss origin are in fact international inventions

Around 75% of biotech patents with Swiss-based inventors list co-inventors from other countries. Only 25% are pure domestic inventions, exclusively listing inventors who are resident in Switzerland. Such a high proportion of international inventions is exceptional in comparison to other countries.

Figure 1 shows that private companies own around 80% of the Swiss-invented biotech patents and that the high proportion of international inventions has remained essentially constant over the past two decades, irrespective of the owner type, i.e. private companies or public research institutions.

Figure 2 shows a comparison of the average Competitive Impact™ (CI) of domestic and international inventions of Swiss origin. International inventions are more than twice as strong, irrespective of the owner type.

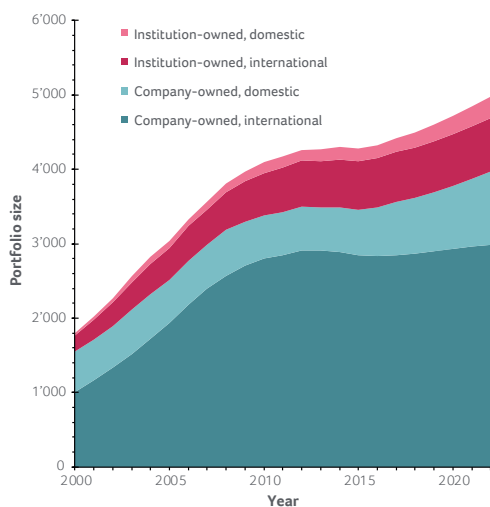


Figure 1: Portfolio size of Swiss origin biotech patents by ownership type (2000 to 2022)

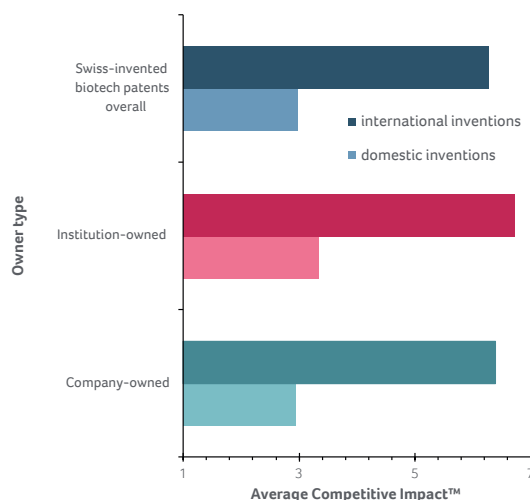


Figure 2: Average Competitive Impact™ of Swiss origin biotech patents by ownership type (data for the reporting date December 31, 2022)

Note: 'International' inventions are defined as those with at least one Swiss based inventor and at least one non-Switzerland based inventor. 'Domestic' inventions are those with Switzerland-domiciled inventors only.

Co-inventor countries of Swiss biotech patents

Figure 3 shows the contributions of inventors from other countries to the 4'767 currently active biotech patents with Swiss inventors, also represented in Figure 4 by the red dot labelled CH.

Around 30% of Swiss biotech patents list co-inventors from either Germany or the US, and 16% list co-inventors from France. The Competitive Impact™ varies significantly for different co-inventor countries, but it is consistently higher than the CI of 3 for Swiss domestic inventions.

Among the top 20 co-inventor countries, the highest average CIs are found for patents with co-inventors from China, Costa

Rica, South Korea, and Poland. However, single patents with exceptionally high CIs and multiple countries of origin appear multiple times in this graph, thereby increasing the average CIs of all countries included. In smaller sets, this effect is particularly strong.

For example, the set for co-inventors from Poland comprises 31 patent families with an average CI of 24. This set includes a CRISPR/Cas patent family featuring nine countries of origin and an impressive CI of 500. This patent alone accounts for an average CI of 17 within the Poland set. In addition, the same patent is included in its eight other countries of origin with similar effect.

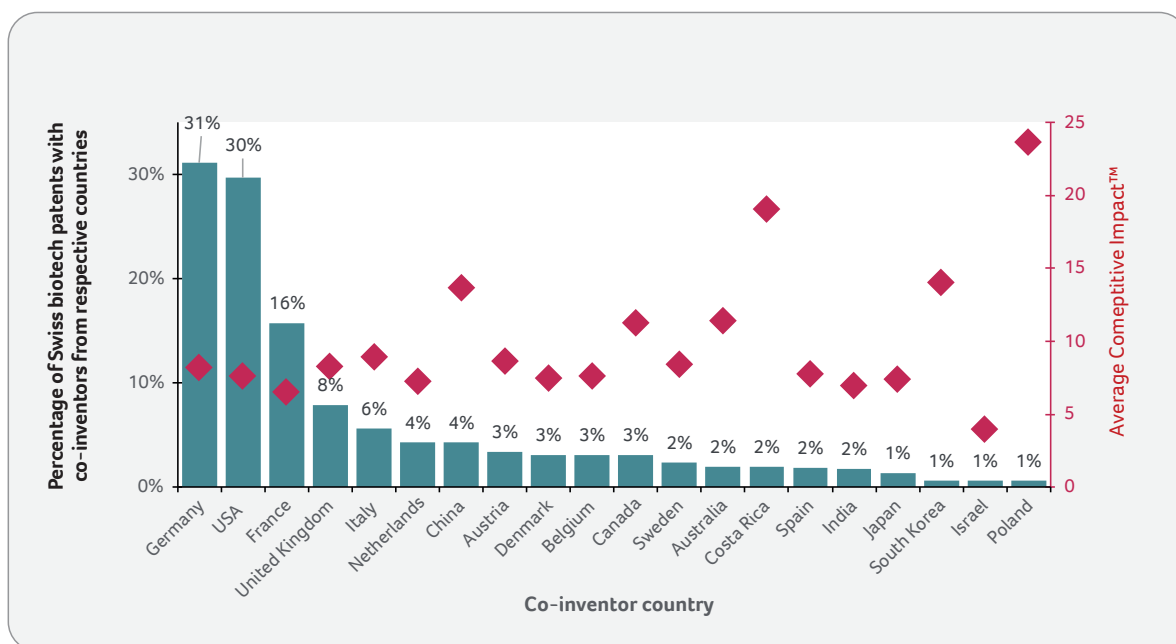


Figure 3: Overview of co-inventor countries listed in Swiss biotech patents and their average Competitive Impact™ (data for the reporting date December 31, 2022)

Data source and methodology

Inventions resulting from international collaboration are directly identifiable in patent documents, because the inventors and their country of residence are part of the bibliographic data.

The data shown in this article were generated using the patent analysis platform PatentSight (LexisNexis) with reporting date December 31, 2022. The Competitive Impact™ is an indicator of the individual strength of a given patent family, derived from the citations received (Technology Relevance™) and the market size it protects (Market Coverage™).

Swiss biotech inventions: Global solutions originating from international collaboration

CONTINUED

Top biotech inventor countries: international collaboration correlates with quality

Figure 4 shows the top 20 countries of origin of biotech patents by quantity, i.e. by portfolio size. Patents involving Swiss-based inventors feature both the highest proportion of international inventions and the highest Competitive Impact™. Most other European countries cluster in the same upper right quadrant.

The large patent portfolios of China, USA, Japan and South Korea comprise less than 30% of international inventions and have relatively low Competitive Impact™.

Surprisingly, India appears in the top right quadrant, next to Switzerland. However, the India data should perhaps be interpreted with caution, because domestic inventions from India may not be fully recorded in the database.

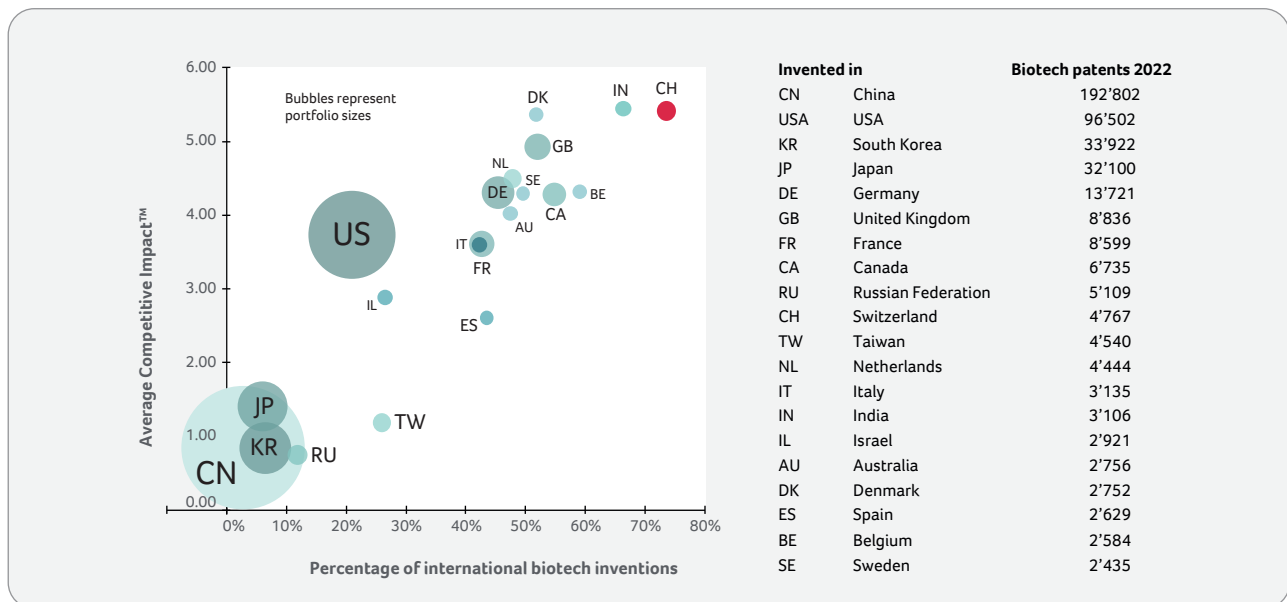


Figure 4: Percentage of international biotech inventions and Competitive Impact™ for top 20 inventor countries (data for the reporting date December 31, 2022)

Take home messages

- Swiss inventors contribute disproportionately to the global biotech portfolio, with regard to both quantity and quality.
- A large proportion of the Swiss biotech inventions are the result of international collaboration.
- All these aspects have remained roughly constant over the past two decades, despite substantial dynamics in the global and the Swiss biotech portfolio.
- Within the Swiss-invented portfolio, the quality parameters, as well as the proportion of international inventions are strikingly similar for both owner types, private companies and public research institutions.

A strong track record may well facilitate access to collaborations with renowned partners worldwide and increase the chances for further achievements. This self-amplifying cycle could be one of the reasons for Switzerland's longstanding leading position in the biotech sector. The smaller a country and its domestic economic base is, the higher the pressure is to seek international collaboration in order to succeed.



Biotechnet Switzerland actively supports the search for effective solutions to global challenges



Laura Suter-Dick

Biotechnet Switzerland | President

School of Life Sciences, FHNW | Professor of Cell Biology and in vitro Toxicology

The world as a whole – and specifically the healthcare system – faces tough challenges, including the aftermath of the recent pandemic and rising healthcare costs. Collaborations between academic institutions, research organizations, and industry to propose, promote and implement innovations will help the biotechnology sector deliver solutions to existing and emerging issues. As a network of research organizations, Biotechnet Switzerland helps bring together key actors to address specific questions.

Gender health

Sex and gender differences can have a strong impact on appropriate diagnosis and treatment, as diseases often present differently between the sexes. Established diagnostic tools and therapeutic approaches are mainly designed for males, with female pathophysiologies largely understudied in the past.

Members of Biotechnet Switzerland facilitate discussion, research and implementation of tools promoting women's health. The topic of sex and gender health was prominently addressed at the 2022 Swiss Symposium in Point-of-Care Diagnostics organized by the Biotechnet thematic platform In Vitro Diagnostics, co-led by Prof. Marc Emil Pfeifer (HES-SO) and Dr. Samantha Paoletti (CSEM).

- Dr. Antonella Santucci Chadha focused on sex and gender differences in medicine and brain diseases in her keynote speech. Her fascinating talk increased awareness and prompted discussions around the need to include sex and gender analysis in clinical development and digital health. Her address was very positively perceived by students, young scientists and seasoned researchers.



Dr. Santucci Chadha leads pro bono the Women's Brain Project, which brings together experts from various disciplines who work with patients and caregivers towards the implementation of sex and gender within precision medicine. She is also the Chief Medical Officer at Altoida Inc. and the Vice-President of Euresearch.
<https://www.womensbrainproject.com/>

Three startup companies presented projects that address women's health, developed in collaboration with Biotechnet member organizations:

- Ava presented their fertility tracking bracelet. It provides data-driven support that helps couples get pregnant faster, which can reduce the need for costly or invasive fertility treatments. The technology was developed in collaboration with CSEM.
- Scailyte presented their first-in-kind molecular diagnostics for endometriosis, based on biomarker discovery from single-cell RNA sequencing. The average diagnostic journey for endometriosis is ten years and includes countless medical visits and invasive interventions. Developed with the University of Bern's Insel Spital, Scailyte's test provides results within a few weeks to help reduce the burden on patients, the healthcare system, and society.
- MOMM Diagnostics put forward tools to detect pre-eclampsia, a pregnancy disorder that can have devastating effects on the health of the mother and the unborn baby. Developed in collaboration with CSEM and FHNW, the test delivers information on the disease risk during pregnancy check-ups, helping doctors to optimize treatment, reduce the stress and anxiety for expectant mothers, save lives and reduce costs.

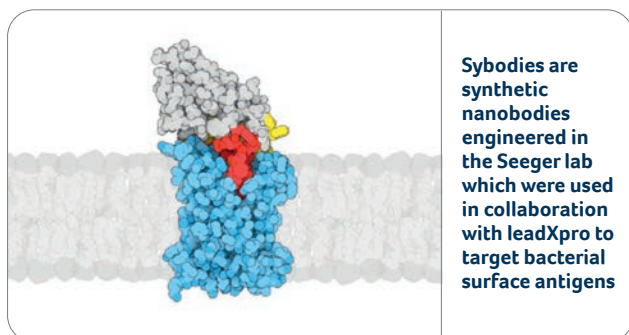
Antibiotic resistance

Antimicrobial resistance (AMR) has been called the silent pandemic and is an urgent global public health threat. It has caused the death of at least 1.27 million people worldwide and was associated with nearly 5 million deaths in 2019 (US–Center of Disease Control, 2022). It also has a major impact on veterinary medicine and agriculture. Causes of resistance are manifold, but the indiscriminate use of antibiotics, together with the inherent ability of microorganisms to develop resistance through mutations, is leading to an increased incidence of infections that either cannot be addressed with conventional antibacterial therapies or do not respond to pharmacological treatment.

Biotechnet’s antibiotics thematic platform is led by Prof. Markus Seeger, (UZH) and fosters research cooperations between more than 20 participants from academia and industry. The platform’s members bring together their expertise to discover and develop novel antibiotics to treat multidrug resistant bacteria, as well as rapid diagnostics.

