

Report of the Foundation Council's working group on the unique contributions of SIB

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Executive summary

SIB's blend of bioinformatics proficiency, networking, and training is key to its success, serves as a model in other countries, and could also serve as a model for other domains within Switzerland. SIB provides expertise in life science data and generates essential knowledge, tools, and services to advance research in many fields, from biodiversity and evolution to medicine. The institute promotes FAIR and open research data, as well as collaborations across the national and international life science landscape.

The working group identified the unique contributions of SIB, which broadly fall into four activities:

- 1) developing open resources of global impact,
- 2) connecting Switzerland to international data infrastructures,
- 3) providing postgraduate training contributing to a skilled workforce in Switzerland, and
- 4) fostering a Swiss bioinformatics network of 88 affiliated groups across 28 institutions.

In addition, the working group discussed the evolving role of SIB in the development of innovative national research data infrastructures. The activities, intertwined and synergetic with one another, contribute in a major way to Switzerland's competitiveness and standing in data-intensive life science research. In the future, SIB should focus on these core activities, and thus contribute to the defragmentation and strengthening of the life sciences' data ecosystem in Switzerland.

Table of content

1.	Context and objectives of the working group.....	2
2.	Methodology	2
3.	Unique contributions of SIB for Switzerland	2
4.	Contribution of SIB to innovative national life science research infrastructure	6
5.	Synergies among the SIB activities.....	8
6.	Conclusions.....	9
	Appendices	10

1. Context and objectives of the working group

The President of the Foundation Council (FC), Simone de Montmollin, established a working group including members of the FC to reflect on the opportunities for SIB to continue to serve the Swiss life science and health community. The working group was tasked to identify the unique contributions of SIB for Switzerland. The working group evaluated the impact, risks, and governance of each of the identified core activities of SIB on Switzerland and its overall global positioning. These core activities were further analysed in a broader context to identify their synergies and cross-links and how they are positioned within the Swiss landscape.

2. Methodology

The working group held four meetings between December 2022 and April 2023, two of which were held in person in Bern, and the other two by videoconference. Background documentation and reports were provided to the working group members.

3. Unique contributions of SIB for Switzerland

The working group identified **four activities** which constitute important and unique contributions of SIB for Switzerland, presented in no particular order.

3.1. Open resources

SIB has pioneered the provision of open resources (databases, knowledgebases, tools) in life sciences. Among the rich ecosystem of resources developed in Switzerland, SIB carefully selects a subset to be part of its portfolio. SIB then provides not only specific expertise to the resources, but also a range of high-quality, innovative services that are unique in the field. In so doing, SIB supports the promotion of excellence in resource development and operation¹.

Impact:

- Data and knowledge resources are key to enable open research data (Appendix A1.1).
- SIB operates 14 resources of global importance (Appendix A1.2), representing 37 tools and knowledge bases serving over 10M users in 2022, gathering over 18,000 citations per year in scientific publications.²
- SIB resources are key for R&D and innovation as well (~9000 patents cite SIB resources). For the last 25 years, SERI has invested in Swiss biodata resources through SIB as an effective way to increase the country's competitiveness in particular in the domains of cutting-edge research in genomics, proteomics, and other -omics technologies.
- Relevance of open resources and data sharing for societal challenges such as loss of biodiversity or pandemic preparedness (V-pipe, Nextstrain).
- Thanks to this investment, these resources can access NIH and EU funding (CHF ~4.5M per year), as well as matching contributions.

¹Gabella et al, *Managing the life cycle of a portfolio of open data resources at the SIB Swiss Institute of Bioinformatics* Brief Bioinform 2022, 23:1 <https://doi.org/10.1093/bib/bbab478>

² 2021 figure from Clarivate Web of Science. In 2022, UniProt/Swiss-Prot accounted for 77% of all visitors, 17% of all citations, and 58% of the SERI funds allocated to resources.

- Switzerland benefits from international visibility and reputation for long-term engagement into data-intensive life sciences and high-quality data and tools. This has implications on the attractiveness of the country for world-class scientists and international funding.
 - The need for SIB resources grows rapidly (doubling of usage in the last 5 years). Researchers in Switzerland and around the world benefit from these high quality resources to analyse and interpret biological data.
 - SIB Resources are internationally recognised, with 5 of them recognized by ELIXIR as Core Data Resources and 5 of them as Global Biodata Core Resources (GBCR), placing Switzerland on the 3rd rank after USA and UK (which includes the European Bioinformatics institute) (data as of 1.01.24).
- Exceptionally high return on investment: a 2021 report about the EMBL-European Bioinformatics Institute estimates the multiplicative factor to range from 11 to 102 folds³.