Projects include:

- Resistell and Prof. Gilbert Greub (Centre hospitalier universitaire vaudois - CHUV): Investigation of nanomotion-based technology for rapid antibiotic susceptibility testing.
- leadXpro and Prof. Markus Seeger (UZH): Sybodies for antibiotics drug discovery.
- BioVersys and Dr. Richard Kammerer (Paul Scherrer Institute - PSI): Development of early lead-like molecules targeting a bacterial transcriptional regulator to treat infections caused by the Gram-negative pathogen *Acinetobacter baumannii*.



In addition to scientific advances, public awareness and outreach activities are key to fight AMR. In the context of the World Antimicrobial Awareness Week (WAAW), Prof. Seeger explained the problem of AMR and the importance of taking appropriate countermeasures in a series of videos produced by Pfizer shared on social media.



Reduction of animal experimentation

Animal experimentation in the life sciences has been a major topic of discussion worldwide for at least 50 years. It is a complex issue and requires the support of scientists, industry and health authorities.

In 2013, animal testing for cosmetic ingredients was banned in the EU, prompting the development of in silico and alternative in vitro cell-based methods. In 2022, a historic landmark was the FDA modernization act which explicitly allows registration of new drugs based on pre-clinical data that does not necessarily include animal data. New in vitro methods to test efficacy and safety of compounds are thus needed, including complex human-based three-dimensional cell cultures, and organ-on-chip approaches, known as microphysiological systems (MPS).

The Biotechnet thematic platform Tissue Engineering for Drug Development and Substance Testing (TEDD), led by Dr. Markus Rimann (ZHAW), has been promoting in vitro alternative methods for more than 10 years.

- TEDD organizes regular events at research and company sites to enable interactions and foster collaborations between scientists. In 2022, TEDD arranged visits to Biotechnet members FHNW and ZHAW, as well as to TECAN and AGORA.
- The TEDD Annual Meeting 2022, held together with the BioInterfaces International Conference at the ETH, Zurich, boasted an excellent scientific program focusing on recent developments of MPS and the clinical translation of these systems.
- Similarly, Biotechnet sponsored the Workshop on Next Generation Organ-on-Chips & Organoids in Geneva hosted by its member CSEM. This international conference brings together decision-makers from the pharma & biotech industry, clinicians, organ-on-chip suppliers, regulatory experts, and research organizations.

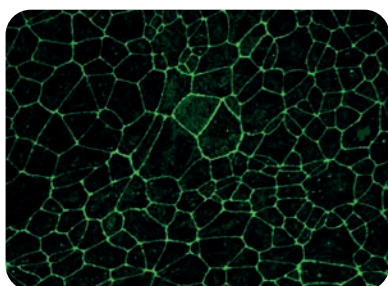
Biotechnet Switzerland actively supports the search for effective solutions to global challenges

CONTINUED

Biotechnet members are advancing applied research in in vitro and in silico testing and effectively providing alternatives to animal experimentation.

These advancements are leading to collaborations between pharmaceutical companies and members of Biotechnet, as exemplified by several recent projects funded by Innosuisse:

- Alentis Pharmaceutical and FHNW: Identifying mechanisms to treat liver fibrosis using three-dimensional cell culture systems.
- Anjarium Biosciences and ZHAW: Generating a novel exosome-based method for drug delivery across the blood-brain barrier.



Blood-brain barrier cell model developed by Prof. Jack Rohrer and his group at the ZHAW

Circular economy and sustainability

The circular economy, sustainability of resources, and the current energy crisis are global issues that must be tackled by fostering collaborations. To address these challenges, Biotechnet is leveraging its international partnerships.

- The 2022 Summer School for Advanced Biotechnology was organized jointly by Biotechnet, Prof. Christoph Griesbeck (Management Center Innsbruck), the Ulysseus European University, and the University of Palermo. Researchers and students from 5 Biotechnet universities had the opportunity to interact with colleagues from 6 Ulysseus universities on the topic of Food, Biotechnology & Circular Economy. The lectures, workshops and networking activities opened new possibilities for collaborations within the framework of the European research program.

- 2022 was the last year of a successful European program on sustainable biotechnologies. INGREEN has focused on developing safe, bio-based, high-quality ingredients produced from underused food, pulp and paper by-products. Prof. Philippe Corvini (FHNW, Bioresources Platform) and teams of scientists from the FHNW (Prof. Patrick Shahgaldian, Prof. Christoph Hugi and Prof. Laura Suter-Dick) worked on whey pre-treatment and optimization of the biotechnological processes to produce galacto-oligosaccharides (GOS), which have potential benefits as prebiotics for animals and humans. They also studied lactobionic acid (LBA) and *Y. lipolytica* biomass, which can be used to produce innovative cheese prototypes with reduced ripening time.

Better understanding of disease, therapeutics, and diagnostics

Data science, artificial intelligence and quantum computing are powerful tools that can help us better understand diseases and develop more efficient treatments and diagnostics. Omics technologies have evolved a great deal in the past 20 years, due to advances in high-throughput technologies for generating and interpreting large amounts of genetic and molecular data.

Biotechnet's newly formed Data Science platform led by Dr. Abdullah Kahraman (FHNW) and Moritz Kirschmann (CSEM) brings together Swiss-wide expertise from member organizations FHNW, CSEM, ZHAW and HES-SO. The group plans to foster interactions and exchanges on data analysis, machine learning and artificial intelligence in biotech on topics such as target molecule generation, digital twins of bioreactors, bioinformatics for omics technologies, and managing data in biotechnology.

Scientific symposia and collaborative projects bridging research and clinical activities are planned to harness the power of data science in providing solutions to health challenges.

“In all, Biotechnet's members strive to provide leading applied research and facilities that can support the development of effective solutions to global challenges. Discover how we can work with you by visiting our online directory.”

Biotechnet members featured in this article:

CSEM: Centre Suisse d'électronique et de microtechnique
FHNW: : Fachhochschule Nordwestschweiz
HES-SO: Haute école spécialisée de Suisse occidentale
Universität Bern

UZH: Universität Zürich
ZHAW: Zürcher Hochschule für Angewandte Wissenschaften
MCI: Management Center Innsbruck (Austria, international member)
Palermo University (Italy, international member)



Biotechnology innovates sustainable alternatives for industry



Hans-Peter Meyer

Swiss Academy of Engineering Sciences SATW | Head, Working Group Biotechnology

The intrinsic advantages of biotechnology are indisputable. The combination of exponential growth and the precision of biochemical reactions offers the promise of truly sustainable production.

The fastest growing bacteria, weighing $\sim 10^{-12}$ g per cell, grow so rapidly that their biomass could theoretically reach the mass of the earth ($9 \cdot 10^{54}$ tons) in less than a week. The ability to harness the growth potential of microorganisms to achieve sustainable production processes is currently most apparent in the pharmaceutical industry, where complex and mostly chiral molecules produced with chemo-, regio- and stereoselective biotechnology tools are vital ingredients of novel drugs and vaccines.

How the pharma sector is unlocking the potential of biotech

Global sales generated by the biotechnology sector have roughly doubled over the last ten years, to around USD 500 billion. Approximately half of these global sales are related to healthcare applications, and in Switzerland the share is much higher. Monoclonal antibodies are of particular importance for the Swiss pharma industry (see Swiss National Science Foundation article, p16), and other key sectors are increasingly exploiting the potential benefits of biotechnology. This new approach has been driven by many factors, including consumer demand for green chemicals, changing environmental policies, price per ton of CO₂, and dwindling natural raw materials.

The Swiss Biotech Report 2021 article 'Organic Chemistry at the Crossroads' outlined the potential applications and benefits of industrial biotechnology and concluded that the organic chemical industry must reinvent itself, as the increasing structural, chiral and functional complexity of life science products is pushing organic chemical synthesis to its limits. As a consequence, two other important branches of the Swiss economy, the flavor & fragrance and agrotech industries, added biocatalysis and biosynthesis to their predominantly mature chemical toolbox some time ago (see scienceindustries article, p30).

Applications far beyond pharmaceuticals and fine chemicals

With the transition from fossil sources and the need to make sustainability a priority in all our activities, biotechnology must be regarded as a vital manufacturing tool and preferred option in sectors far beyond the small molecule pharma products, fine chemicals, vitamins, and agrochemicals.

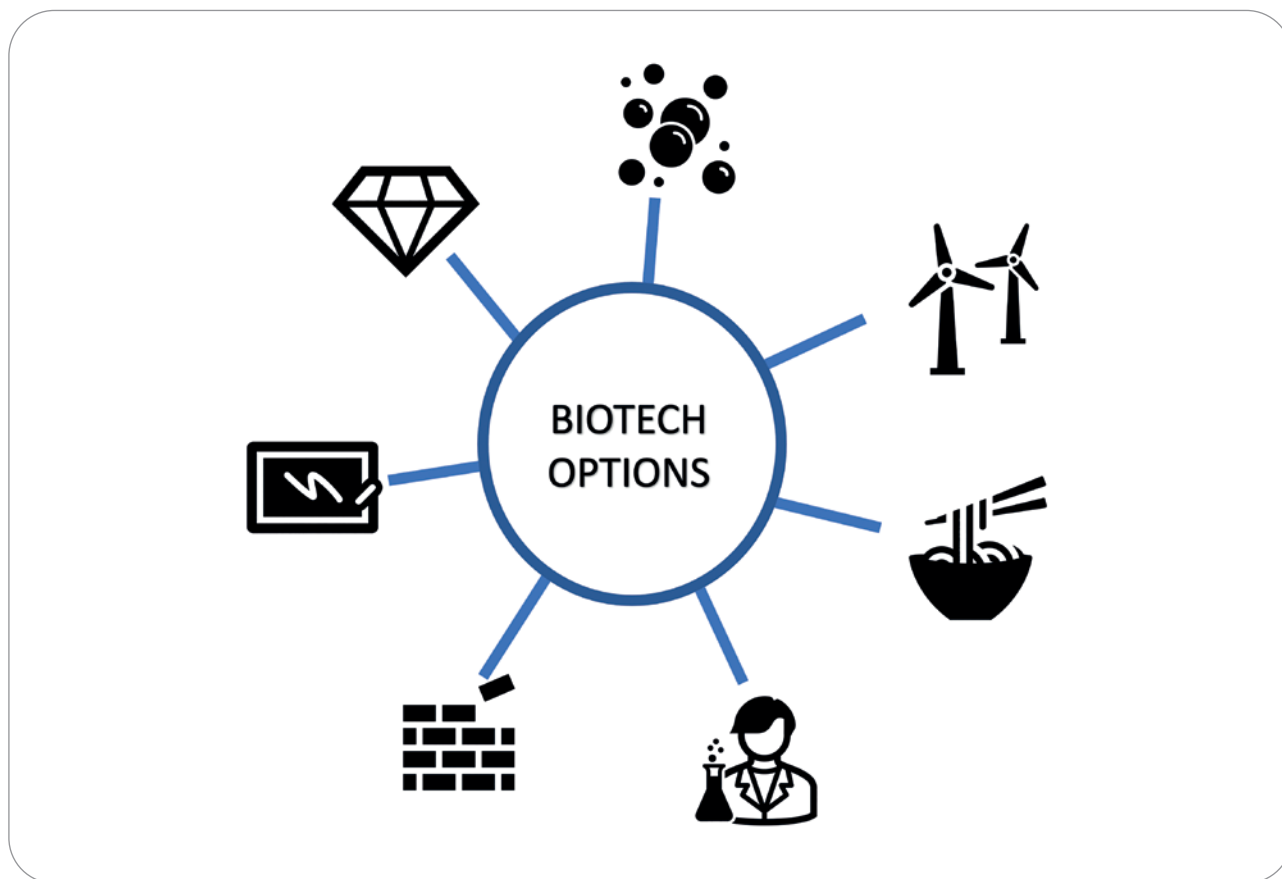
Table 1 shows selected examples of technologies in which the combination of exponential growth and specificity of biotech systems is already being successfully exploited. These are key areas for the application of Swiss innovation, as part of international collaborations to unlock the advantages of industrial biotechnology and develop effective solutions to global challenges.

Rare Earth Elements (REE) mining and recycling	REEs, particularly the lanthanides, are sometimes called the “vitamins of modern industry”. They are key components of permanent magnets, batteries, motors, iPhones, and LED lights. China is currently the dominant producer. Mining and recycling procedures are not sustainable as almost 90% of the 54 million tons of global electronic waste produced each year are not recycled, and it is one of the fastest growing waste streams worldwide. The proposed solution: recombinantly expressed microbial REE metal-binding protein chelators, adapted for the low-grade ore mining and recycling of rare earth elements, which are classified as strategic materials by the military and by several governments.
Animal protein replacements	It takes about 25 calories of animal feed to produce just one calorie of animal protein. Reforestation of half of the land used for animal feed cultivation could offset all current US greenhouse gas emissions by 2035. The world needs sustainable animal protein alternatives. Replacement products usually consist of vegetable raw materials or mushrooms but cell-based, “victimless” meat and seafood products derived from biopsies from live animals are expected to reach markets soon. These provide better taste and texture experiences but manufacturing costs are still too high for them to make a major impact. Besides meat replacement, cocoa, dairy products or honey are other product targets for cell-based production.
Leather, fibers, polymers	The fashion and textile industry is highly unsustainable due to excess garments, use of plastics, hazardous chemicals and colors. Greenpeace launched the “Detox my Fashion” campaign 10 years ago. Biobased, “victimless leather”, biofibers, and biopolymers are already being used in medtech, food packaging, textiles, and other sectors. Several products are available today, ranging from spider silk to polyhydroxyalkanoates produced by fermentation.
Colors and pigments	In 2006, Smarties had to be removed from shelves because of a synthetic blue colorant. The current “natural” food color market overtook the synthetic one in 2018 and has reached USD 2 billion. These natural colors must comply with requirements such as pH and heat resistance, and are replacing synthetic colors. Sustainable colors may be sourced from fruits, vegetables, and agricultural residues, but are increasingly produced using microbial biocatalytic and biosynthetic methods.
Lubricants	Environmentally safe lubricants are needed for on- and off-shore wind turbines, which deliver globally about 840 GW. Each turbine requires around 1’000 liters of lubricating oils and 200 kg of grease per year. The sesquiterpene farnesene is a potential possible starting material for lubricants. Another biotech approach is to convert CO ₂ into high performance lubricants through algal lipids (CO ₂ – from greenhouse gas to raw material).
Cement industry	The annual production of over four billion tons of cement alone causes almost 8% of the global carbon emissions. Microbially-mediated construction processes and biotechnologies are proposed for the production of construction biomaterials, together with ground improvement by microbially induced calcite-precipitation (MICP) or microbially-induced calcite cementation (MICC).
Microbial Fuel Cell (MFC)	MFCs oxidize biomass and organic matter into bioelectricity with a theoretical energy efficiency of over 50%. MFCs can be exploited for various applications from power generation to phosphate recovery. The phosphorus used in intensive agriculture comes from non-renewable phosphate rock and the EU has identified phosphate P rocks as a critical and “non-renewable” raw material. The only solution for Switzerland is to extract phosphorus from the 200’000 tons/yr of wastewater sludge which contains about 1% phosphorus. MFCs offer an opportunity for the efficient recycling of this critical element.

Table 1: Uses of biotechnology which go far beyond the typically known examples

Two examples included in the table are related to inorganic chemistry. The “Periodic Table of Endangered Elements” published by the American Chemical Society (<https://www.acs.org>) in 2017 lists no fewer than 44 elements which face supply limitations in the coming years. Rare earth elements and phosphorus are two examples where specificity of biological systems can be used for the mining or recycling of these critical elements.

This list is anything but exhaustive and it shows how diverse the required processes, operations and biological systems can be. The biotechnological production of large parenteral proteins (red biotechnology) is technically and economically well-defined and the sector is very well organized through the Swiss Biotech Association. Industrial biotechnology, on the other hand, serves a multitude of different markets, using a range of disparate manufacturing methods. Moreover, the industrial biotechnology sector is not yet organized in Switzerland because of differing interests and economic drivers.



The need for international collaboration

Most players described in this article use microbiology, genetic engineering and bioprocessing for value generation but are active in very different markets and, as a consequence, are not direct competitors. This facilitates free exchange of ideas, and knowledge could be pooled, shared, exchanged and exploited in a regulated manner. An example of this approach is the collaboration between Novartis AG and Syngenta AG, two companies exploiting two entirely different markets, that started a very successful joint project in 2017 with the ZHAW Life Sciences and Facility Management to tackle the challenge of halogenase mediated late-stage catalysis.

To achieve continued success in a highly competitive market requires continuous innovation, not only in the laboratory or in the manufacturing plant, but also in the way we work together.

The use of blockchain technology can ensure security and facilitate cooperation in areas which may previously have been seen as potentially conflicting, but which may offer tremendous opportunities through decentralized and controlled peer-to-peer exchange. Such an approach is currently being investigated by the Swiss Industrial Biocatalysis Consortium (SIBC).

There is huge potential for the further development of an active industrial biotech cluster in Switzerland, and the Swiss Biotech Association and the Swiss Academy of Engineering Sciences (SATW) have continued their efforts to bring an Industrial Biotechnology working group into being. A knowledge exchange platform has been created and embedded into the swissbiotech.org website aimed at connecting key players and fostering the formation of an industrial biotech community.



How industrial biotechnology can reduce costs, boost manufacturing efficiency and improve sustainability



Jan Lucht

scienceindustries | Head Biotechnology

Industrial biotechnologies developed and applied by Swiss companies have already demonstrated their potential to lower the environmental footprint of the industry by reducing greenhouse gas emissions and the consumption of limited biological resources. In the healthcare sector, biotechnology plays a crucial role in the manufacture of active ingredients and the development of innovative therapies and vaccines, delivering effective solutions for individual patients' and global health needs.

Biotechnology is providing tools to increase the efficiency and sustainability of production processes across many industry sectors, thereby contributing to global sustainability goals. From the production of food and feed components, to flavors and fragrances, to fine chemicals, fuels, plastics, textiles and advanced materials, biotechnology and biomanufacturing are gaining in importance. In addition to providing desired products at competitive prices, they often offer the opportunity for more sustainable, environmentally friendly production processes. For example, fossil raw materials which cause high greenhouse gas emissions can be substituted by renewable biomass or recycled inputs, and limited biological resources can be replaced by more abundant materials or by alternative production approaches (see SATW article, p26). Through the development of novel processes and ingredients, Swiss companies will make a major contribution to the global reduction in the environmental footprint of manufacturing.

A biobased, climate-positive alternative to polyester

Global production of textile fibers currently exceeds 110 million tons per year and is growing rapidly. About two thirds of the production is synthetics, mostly polyester. As the production capacity of natural fibers is limited, the share of synthetic fibers is predicted to increase further. With its huge consumption of fossil raw materials, the textile industry contributes more than 10% to global carbon dioxide emissions. In addition, the very slow biodegradation of polyester fibers poses environmental problems.

Swiss innovation and manufacturing company HeiQ, founded in 2005 as a Swiss Federal Institute of Technology Zurich (ETH) spin-off, set out to improve the sustainability of the textiles industry, and developed a biobased fiber as an alternative to polyester and nylon. In 2021, the company presented AeoniQ™, a versatile cellulose filament yarn that delivers performance, function, and comfort. It is manufactured by a proprietary, environmentally friendly process from different cellulosic raw materials such as recycled textiles, organic waste, and algae. Especially promising for large-scale production is bacterial cellulose as input. This can be produced by a microbial biotech conversion process from several non-valorised agricultural and food waste streams that are available in large quantities at low cost.

Currently, HeiQ is expanding production capacities for AeoniQ™ in close collaboration with major brands, with a mission to decrease the environmental footprint of the textiles industry. Replacing fossil-based polyester with the biobased cellulose product has a strong climate-positive effect. In addition, the new fiber is easily recyclable and biodegradable.

Biotech fragrance production protects natural resources

Fragrance compounds have traditionally been prepared from natural resources, such as flowers or ambergris. These are often of limited availability and therefore precious. More recently, chemical synthesis has opened alternative routes to fragrance compounds, but it often relies on fossil raw materials. In a push to increase the reliability of the supply and the sustainability of production, manufacturers are also turning to industrial biotechnology.

In 2019, Switzerland-based Givaudan, the largest global player in the flavor and fragrance sector, presented a breakthrough biotechnology approach for synthesising Ambrofix, the most widely used biodegradable fragrance ingredient. This is just one

of several Givaudan products, in which industrial biotechnology combines economical production with sustainability, enabling conservation of valuable natural resources, an efficient carbon utilization, and upcycling of by-products.

With its characteristic and memorable ambery and woody smell, Ambrofix is ubiquitous in products ranging from household and personal care items to fine fragrances. Previously the compound was produced by a semisynthetic approach starting from clary sage, a botanical resource with limited availability. The new biotech process uses sustainably sourced sugar cane as the raw material and requires a hundred times less land to produce one kilogram of the sought-after ingredient compared to the traditional production method. This process is recognized as the most sustainable and carbon efficient on the market.

Omega-3-fatty acids from algae conserve marine life

Fish, with its high content of omega-3 fatty acids, is an important component of a healthy and balanced diet. Because the sustainable supply of wild-caught fish from the oceans is limited, aquaculture plays an ever-increasing role, and currently provides more than 50 percent of all harvested fish. But cultured fish also need omega-3 fatty acids to thrive and produce nutritious flesh rich in fatty acids essential for our health. As a component of fish feed, these currently are mostly provided by fish oil from wild caught fish. More aquaculture therefore leads to a growing need for fish as feed component. The high global demand outstrips supplies and contributes to the further depletion of our oceans.

To address these challenges, DSM and Evonik in 2018 established the joint venture, Veramaris. Using industrial biotechnology and large-scale fermentation of agricultural biomass with a strain of Pacific microalgae, the company produces an omega-3-fatty acid rich algal oil that can completely substitute fish oil as a feed component for aquaculture.

One ton of algal oil produced by Veramaris replaces 60 tons of wild caught fish. This product of industrial biotechnology addresses the shortage of omega-3-fatty acids for aquaculture feed, facilitates the production of more nutritious and healthy food for human consumption, and at the same time conserves marine life and biodiversity by reducing the demand for wild caught fish as aquaculture feed.

Framework conditions are key

In Switzerland, incentives for biomanufacturing are less well developed than in many other industrialized countries. For example, Switzerland does not yet have a dedicated bioeconomy strategy, and public and political awareness of industrial biotechnology and its potential is still limited. However, with its excellent research institutions, the close and well-established collaboration between academia and industry, and a good national and international networking between the players, Switzerland offers some key requirements for a thriving industrial biotechnology ecosystem both within and outside the pharma sector. Increased political support for innovative technologies and biomanufacturing could further contribute to the sustainability of the industry – in Switzerland as well as globally.



HeiQ AeoniQ, a “game-changing” biobased, climate-positive yarn

Photo credits: HeiQ AeoniQ™

Switzerland: Innovative biotech hub in motion - past, present, and future

Michael
Altorfer
Swiss Biotech
Association | CEO



Marta
Gehring
Swiss Biotech
Association | Special projects

The Swiss biotech industry is innovative, internationally connected, and versatile. It owes its strength to its ability to innovate in collaboration with global partners and evolve with changing market dynamics.

A history of strategic metamorphosis

In 1921, dye manufacturer Sandoz (now a division of Novartis) recognized the uncertainties facing the industry and after announcing its decision to diversify into pharmaceuticals, began to develop chemical dyes and pigments derived from natural sources.

Roche and Ciba (now Novartis) built their first US factories in 1927 and 1936 respectively. One of the world's first global biotechnology companies, Biogen was founded in Geneva in 1978. Novartis was then created in 1996 through a merger of Ciba-Geigy and Sandoz.¹

These are early examples of what was to come: drug companies using mergers to innovate, bolster product portfolios with external innovation, and work more efficiently. The Swiss drug industry thinks globally and acts locally, and has been doing so for over a century.

Also the research activities have been wide ranging, pioneering, and agile. Swiss Nobel Price winners in chemistry, physiology and medicine have been shaping some of the most fundamental discoveries which continue to have a significant impact on innovations that improve the global healthcare system today. These include: vitamins (1937), cortisone (1950), drugs that block the actions of specific neurotransmitters (1957), restriction endonucleases (1978), nuclear magnetic resonance (NMR) methods for studying biological macromolecules (2002) and cryo-electron microscopy (2017).

This ability to continuously evolve, from natural pigments to chemical synthesis to biotechnology, has shaped the healthcare landscape in Switzerland and around the world. By remaining outward looking, Switzerland has managed to stay ahead of the curve. Evolution and adaptation to global demand patterns have clearly benefited the industry and its ecosystem.

“Big pharma’s desire to complement its internal product portfolio by in-licensing and acquiring innovative products from external partners has been matched by a boost in Swiss biotech innovation hubs’ output of innovative drugs. At the same time, increasingly diverse modalities have spearheaded a broader range of therapeutic options.”

With a population of just under nine million, Switzerland is home to many globally recognized companies and research institutions, and is a world-leading biopharma innovation hub. The country continues to be a key player in shaping innovation of the global healthcare system and does so in close collaboration with its international partners. Consequently, it has been the source of a number of multiple first-in-class and therapies in oncology, CNS treatments, pulmonary arterial hypertension and infectious diseases - breakthroughs that have had a major impact on global health problems and have greatly improved patients' lives. Gleevec® (imatinib) for cancer, Rebif® (interferon beta 1a) for multiple sclerosis, Tracleer® (bosentan) for pulmonary hypertension, Kymriah® (tisagenlecleucel/CAR-T) for lymphoblastic leukemia, and the Ebola treatment (Ebanga™) are just but a few examples of breakthrough Swiss biotech innovation.

The country has a strong focus on research and development, a highly skilled workforce, and a favorable business environment characterized by highly efficient processes and minimal bureaucracy. This encourages innovation and investment in the biotech sector, making it highly productive without the need for government subsidies.

This collaborative productivity among different players in the biotech innovation ecosystem has been mastered in Switzerland and is critical to its success. The development of a new drug requires high, early-stage investment with no guarantee of clinical trial success. Phase III trials also require high investment and an ability to navigate complicated regulatory and market access pathways capabilities that only larger multinationals typically have.

These factors have created a dynamic industry profile in Switzerland whereby smaller, creative “emerging biotech” companies fund much of the innovation which is subsequently picked up by multinationals

in Switzerland or elsewhere. Big pharma’s reduced innovation capacity has been matched by a boost in Swiss biotech innovation hubs’ output of innovative drugs.

At the same time, the expansion in the diversity of modalities has spearheaded a broader range of therapeutic options. Switzerland’s growth in modalities is shown below (type of molecule and developer versus service provider). Switzerland is a growth center for services, cell and gene therapy and immunotherapy and a leading center for antibody R&D and manufacturing.²

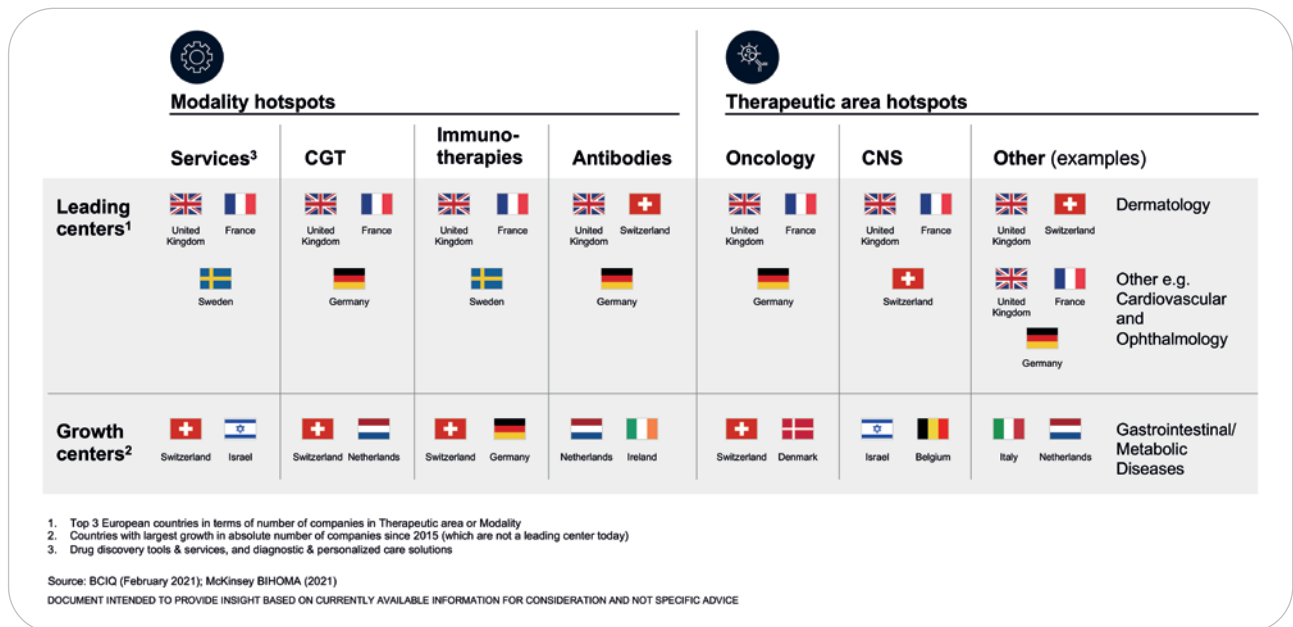


Figure 1: Modality and therapeutic area hotspots in Europe, 2021 (reproduced with permission of McKinsey). In all modalities and in key indications, such as oncology and CNS, Switzerland is either a leading or a growth center

Switzerland’s outward looking innovation capacity

The finance and resource-intensive ‘R&D-driven’ model of biotech has been mastered in Switzerland. As a result, the Swiss biotech industry is one of the most advanced and innovative in the world. Using very different methodologies, the World Intellectual Property Organization’s Global Innovation Index 2022 and Nature Biotechnology’s The Worldview national ranking of health biotech sectors (2022) both found Switzerland, the USA, and Sweden to be leading centers for R&D-driven biotech.

Additionally, in Nature Biotechnology’s 2022 report (The Worldview national ranking of health biotech sectors³) Switzerland is in the top ten in nine out of 10 categories. It is no surprise then that Big Pharma is scrambling to acquire Swiss assets early in the development process: a recent review found that between 2005

and 2020, 33% acquired companies’ lead asset was just in Phase II. A large proportion of these acquisitions focused on oncology (30%) and CNS (16%), which are particularly strong in Switzerland.

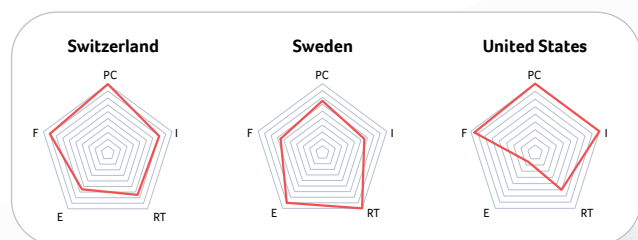


Figure 2: Pentagon charts for the top three centers for R&D-driven biotech nations (reproduced with permission of Nature Biotechnology). Pillars delineate strengths - from top clockwise: Public Biotech Companies (PC); Investment (I); Research and Translation (RT); Education (E); Fundamentals (F).

Switzerland: Innovative biotech hub in motion past, present, and future

CONTINUED

A global research hub developing tomorrow's drugs

Switzerland continues to make improvements in its growth rate across all biotech innovation areas, even when starting from a high base.

Switzerland fares well in discovery (early-stage innovation), translation (creation of new companies supported by early-stage financing), growth capital (late stage and public market funding) and impact index (number of launches). This means that it has progressed in all areas in the five-year period 2015–2020 (see Figure 3). This is promising for the development of tomorrow's drugs.

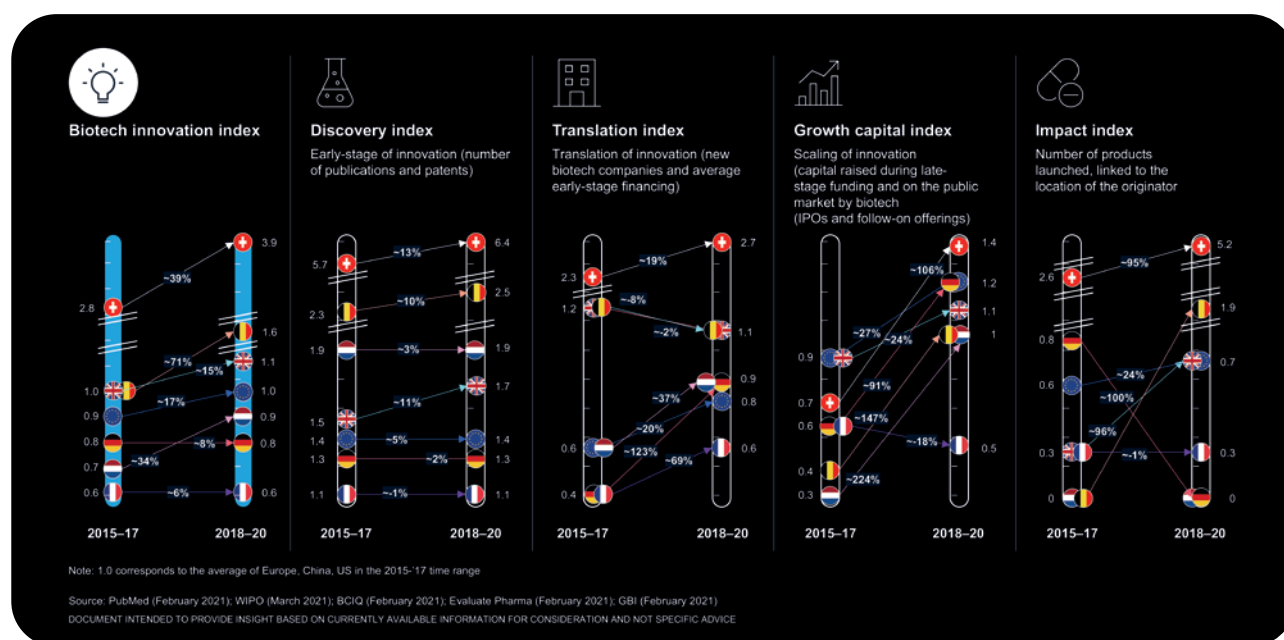


Figure 3: European Biotech Innovation Index across four dimensions

It is not always easy to continue to make improvements when starting from a high base. Yet Switzerland's attention to global market needs, its disciplined R&D, collaborative ecosystem, and its access to capital and talent have allowed it to continue to improve across all biotech innovation dimensions, from early innovations to launch impact.

Swiss industry's dedication to biotech and Switzerland's ability to grow and develop its vibrant ecosystem is unwavering and the results speak for themselves. The summary Biotech Innovation Index (above) indicates that Switzerland is once again ranked number one. Such continuous innovation will bring increasing benefits to global health systems and individual patients as we move towards a new era of precision medicine.

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SIX Swiss Exchange: A safe haven in stormy times



Fabian Gerber

SIX Swiss Exchange AG | Senior Relationship Manager Primary Markets

In a challenging global stock market environment, companies from the life sciences sector listed on SIX Swiss Exchange continue to benefit from a robust, resilient capital market with comparatively low market volatilities.

Achieving sustainable success on solid ground

The Swiss stock market has not been spared valuation corrections driven by geopolitical unrest and macroeconomic challenges, and the impact of these factors has been particularly severe in the technology and biotech sectors. Heavy corrections in biotech share prices also reflect their high sensitivity to interest rate changes, which typically have a drastic effect on discounted cash flows (estimates) for biotech companies.

Nevertheless, in these turbulent times, the Swiss life sciences index has held up relatively well, outperforming its US benchmark with both an excess return and lower volatility (see Figure 1). The relative strength of the Swiss capital market demonstrates its quality and stability, backed by a strong currency.

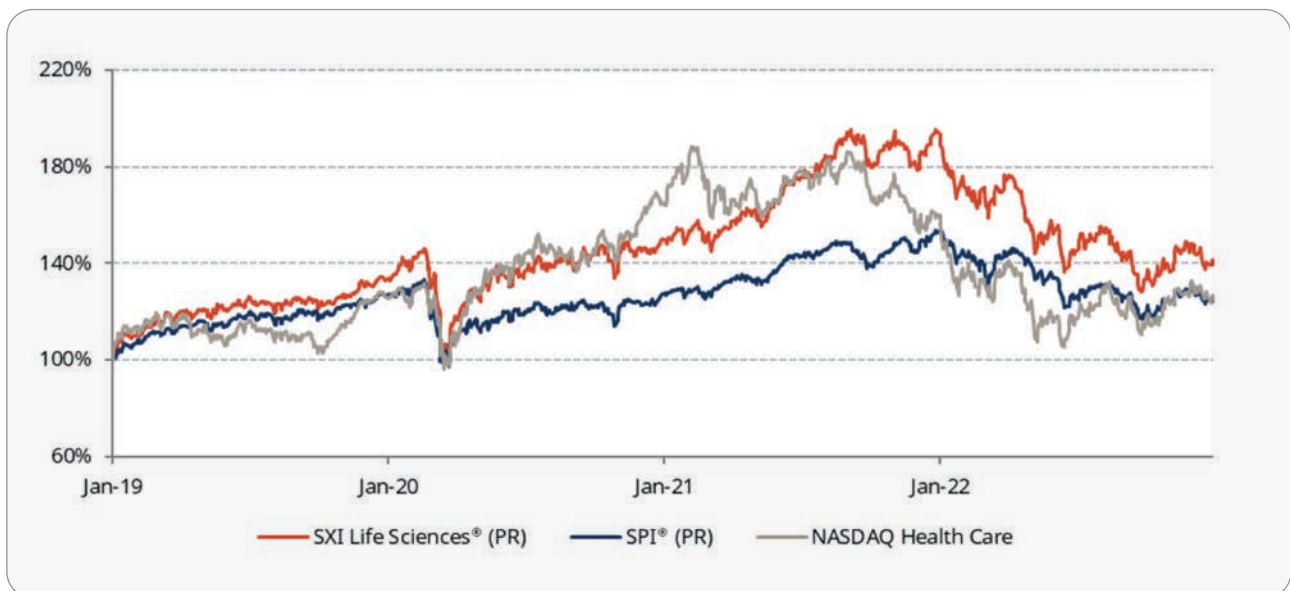


Figure 1: Performance comparison SXI Life Sciences Index vs. NASDAQ Health Care Index 2019 to 2022 (values relative to January 2019)

Since January 2019, the SXI Life Science Index has outperformed the NASDAQ Health Care Index by 13.6 percentage points (+39.2% vs. +26.6%) with lower fluctuations in value.¹

These statistics cannot be a coincidence and are proof of the excellent conditions that listed companies find on SIX Swiss Exchange: they benefit from high visibility and a capital-rich domestic and international investor base, and Switzerland's vibrant life science ecosystem helps them develop and expand their product pipelines in calmer waters.

¹ The historical volatility of the last 250 trading days (Jan-21 to Jan-22) for the SXI Life Sciences was around 24%, for the NASDAQ Health Care around 29%.

The difficult market environment in the past year along with the dismal performance of many IPOs listed since 2021 has also had an impact on global IPO activity, which has come to a virtual standstill. Despite these challenging market conditions, two new companies from the biotech sector ventured onto SIX Swiss Exchange last year: Kinarus Therapeutics and Xlife Sciences, the latter of which was the first company to list on the newly launched SME stock exchange segment Sparks.

The strategic importance of the right listing location

Even though IPO activity took a sharp negative turn after a record-breaking year in 2021 with the US being particularly affected, it is unlikely to lose much of its appeal to domestic and European biotech/life sciences companies considering an initial public offering (IPO).

While just over 10% of all IPOs by Swiss companies since 2000 were conducted on a stock exchange in the United States, the choice of the right listing location is particularly relevant to the biotech sector.

The potentially higher company valuations achievable in the US at the IPO stage have often been cited as a reason for choosing to list on a US stock exchange. However, the choice of the right stock exchange for an IPO is a strategic decision and the pros and cons associated with a specific listing location must be weighed against each other. It is advisable not only to focus on the valuation at the time of the IPO but also, particularly in the case of a younger company, to assess whether it will be well placed to create sustainable shareholder value in the years following the IPO, while complying with the requirements imposed on it as a publicly listed company by investors, analysts and the regulator.

Keeping costs under control

The total costs and requirements of an IPO in Switzerland compared to the US should be carefully evaluated. In the US, issuers are required to file a registration statement with the United States Securities and Exchange Commission (SEC). The preparation of the necessary documentation can be a lengthy process, absorbing significant management attention and resources. Equally important are the costs of preparing the business and of operating as a public company. The so-called directors' and officers' (D&O) liability insurances have become unavoidable when opting for a US listing, due to the ever-increasing risks and potential costs of securities litigation, and can result in annual insurance fees and expenses in the millions of dollars. In addition, ensuring compliance with the regulatory requirements and obligations of public companies in the United States (e.g. Sarbanes-Oxley Act, US tax law) can further drive costs and must be taken into account.



Using the QR code above you can download the white paper **“Evaluating the aspects of a Swiss versus a US listing”**, which discusses the costs, risks and legal aspects of IPOs and shows how a SIX listed company can efficiently access US-based investors, without the need to undergo the time-consuming registration procedure with the SEC.

Ingredients for life-changing medicines and the Switzerland factor

One of the many success stories on SIX Swiss Exchange is Bachem. The pharma and biotech supplier has been listed on SIX Swiss Exchange since 1998 and is an impressive example of the ecosystem for listed life sciences companies. Bachem develops and manufactures peptides and oligonucleotides as active ingredients for medicines. It is considered the market leader for peptides and aspires to reach a significant role in oligonucleotides, as well.

Around 1'300 of its 1'800 employees work in Switzerland. In October 2022 the company announced plans to expand its Swiss presence further - both at its headquarters in Bubendorf (canton Basel-Land) and with a land purchase for a new site in Eiken in the canton of Aargau. The expansion in Bubendorf will see investments of CHF 500 million and up to 800 new jobs in the next three years, while the new site is to go online at the end of the decade with 500 new jobs and investments of CHF 750 million. In 2021, the company turned a historic record turnover of over CHF 503 million with an EBITDA margin of 31.3%. Based on the ongoing demand for its products and services, Bachem aims to reach sales of CHF 1 billion in the coming years and continue to deliver an EBITDA margin of more than 30%.

SIX Swiss Exchange: A safe haven in stormy times

CONTINUED

In the following interview, Thomas Meier, CEO of Bachem, tells us about Bachem's growth story and the important role played by Switzerland and its life sciences ecosystem.



Thomas Meier
CEO of Bachem

What advantages can Bachem take from the local life sciences ecosystem? What distinguishes the Swiss life sciences ecosystem?

Bachem is focused on chemically developing and manufacturing peptides and oligonucleotides. These are very complex molecules that are increasingly used in a wide range of medicines. The manufacturing technology is constantly evolving. You need a highly skilled labor force, strong partners in academia and an environment that is conducive to new ideas. The combination of strong innovation in both business and academia, and positive regulatory conditions and infrastructure is unique in Switzerland. And we benefit greatly from this environment.

How is the company dealing with the current market challenges?

Actually, the market for our ingredients is booming and we are expanding capacity. So the main challenge is executing on our growth plans. But externally we have seen costs and greater competition in the job market as factors. Here again, we benefit from our presence in Switzerland: a stable currency, moderate inflation and access to the French and German labor force are mitigating factors in today's macroeconomic environment.

How and with which solutions does Bachem contribute to meeting the global medical challenges?

The ingredients we create for our customers are used in medicines against cancer, diabetes, obesity or rare diseases. Some of these could not be manufactured chemically until recently. So we contribute both toward combating large public health burdens and rare diseases that still have very little treatment options.

What makes you confident that you will achieve your ambitious growth targets? What makes you stand out?

We are not alone in the market and we have a healthy respect for our competitors. This keeps us on our toes. But we like to think that we have a strong focus on innovation and can maintain a competitive lead because of it. There is a strong commitment to quality at Bachem. And we are very dedicated to retaining internal know-how, training and our apprenticeship program. Finally, we think more in terms of sustainable, long-term success.

How important is the listing on SIX Swiss Exchange for Bachem and how does it contribute to the achievement of your growth ambitions?

Bachem is one of numerous pharma and biotech suppliers – or CDMOs (contract development and manufacturing organizations) – located in Switzerland. The Swiss financial market therefore has a strong appreciation and understanding of our business and life sciences in general and understands how our industry works. This has also helped us when raising capital through an equity increase. I think our customers appreciate these principles.



How Swissmedic helps to foster the spirit of innovation and accelerate the regulatory process



Jörg Schläpfer

Swissmedic | Head of Management Services and International Affairs

Global advances in biotechnology and personalized medicine pose a challenge to regulatory authorities. Patients expect to benefit as quickly as possible from innovative and effective therapeutic products and treatments, but these must be safe and of high quality.

Swissmedic strengthens the Swiss research hub by supporting innovation and accelerating the approval process for new products long before they are ready to be commercialized. Through collaborations with international partners, Swissmedic facilitates controlled and rapid access to promising products for drug developers and patients not only in Switzerland but around the world.

The role of Swissmedic

Swissmedic was established in 2002 and over the past two decades it has had a major impact on the implementation of Swiss innovation to protect human and animal health around the globe.

As the Swiss authority responsible for the licensing, authorization and monitoring of medicinal products, Swissmedic is involved in the entire life cycle of medicines. Efficient assessment of advanced therapy medicinal products (ATMPs) requires Swissmedic staff to constantly renew and expand their competencies.

The COVID-19 pandemic demonstrated the importance of intensive dialogue with research groups and applicants before and during the review procedure, and made a vital contribution to fast – but carefully considered – authorization decisions.

Swissmedic innovation office

While Swissmedic is learning from the experiences of innovation offices at other regulatory authorities, it also wants to shape its own solution – the version that is appropriate for Switzerland.

Created at the end of 2022, the innovation office is a new concept in Swissmedic's portfolio and is designed to achieve faster access to innovative medicines. The idea is to take a step closer to the innovators so that small companies and startups can be supported from an early stage.

The innovation office promotes networking and regular dialogue with research organizations and industry in order to become closer to the drivers of innovation and to tackle regulatory challenges in a solution-focused manner. During an initial pilot phase, it will concentrate on small operators – on the startups, spin-offs, research groups and incubators that promote innovation.

Low-threshold advice services are designed to support those who have concerns about contacting the regulator. The sooner they know what is needed, the faster a successful outcome can be achieved. The earlier a mistake is discovered, the more easily it can be corrected, so that neither the medicinal product nor the startup is jeopardized.

Lessons from the COVID-19 pandemic are also being implemented. During the pandemic, active dialogue with stakeholders and access to scientific advice and support were crucial to allow COVID-19 vaccines to be authorized at unprecedented speed. Moreover, scientific advice for clinical trials was offered for the first time during the pandemic, and in many cases this enabled the required licenses to be granted within a few days, particularly in the case of science-initiated studies (investigator initiated trials).

New ways of connecting with target groups to provide access to expert advice, and new ways of sharing information are currently up for discussion. Universities and innovation hubs

are approached proactively and “regulatory speed dating” may help startups overcome possible preconceptions about the “medicines police in Bern”. Initially, the innovation office will restrict itself to advice relating to ATMPs, since Swissmedic is able to act most flexibly in this area. After a pilot phase that is expected to last from 18 to 24 months to determine the appropriate scale and the most effective form of cooperation, Swissmedic would like to extend its accumulated experience to other therapeutic products.

By identifying and supporting highly promising medical innovations at an early stage and working with other research organizations, Swissmedic will contribute to the success of Switzerland as a leading global research hub and help those patients for whom adequate treatments do not yet exist.

Innovating Swissmedic’s own procedures

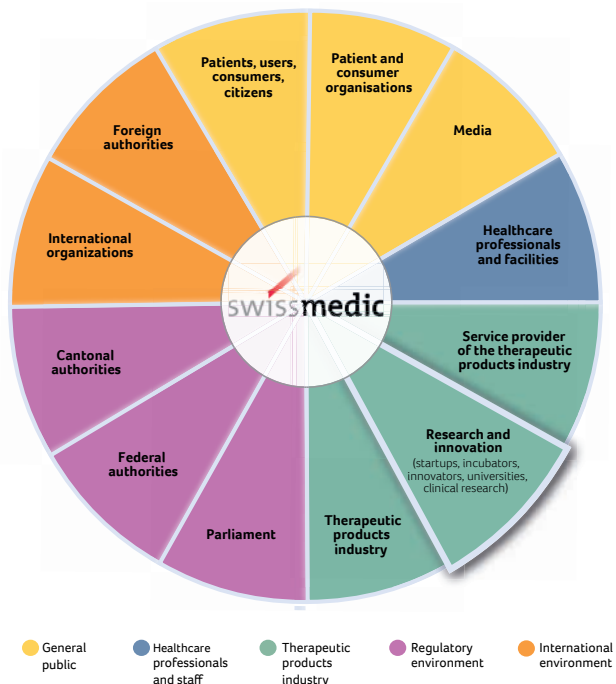
Swissmedic is increasingly transforming itself from a document-driven to a data-driven organization. Core processes have now been digitized and our highly integrated IT systems allow timescales to be adhered to or shortened. Interactions will soon be processed via a new portal which allows applicants to submit their data in a structured manner, thereby optimizing the ability to plan ahead and simplify application planning. The reorganization of operations and modified processes also form the basis of a more agile approach to regulation so that decisions can be made more quickly but with no reduction in rigor.

New technologies are opening up other highly promising fields in relation to the use of artificial intelligence (AI) and machine learning to assist in processing large volumes of data provided as supporting evidence. The pharmaceutical industry already employs systems that sort and initially assess adverse drug reactions using AI.

It will probably not be possible in the foreseeable future to review applications exclusively with a system based on AI as the number of currently available marketing authorization applications and authorization decisions from the past do not provide a sufficient basis for “training” AI systems, and decades-old authorization dossiers cannot help an AI system to evaluate today’s applications. But intelligent technologies could be used in other areas to help refine, search or contextualize data, and automate standardizable and repetitive tasks. These functions are crucial in the areas of authorization, market surveillance and licensing for central processes, for example in the preparation of certain licenses and assisting in the processing of adverse drug reaction reports.

Swissmedic Stakeholder Map

Innovation as a focal point of Swissmedic’s stakeholder engagement



The key to successful innovative solutions

The therapeutic products sector thrives on innovation and Swissmedic must establish itself as an innovation enabler. With the compassionate use and the temporary authorization of human medicinal products it already has several options to support rapid access to innovative medicines.

Swissmedic also offers scientific advice or pre-submission meetings, not just for authorization applications but also, for example, for establishment licenses for new production facilities or for situations in which researchers have to decide the best study design for their new active substance at an early stage of drug development.

By interacting with research organizations, Swissmedic can keep abreast of the latest technology trends and understand envisaged solutions. Applicants, for their part, receive regulatory feedback and valuable know-how to help them advance their innovation or infrastructure projects.

Investing in Switzerland: Arena Pharmaceuticals - a global company benefiting from a presence in Switzerland



Sirpa Tsimal

Switzerland Global Enterprise | Director Investment Promotion

In 2022, Pfizer acquired Arena Pharmaceuticals, a San Diego-based clinical stage company developing innovative potential therapies for the treatment of several immuno-inflammatory diseases. Amit Munshi, former President and Chief Executive Officer, talks with Switzerland Global Enterprise about why Arena Pharmaceuticals' Swiss hub was not only crucial to the company's success, but how other global biotech companies can benefit from a presence in Switzerland.



Amit Munshi

Former President and Chief Executive Officer
Arena Pharmaceuticals

You have lived and worked in biotech hubs like San Diego, Boston and Switzerland. What makes Switzerland unique?

In building a global pharmaceutical business, having the right people for every stage of development is critical to operational success. Over the years, I have set up Swiss hubs for three of my companies. The decision to do so was driven not by tax efficiency but rather by a desire for operational excellence.

Managing global clinical studies requires a global skillset, and having excellent infrastructure was critical. For example, at Arena Pharmaceuticals we had over 500 clinical sites in 40+ countries around the world. It is very difficult to manage these geographically dispersed clinical programs based solely in San Diego or Boston. In our Swiss office, the team spoke 20+ languages and had experience with regulatory interactions globally. This accelerated our responsiveness and allowed us to manage timelines even during the pandemic. Switzerland provided the right, globally aware talent base.

What was a key factor for the success of Arena Pharmaceuticals?

There were many success factors, including having the right clinical-stage assets and of course being able to capitalize on these. Of our 500 clinical sites, fewer than 20% were in North America. We needed to recruit patients, manage supply chain and regulatory interactions throughout Europe, the Middle East and Asia. Switzerland offered us the infrastructure to make that happen.

Where does Switzerland stand when it comes to talent in biotech?

Switzerland attracts an internationally diverse workforce in biotechnology. Experienced scientists and clinicians are willing to relocate to Switzerland due to the quality of life, healthcare, and central location.

What are the biggest current challenges for biotech companies to be innovative and globally competitive, and what role can Switzerland play?

At the moment, the single biggest issue for the biotech industry is capital. The current public capital market environment makes it difficult for biotech companies to continue to grow and survive.

Switzerland has significant institutional capital, but high-risk/reward biotech has not received its proportional share of those resources. The Swiss challenge is to move from a conservative deployment of capital to being able to allocate capital to high-risk ventures. Swiss capital could be used to build Swiss-based companies. The presence of world class universities, research capabilities and talent base are existing core ingredients in building local biotech companies. Getting critical momentum with high-risk capital would go a long way towards propelling Switzerland further in biotech innovation.

What fascinates you about biotech?

There are few industries that attract brilliant people all focused on improving the human condition. After over three decades in the business, I am constantly astounded by the increasing rate of scientific progress.

There are few industries where you can say that your legacy (the drugs you bring to market) will persist long after you leave this planet.

What is your advice to growing biotech companies in terms of setting up their global strategic footprint?

After 32 years in pharma/biotech, I believe we have moved away from building sustainable businesses, and the emphasis in the last decade has been to build and sell. We need to get back to the idea that we can build long term, sustainable biotech businesses. This requires higher-risk tolerant, patient capital.

Today, I believe that a biotech company is better equipped for growth with a US base and a Swiss hub. Pattern recognition with investors and access to capital are paramount. The predominant source of capital likely will continue to be the US capital markets until the mindset on capital allocation changes in Europe. When it does, you may see Swiss global biotech companies setting up US hubs. That would be the ideal situation for the Swiss biotechnology industry.

Can you describe Switzerland in three words?

To best describe Switzerland, I believe you must describe the feeling of being there – very difficult to do in three words! I have a 30-year relationship with Switzerland and hope to return in my future ventures or maybe even to live there again.



How Switzerland is contributing to the commercial success of biotech companies worldwide

Isma Hachi

IQVIA | Biotech
Commercial Director



Max Newton

IQVIA | Global Supplier
& Association Relations

Biotech is the key growth area for pharma and life sciences, and Swiss-based biotech companies play a major role across the entire development cycle, from their share of the pipeline, to clinical trial activity, to the emerging commercialization of new molecules. Switzerland's ability to drive and nurture innovation is continuing to expand.

Emerging biotech companies were responsible for only one-third of innovation in 2002 – by 2022 they provided two-thirds of the R&D pipeline. This doubling of their contribution over the past two decades highlights the increasing importance of smaller companies in driving innovation.¹ For example, biotechs now generate over 90% of cell, gene, and RNAi technologies, and are responsible for more than 1'500 oncology medicines in development globally.

Switzerland is playing a vital role in the global biotech sector

Switzerland's ecosystem provides an ideal location for company headquarters

The Swiss ecosystem is one of the most attractive biotech ecosystems in the world and is built around multiple biotech hubs in the Basel, Zurich-Zug-Lucerne-Schaffhausen, and Romandie regions. About 20% of European life science companies have their headquarters in Switzerland, representing over 90 companies with active clinical trials.²

Swiss-based companies play a leading role in clinical trial activity globally

Over the past decade, the number of clinical-stage biotech therapeutics has grown by 60% to more than 2'500 globally. On a per capita basis, Switzerland's contribution to the global pipeline is the highest in the world. In 2022, there were ~190 molecules with active clinical trials led by Swiss-based companies, with a focus on oncology, neurology, and gastrointestinal conditions.³

Swiss biotech companies actively contribute to the launch of new medicines achieving world-class success

Biotech companies dominate the pipeline (>60%) and partner with larger firms to account for a further ~7% of the total drug development pipeline. In recent years, the market access landscape has also been

favorable to biotech companies – around 7% of all innovative medicines launched in Europe in the past five years were developed by Swiss biotech companies.⁴ The number of European markets which reimburse products developed by Swiss biotech companies is 25% higher than the average for non-Swiss biotech companies.⁵

There are notable Swiss examples of biotech companies self-commercializing their innovative therapies without large pharma support

Increasingly, companies have held on to their products to file and commercialize their assets themselves, thereby maximizing the value they capture. Some examples include Alnylam, Mirum Pharmaceuticals and Blueprint Medicines.

Blueprint Medicines, a biotech company with global headquarters located in the Cambridge, US, and international headquarters located in Zug, Switzerland, has developed a first to market therapy, AYWAKYT® (avapritinib), to treat patients with advanced systemic mastocytosis (AdvSM), a rare hematological disorder, with a global prevalence between ~4-5 per million.⁶ Blueprint Medicines has chosen Switzerland, as strategic position, to support the commercialization of AYWAKYT® outside the US.

Although the sector is still considered ‘emerging’, the combined revenue generated by Swiss companies which have successfully launched their molecules in the past five years alone exceeds USD 270 million.⁷

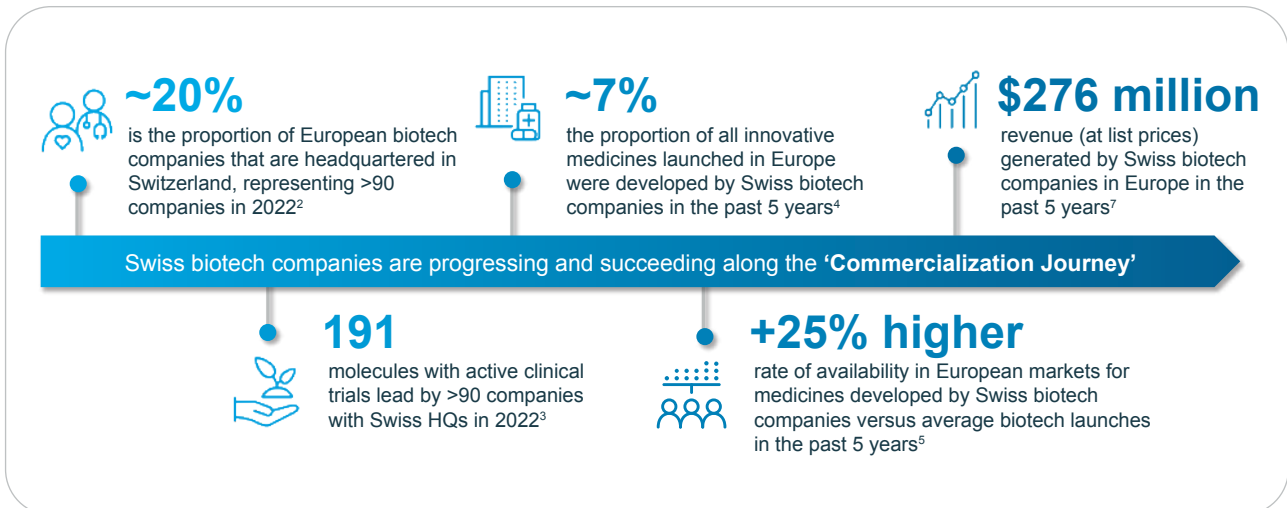


Figure 1: Key highlights of Swiss biotech companies

Continuing the success of Swiss biotech into the future

Continued investment

2021 marked a peak in venture capital funding that has not been matched in 2022 at the global level.¹ Based on the recently published Swiss Venture Capital report,⁸ the Swiss biotech sector remains fourth in the world in terms of invested capital in 2022 after ICT (Information and Communication Technology), intech and Cleantech.

In 2022, five out of the 20 largest financing rounds were biotech companies, including ImmunOs Therapeutics, a late-stage biotech company that focuses on leukocyte antigens (HLA) to stimulate both the innate and the adaptive immune systems of cancer.⁸

Novel research

Globally, Switzerland and Japan represent a higher share of the late-stage pipeline than early-stage, with companies having more drugs per company on average than in other regions. This indicates that the coming years will be focused on the commercialization of Swiss-led molecules. At the same time, Switzerland’s position as the highest ranked country per capita in early-stage development demonstrates that creating a long-term pipeline has not been neglected.

“Switzerland provides a unique ecosystem of highly qualified talent, a diversity of trusted partners, business friendly regulation and accessibility to major academic and innovation hubs around the world. These criteria are key for business growth and among the key factors Blueprint Medicines considered when opening our European headquarters in Zug.”

Francesc Almirall Alzamora, Director Commercial Operations & Launch Excellence at Blueprint Medicines.

How Switzerland is contributing to the commercial success of biotech companies worldwide

CONTINUED

The growth that we expect to see in the number of first launches is partially driven by the increase in the number of orphan drug approvals. Given the reduced commercial footprint needed to launch in these indications, we tend to see many first launches concentrated in orphan indications. Research shows that of those 10 first launches in Europe, 60% were in orphans over a period when the number of orphan drug approvals has more than quadrupled from 2011 to 2018.⁹

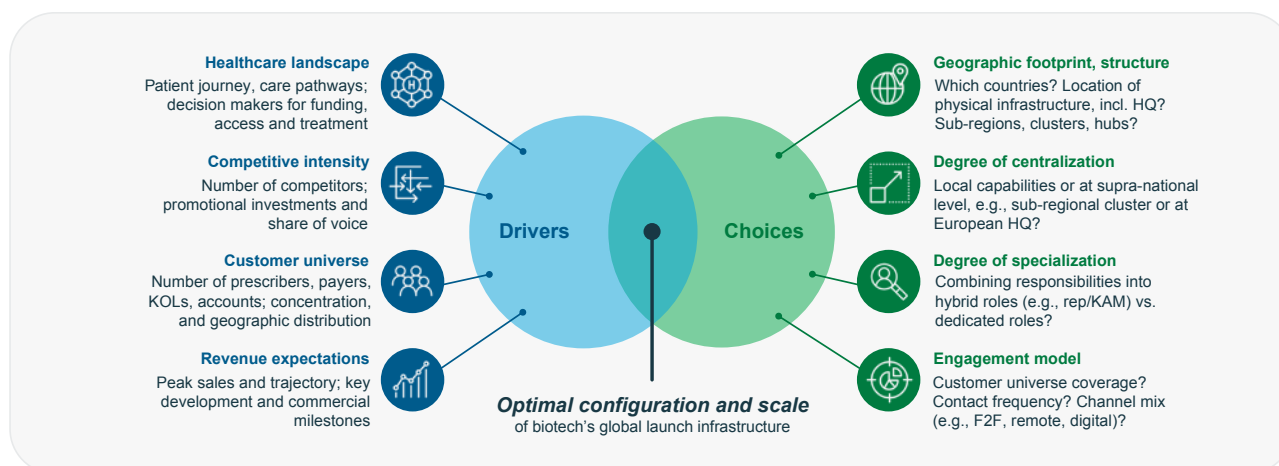


Figure 2: Drivers of biotech's global commercial infrastructure and key choices

Commercial and market access drivers and choices

It is not uncommon for commercialization to be low on the list of initial priorities for biotechs, with budgets often very limited prior to Phase III readout. Consequently, biotechs tend to be late in starting key commercialization activities and often find themselves having to catch-up and deliver against compressed timelines. This challenge sets up biotech-specific success factors for commercialization such as: the need for flexible cost structures; the ability to ramp-up resource fast to plug capability gaps; and the ability to address the question of the optimal infrastructure model (what are the key drivers and choices to establish an agile and scalable commercial infrastructure?).

In our extensive work with biotech companies, we have observed common infrastructure choices made in preparation for a European launch such as the engagement model, the degree of centralization, the degree of specialization of roles and the geographic footprint and structure. As mentioned earlier, many biotechs based outside Europe choose Switzerland for setting up their European HQ, driven by a business-friendly environment and a deep talent pool, including individuals who honed their skills and gained relevant launch experience at big pharma, or indeed another, commercial-stage biotech.¹⁰

Many drivers determine the requirements for a fit-for-purpose commercial model such as the competitive intensity, the share of the customer universe, the commercial roadmap to reach revenue expectations for the launch and the local healthcare landscape including regulatory changes. In the future, access to new therapies will be impacted by major regulatory changes such as the Inflation Reduction Act (IRA) in the US and the adoption of the legislation for joint European Health Technology Assessment (EU HTA). The intention of new regulations, specifically EUnetHTA, is to establish guidelines but a challenge remains on how to align with the requirements of all Member States.¹¹

Uncertainties related to the development of new regulations and the macro-economic environment will create new challenges and opportunities for all countries, including Switzerland. Switzerland remains ahead of much of the world and a leader within Europe in terms of clinical and development activities, but the continued success of the industry is based on availability of funds, continued investment in research activities, a local support to build the optimal infrastructure and the continued willingness to approve novel therapeutics by international payers. The development pipeline suggests Swiss biotech companies will continue to be at the forefront of the biotech sector and expand their contribution worldwide.

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“It is essential to share with the public the importance and success factors of biotech companies and ensure that decision-makers understand what it takes for the industry to develop and remain competitive,”

says Michael Altorfer, CEO of the Swiss Biotech Association.

“Young talent should be inspired and motivated to take a closer look at the great variety of career profiles in biotech.”

Celebrating and honoring outstanding contributions to the industry

The Swiss Biotech Success Stories Awards are presented each year at Swiss Biotech Day to honor those who have made important and sustainable contributions to the biotech industry in Switzerland. The awards reflect the diversity and achievements of this innovative sector.

Switzerland is one of the world's leading biotech hubs and attracts many foreign companies, specialists and investors. It provides over 50'000 jobs and, together with the pharmaceutical and chemical industries, accounts for almost half of Swiss exports. To make the industry's impact more visible, the Swiss Biotech Success Stories initiative was launched in 2018. Selected success stories are showcased to illustrate how Swiss biotech companies help patients, improve healthcare worldwide, and make a valuable and significant contribution to the Swiss and global economy.

Laureates are individuals or groups of extraordinary merit in scientific, translational, medical or commercial fields, that have a positive impact on the biotech and life science industry and society in Switzerland.

12 success categories

- Completed achievement with lasting impact
- Scientific breakthrough
- New technology
- Strong impact on society
- Product approval and sustainable revenues
- Important IP, innovative deal-making, acquisition
- Involvement of one or more Swiss citizens
- Swiss-based company / institution
- Creation of jobs in Switzerland
- Other aspect with a direct link to Switzerland
- Enabler for the biotech industry
- Swissness: Think global, made in Switzerland

This year's winners of the Swiss Biotech Success Stories Awards are SOPHiA Genetics and Humabs BioMed. They are prime examples of Swiss-based companies addressing major global challenges in the fields of infectious diseases and personalized medicine.



Genedata and Etienne Jornod - winners of the Swiss Biotech Award 2022



Swiss Biotech Success Stories Award winner 2023

SOPHiA GENETICS



SOPHiA GENETICS - generating clinically actionable insights and improved patient outcomes from a global data-sharing network

SOPHiA GENETICS was founded to generate clinically actionable insights from data to improve patient outcomes. The company's mission is to provide equal access to knowledge and capabilities by democratizing data-driven medicine.

SOPHiA GENETICS has purposefully built a cloud-based software-as-a-service (SaaS) platform capable of analyzing data and generating insights from complex data sets and different modalities. The platform standardizes, computes, and analyzes digital health data and is installed across decentralized locations to break down data silos.

Using data-driven medicine, healthcare professionals supplement their own experience with data insights and shared knowledge from their peers to inform the best course of action for their patients or research.

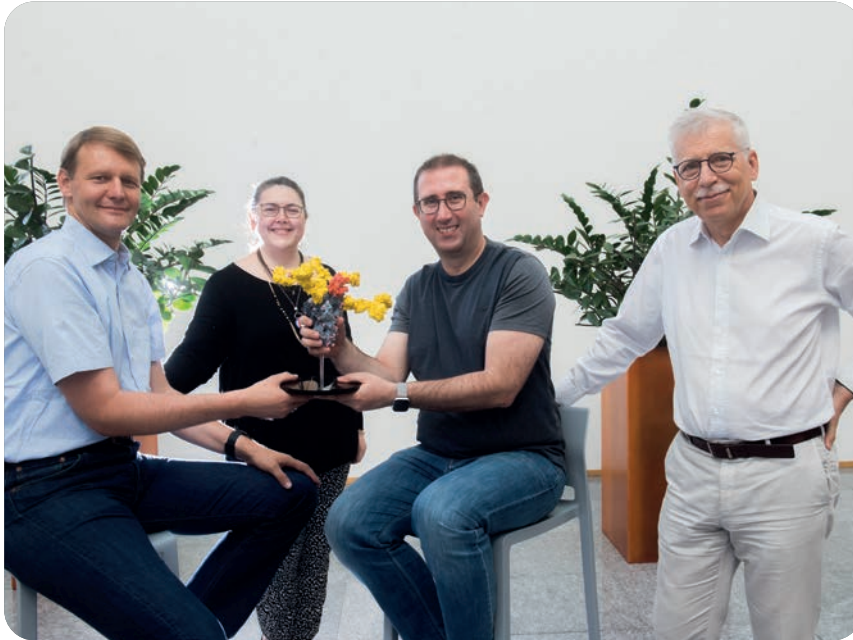
The goal is to empower clinicians and researchers around the world to practise data-driven medicine and improve clinical and scientific outcomes. SOPHiA GENETICS believes that a decentralized platform is the most powerful and effective solution to create the largest network, leverage data, and bring the benefits of data-driven medicine to customers and patients globally.

“From its inception, SOPHiA GENETICS has identified opportunities for innovation in the healthcare industry that would significantly improve patients’ care. We’re committed to making a difference. Our corporate DNA, rooted in quality, precision, and robustness, is the key to our success and a promise of hope for millions worldwide.”

Jurgi Camblong, Co-Founder & CEO of SOPHiA GENETICS

Swiss Biotech Success Stories Award winner 2023

Humabs BioMed, a wholly owned subsidiary of Vir Biotechnology



Humabs BioMed, a pioneer in the discovery, engineering, and early development of human monoclonal antibodies to fight infectious diseases.

As a wholly owned subsidiary of Vir Biotechnology (Nasdaq: VIR), Humabs BioMed and its immunologic expertise and cutting-edge technology is enabling the delivery of innovative solutions to address the world's most serious infectious diseases.

The antibodies discovered and developed by Humabs have helped Vir transform the infectious disease landscape. From Ebola to COVID-19, their success in delivering novel commercialized medicines has given Vir the financial strength and experience needed to advance its robust pipeline.

Humabs is recognized for its pioneering role in the discovery, engineering, and early development of human monoclonal antibodies to fight infectious diseases. The world class scientific team at Humabs has published its scientific discoveries in dozens of prestigious peer-reviewed scientific journals such as Science, Nature and Cell.

Humabs was co-founded in 2004 by Dr. Antonio Lanzavecchia, a renowned immunologist and founding director of the Institute for Research in Biomedicine (IRB) in Bellinzona, and Dr. William J. Rutter, an industry veteran, academic and successful entrepreneur. It was acquired by Vir in 2017 and its antibody discoveries play an important role in collaborations with institutions such as the U.S. Biomedical Advanced Research and Development Authority.

2023 will be a pivotal year for Vir, with Phase II data readouts expected for three of the company's advanced development programs in flu, hepatitis B and hepatitis D virus infection – all clinical trials evaluating investigational monoclonal antibodies that came out of the work at Humabs in Bellinzona.

“Guided by science, we relentlessly build on our immunologic expertise and technologies in pursuit of transformative medicines to help patients worldwide facing serious infectious diseases. Our discoveries and innovations are the result of the passion and dedication of our team of world-class scientists.”

Filippo Riva, Managing Director of Humabs BioMed

Independent jury of experts



Luca Bolliger

President of the jury
Vice President Swiss Biotech
Association



Patrick Aebischer

Entrepreneur
Former President of EPFL



**Stefanie
Flückiger-Mangual**

CEO and Co-Founder
Tolremo



Gabrielle Gache

Head of Business
Development (EMEA)
Santen Pharmaceuticals



Seraina Gross

Business Journalist
Handelszeitung



Chandra P. Leo

Investment Advisor Private
Equity HBM Partners



Daniela Marino

CEO and Co-Founder
Cutis



Jürg Zürcher

Independent biotechnology
leader and expert



Thomas Staffelbach

Secretary of the jury
TS Kommunikation

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Hall of fame 2019 - 2022



Headquartered in Allschwil, Actelion is part of the Johnson & Johnson Family of Companies. Its groundbreaking research and medicines have been a key contributor to improve the lives of people affected by pulmonary hypertension, and have made Actelion an industry leader in this area.



Bachem is a leading manufacturer of peptides and oligonucleotides. The company has grown over 50% in the last five years and now offers more than 5,500 different biologically active peptides amino acid derivatives and oligonucleotides. Its investment plans call for the investment of over USD 400M to continue to pursue its growth strategy.



Basilea Pharmaceutica is a leader in novel antibiotics and antifungals. Since its listing in 2004 (SIX: BSLN), Basilea has launched two anti-infective treatments: Cresemba (isavuconazole) for invasive fungal infections and Zevtera (ceftobiprole), an antibiotic for severe hospital bacterial infections.



Headquartered in Zug, Biogen has been a key stimulus and model for the biotech industry. Its best-selling drug against multiple sclerosis or its latest Alzheimer's candidate, as well as the new production facilities in Luterbach, creating 600 new jobs, are proof of Biogen's success.



Family-owned Debiopharm from Lausanne, identifies high-potential compounds in oncology and for the treatment of bacterial infections. They are tested in clinical development and licensed to business partners globally. Over a million patients benefit from their therapies every year.



ESBATEch, now a Novartis company, is recognized for its pioneering role in developing single-chain antibody fragments for ophthalmic indications. The most advanced product from the ESBATEch platform received marked approval by the FDA in October 2019 and shortly thereafter in all major markets.

Hall of fame 2019 - 2022



Etienne Jornod, Swiss entrepreneur, was Executive Chairman of the Vifor-Galenica Group delivering 25 consecutive double-digit net profit growth, supporting millions of patients and creating thousands of jobs. In 2020, he acquired OM Pharma with friends, aiming to create a unique biopharmaceutical company based on bacteria lysates expertise.



Genedata, global market leader for software solutions that digitalize data-rich and complex bio-pharmaceutical R&D processes, enables an R&D revolution driven by precision medicines and artificial intelligence approaches. It helps the industry to deliver innovative biotherapeutics, vaccines and cell & gene therapies faster.



The Schlieren-based company is an integral part of Roche Pharmaceutical Research and Early Development since 2005, and a pioneer in antibody engineering in cancer immunotherapy. Its antibody glycosylation technology increases immune-mediated cancer cell killing and builds the basis for improved cancer medicines.



Helsinn, an important employer in Ticino, has a broad portfolio of marketed cancer care products and a deep development pipeline. It has built significant R&D and manufacturing capacities, also advances patient care and supports healthcare innovation with its investment fund.



Lonza is a global leader in contract development and manufacturing services with strong R&D capabilities and world-class facilities across five continents. In 2020, Lonza supported more than 820 pre-clinical and clinical small and large molecules, more than 245 commercial small and large molecules and produced 230 billion capsules.



Founded by the renowned immunologist, Professor Bernard Mach MD PhD, privately-owned Novimmune is a leading light in the discovery and development of fully-human, antibody-based drugs used to fight autoimmune and inflammatory diseases and cancer.

Hall of fame 2019 - 2022



Fully integrated into GlaxoSmithKline since 2013, Okairos from Basel developed innovative T-cell based vaccines for major infectious diseases such as malaria, hepatitis C, HIV, and Ebola. Its novel replication-incompetent adenovirus vectors could enable the development of important new vaccines and offer immunizations against illnesses that lack vaccines.



The advanced technologies in protein expression by Selexis provide biotech and pharmaceutical companies a rapid, stable, and cost-effective solution for the production of recombinant proteins. Nearly a hundred drug candidates in clinical development and three commercial products utilize the technologies of the Plan-les-Ouates-based company.



The trio of foundations has been supporting biotech startups with great success for more than 10 years, thereby making a significant contribution to the growth of the Swiss biotech industry. They share the nomination for the Swiss Biotech Success Stories Award.



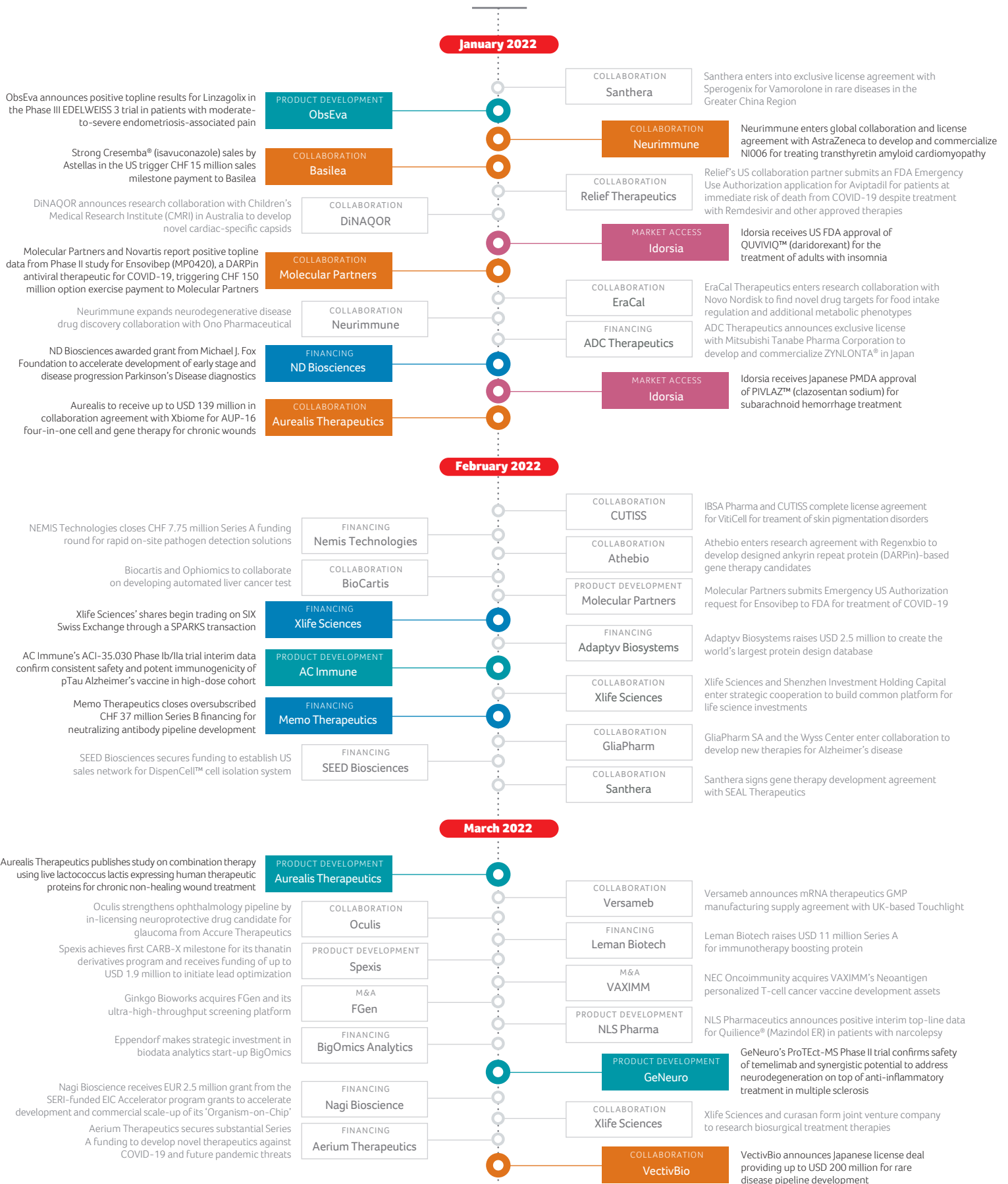
This transformational joint venture provides Vifor Pharma direct access to dialysis patients, facilitating the product distribution and recruitment for clinical development. It transformed the company from Glattbrugg rapidly into a global nephrology corporation. Such vertical integration is a role model for the convergence of different life science sectors.



Werner Arber, Swiss microbiologist and geneticist, won the 1978 Nobel Prize in Physiology or Medicine for his discovery of restriction endonucleases. His groundbreaking research in the field of molecular genetics was instrumental in the development of biotechnology.

Find more info at [swissbiotech.org/success-stories](https://www.swissbiotech.org/success-stories)

Swiss biotech events of 2022



April 2022

ADC Therapeutics receives permanent J-Code for ZYNLONTA® (J9359) from US Centers for Medicare & Medicaid Services
MARKET ACCESS
ADC Therapeutics

MoonLake Immunotherapeutics goes public on NASDAQ via SPAC and reaches valuation of USD 192.24 million
FINANCING
MoonLake Immunotherapeutics

GeNeuro and FondaMental Foundation announce the first collaboration results in the development of diagnostic and therapeutic options for patients with post-COVID neuropsychiatric syndromes
PRODUCT DEVELOPMENT
GeNeuro

SOPHIA GENETICS hits milestone of One Million Genomic Profiles analyzed by the SOPHIA DDM™ platform
COLLABORATION
SOPHIA GENETICS

Numab Therapeutics signs a CHF 258 million immuno-oncology licencing deal with Ono Pharmaceuticals
COLLABORATION
Numab Therapeutics

CDR-Life closes USD 76 million Series A funding to support advancement of T-cell engagers
FINANCING
CDR-Life

Cimeio Therapeutics raises CHF 46 million for cell-shielding technologies development
FINANCING
Cimeio Therapeutics

Basilea announces licensing of a novel first-in-class antifungal program from Fox Chase Chemical Diversity Center, Inc.
COLLABORATION
Basilea

May 2022

BioVersys completes Phase I clinical trial of BV100, an injectable formulation of rifabutin for treatment of serious bacterial infections
PRODUCT DEVELOPMENT
BioVersys

Engimmune Therapeutics raises CHF 15.5 million in seed financing to develop novel T-cell receptor therapeutics
FINANCING
Engimmune Therapeutics

New study led by Memorial Sloan Kettering Cancer Center shows Idylla™ GeneFusion assay enables more rapid screening of targetable fusions compared to routine methods
PRODUCT DEVELOPMENT
BioCartis

Gnubiotics signs microbiome innovation strategic partnership with ADM
COLLABORATION
Gnubiotics

AC Immune CEO Andrea Pfeifer receives Aenne Burda Award in recognition of her work in the field of neurodegenerative diseases
AWARD
AC Immune

Wyss Zurich receives further CHF 100 million for bionic technologies research combining regenerative medicine and robotics
AWARD / FINANCING
Wyss Zurich Translational Center

Idorsia's Phase III study with aprocitentan demonstrates significant antihypertensive efficacy in patients with resistant hypertension
PRODUCT DEVELOPMENT
Idorsia

Idorsia's new treatment QUVIVIQ™ (daridorexant) launched in the US for adults living with insomnia
MARKET ACCESS
Idorsia

Asceneuron receives second grant from Michael J. Fox Foundation to accelerate clinical development of O-GlcNAcase (OGA) inhibitor for Parkinson's disease
FINANCING
Asceneuron

AC Immune publishes positive Phase Ib anti- α -beta Down's syndrome vaccine results
PRODUCT DEVELOPMENT
AC Immune

MoonLake Immunotherapeutics publishes long-term Phase Ib data from sonelokimab Nanobody® psoriasis trial
PRODUCT DEVELOPMENT
MoonLake Immunotherapeutics

Nouscom and Janssen collaboration leads to successful VAC85135 cancer vaccine IND clearance
COLLABORATION
Nouscom

Anokion announces positive data from ACeD Phase I clinical trial evaluating KAN-101 as a treatment for celiac disease
PRODUCT DEVELOPMENT
Anokion

June 2022

ImmunOs Therapeutics raises USD 74 million Series B financing round to develop cancer and autoimmune therapies from its HLA-based technology platform
FINANCING
ImmunOs Therapeutics

TOPADUR and University Hospital / University of Zurich awarded a CHF 600'000 Innosuisse grant to develop new therapeutic approach to diabetic retinopathy.
FINANCING
Topadur

ADC Therapeutics announces positive results from pivotal Phase II clinical trial of camidanlumab tesirine (Cami) in relapsed or refractory Hodgkin lymphoma
PRODUCT DEVELOPMENT
ADC Therapeutics

Aurealis Therapeutics reports 83% patients receiving lead therapeutic dose achieved complete healing in Phase I study of AUP-16 in non-healing diabetic foot ulcers
PRODUCT DEVELOPMENT
Aurealis Therapeutics

Cresemba® sales in Asia Pacific region trigger sales first USD 1.25 million milestone payment to Basilea from Pfizer
MARKET ACCESS
Basilea

Biocartis announces launch of its CE-marked Idylla™ GeneFusion Panel for rapid treatment decisions in lung cancer
MARKET ACCESS
Biocartis

Novaremed publishes Phase I and Phase IIa study data with NRD.E1 demonstrating the potential of this investigational non-opioid pain treatment
PRODUCT DEVELOPMENT
Novaremed

Basilea announces approval for additional formulation of antifungal Cresemba® (isavuconazole) in China
MARKET ACCESS
Basilea

Verve Ventures announces closing of its first fund at CHF 45 million
FINANCING
Verve Ventures

Kinarus Therapeutics goes public at SIX Swiss Exchange, through a reverse merger with Perfect Holding
FINANCING
Kinarus Therapeutics

Invasight closes CHF 4.5 million oversubscribed seed round to accelerate development of protein-protein interaction antagonists (PPIAs) against invasive cancers
FINANCING
Invasight

BioVersys secures CHF 24.2 million financing for development of AMR clinical pipeline
FINANCING
BioVersys

CRISPR Therapeutics presents positive results from its Phase I COBAL™-LYM trial of CTX130™ in relapsed or refractory T-Cell malignancies
PRODUCT DEVELOPMENT
CRISPR Therapeutics

Limula takes technical lead of EIC-funded European PAT4CGT consortium developing modular cell & gene therapy manufacturing platform
COLLABORATION
Limula

ObsEva announces European Commission Marketing Authorization for Ysely® (linzagolix), an oral GnRH antagonist, for the treatment of uterine fibroids
MARKET ACCESS
ObsEva

Kinarus Therapeutics' KIN001 shows strong antiviral activity against SARS-CoV-2 and variants of concern
PRODUCT DEVELOPMENT
Kinarus Therapeutics

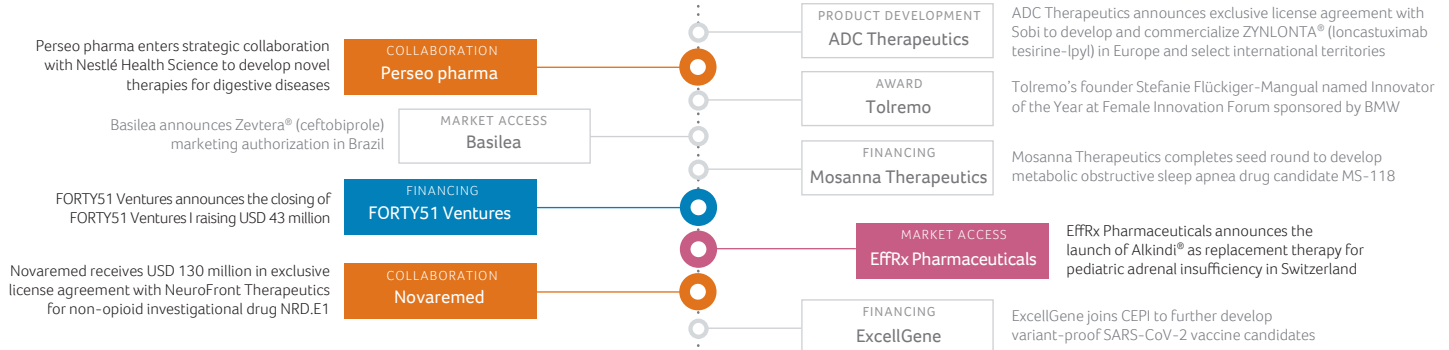
Biocartis announces new agreement with AstraZeneca for the development and marketing of a companion diagnostic for Tagrisso®
COLLABORATION
Biocartis

Lonza and Adva Biotechnology agree to expand availability and use of automated bioreactors through license to Lonza's patents
COLLABORATION
Lonza

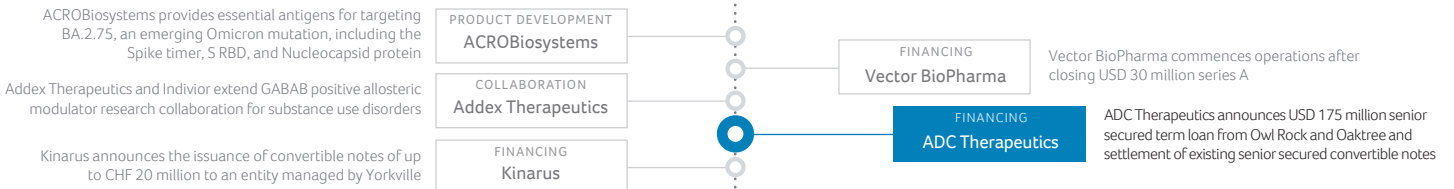
VectivBio announces closing of USD 54 million aggregate financing
FINANCING
VectivBio

Swiss biotech events of 2022

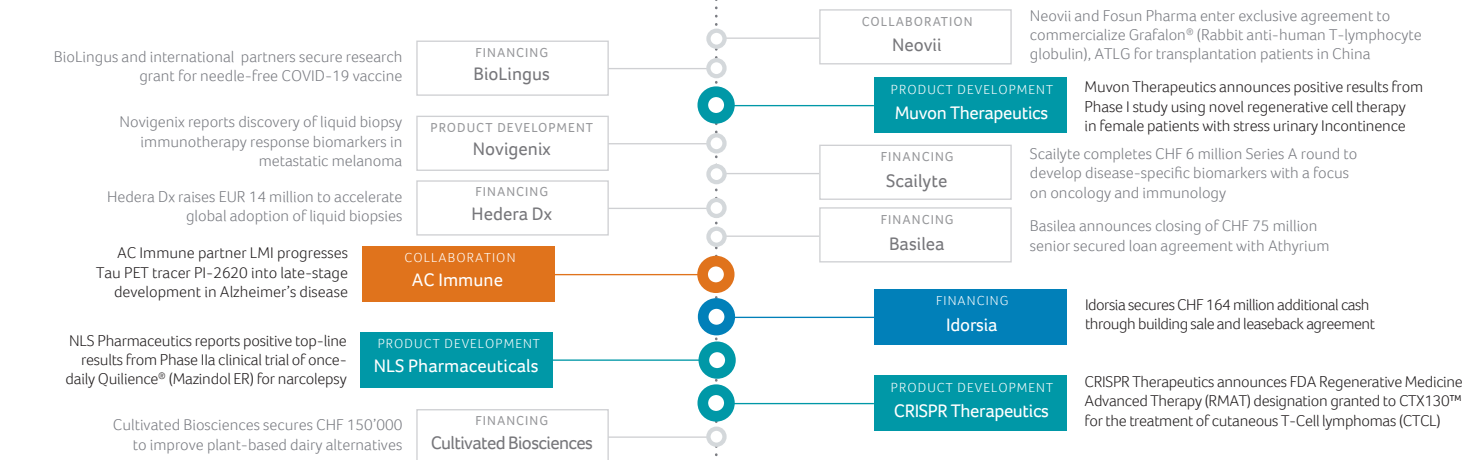
July 2022



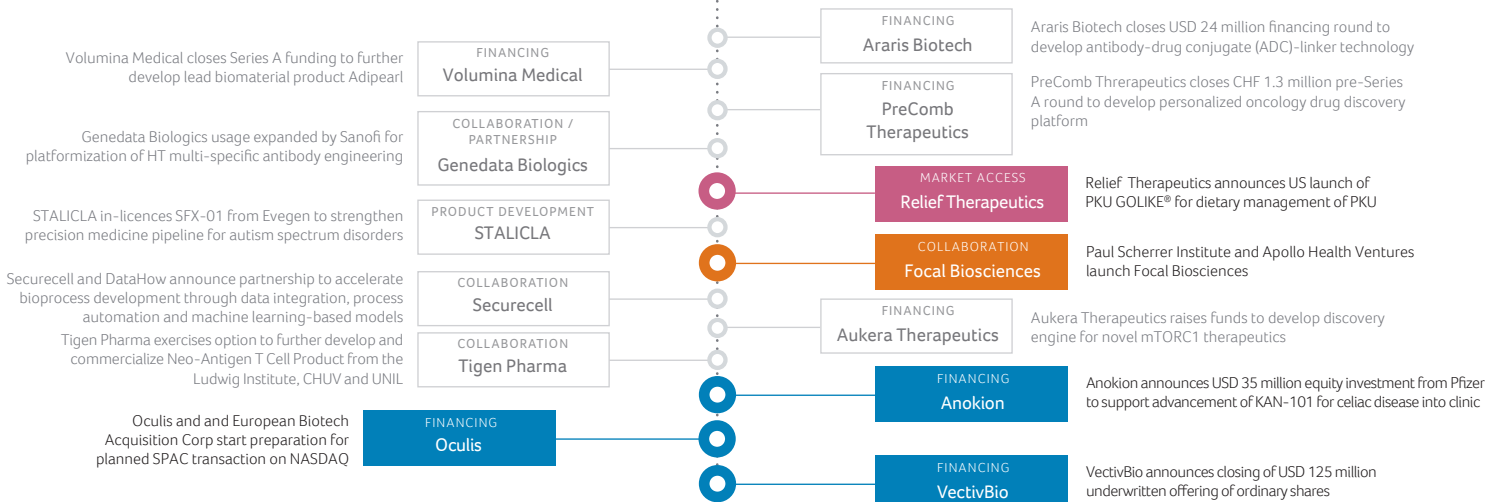
August 2022

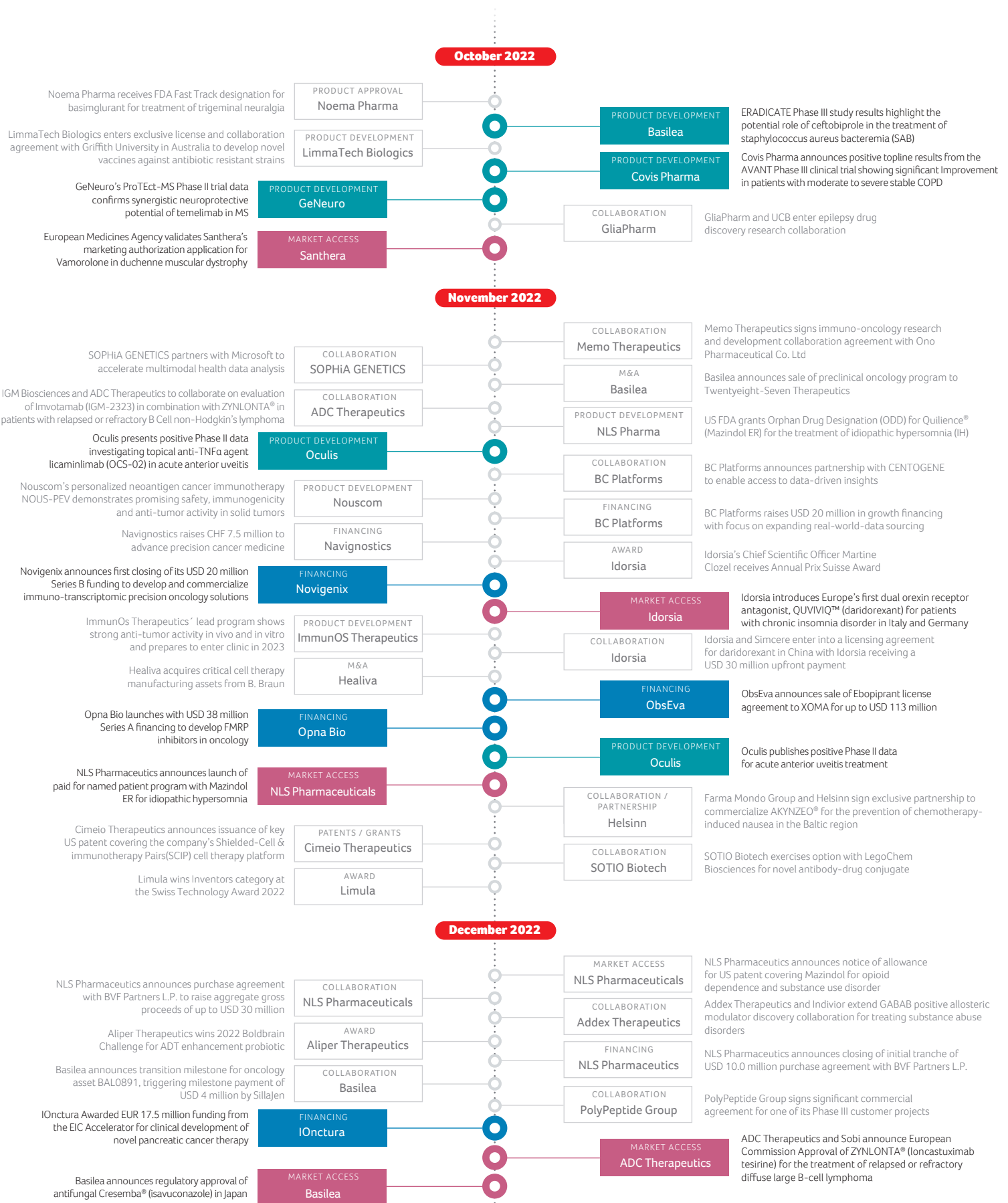


September 2022



October 2022





Disclaimer: Please note that the above presented information is only a selection of publicly available information. We therefore cannot guarantee that all events are included in the above summary for 2022.

Contributors' profiles

Swiss Biotech Association

The Swiss Biotech Association has represented the interests of the Swiss biotech industry since 1998. To support its members in a competitive market, the Swiss Biotech Association works to secure favorable framework conditions and facilitate access to talents, novel technologies and financial resources. To strengthen and promote the Swiss biotech industry, the Swiss Biotech Association also collaborates with numerous partners and life science clusters globally under the brand Swiss Biotech™.

www.swissbiotech.org

EY

EY is a global leader in assurance, tax, transaction and advisory services. The insights and quality services we deliver help build trust and confidence in the capital markets and in economies the world over. Our Global Life Sciences Sector brings together a worldwide network of 23'000 sector-focused professionals to anticipate trends, identify their implications and help our clients create competitive advantage. We can help you navigate your way forward and achieve sustainable success in the new health-outcomes-driven ecosystem.

www.ey.com/lifesciences

scienceindustries

scienceindustries is the Swiss business association of chemistry, pharma and life sciences. It supports around 250 member companies: fostering an innovation-friendly environment in Switzerland, creating a competitive production and business framework, enabling attractive market conditions, and facilitating worldwide market access.

www.scienceindustries.ch

Swiss National Science Foundation

The Swiss National Science Foundation (SNSF) is Switzerland's foremost research funding agency. In accordance with its government mandate, the SNSF supports scientific research in all disciplines, from physics to medicine to sociology. Each year the best projects are awarded around CHF 900 million in total based on rigorous evaluation processes. The SNSF supports 5'500 projects involving 20'000 researchers at year-end 2022.

www.snsf.ch

Swiss Federal Institute of Intellectual Property

The Swiss Federal Institute of Intellectual Property (IPI) is the federal center of competence for patents, trademarks, geographical indications, design, and copyright. Individuals and companies can register their inventions and creations with the IPI to protect them from being copied. In addition to this, the IPI informs the public about the IP rights system of protection. It also fulfils a political mandate in all areas of intellectual property in that it prepares legislation, advises the federal authorities, and represents Switzerland within international organisations and vis-à-vis other countries.

www.ige.ch

biotechnet

biotechnet Switzerland helps industry access high-caliber competences in biotechnology from Swiss universities of applied sciences, universities, and research and technology organizations. Industrial partners including small, medium and large enterprises can rely on our proven expertise and outstanding infrastructure to support innovative research & development projects. We are also a premium partner to address continuing education needs

www.biotechnet.ch

Swiss Academy of Engineering Sciences SATW

SATW is a network of engineering experts contributing to the progress and competitiveness of the Swiss economy. Positioning Switzerland in a leading role is one of the key goals of the academy, and we work to identify promising technologies and assemble the best experts to foster innovation. SATW is also the leading Swiss organization for encouraging young women to pursue a career in a technical field.

www.satw.ch

SIX

SIX Swiss Exchange operated by SIX, is the leading European exchange for companies from the life sciences sector. The exchange is the fourth largest overall in Europe in terms of both free float market capitalization and trading volume. It hosts 3 of the 5 highest capitalized companies in Europe and with Sparks - the new equity segment for small and medium-sized companies - the Swiss stock exchange is also the ideal place to list when it comes to growing your SME.

www.six-swiss-exchange.com

Swissmedic

Swissmedic, the Swiss Agency for Therapeutic Products, is the Swiss authority for the authorization and monitoring of therapeutic products (medicinal products and medical devices). The Agency is attached to the Federal Department of Home Affairs, is independently organized and managed, and has its own budget. Statements made in the Swiss Biotech Report represent the view of Swissmedic from the regulatory perspective.

www.swissmedic.ch

Switzerland Global Enterprise

Switzerland Global Enterprise (S-GE) is mandated by the Swiss government for export and investment promotion. In its role as a center of excellence for internationalization, its mission is to help Swiss SMEs develop new potential for their international business and to strengthen Switzerland as an economic hub. S-GE assists foreign companies in evaluating Switzerland as a business and technology location, and together with its cantonal partners helps companies during the entire site selection and incorporation process.

www.s-ge.com/invest-biotech

Guest Contributor – IQVIA

IQVIA (NYSE:IQV) is a leading global provider of advanced analytics, technology solutions and clinical research services to the life sciences industry. IQVIA creates intelligent connections to deliver powerful insights with speed and agility — enabling customers to accelerate the clinical development and commercialization of innovative medical treatments that improve healthcare outcomes for patients. With approximately 86'000 employees, IQVIA conducts operations in more than 100 countries.

www.iqvia.com

The contributors have been listed in order of appearance in this report

“Swiss inventions contribute disproportionately to the global biotech portfolio with regard to both quality and quantity. However, the majority of them are in fact the result of international collaborations.”

Christian Moser

Swiss Federal Institute
of Intellectual Property

“In 2022 biotech companies provided two-thirds of the global R&D pipeline. Biotechs now generate over 90% of cell, gene, and RNAi technologies, and are responsible for more than 1’500 oncology medicines in development worldwide.”

Isma Hachi

IQVIA

“Many of the most important recent scientific discoveries, such as the ability to produce monoclonal antibodies in useful quantities, were achieved through basic research and widely distributed knowledge.”

Florian Fisch

Swiss National Science Foundation

“By supporting promising medical innovations at an early stage, Swissmedic aims to contribute to the success of Switzerland as a center of research – to help those patients for whom adequate treatments are not yet available.”

Jörg Schläpfer

Swissmedic

Impressum

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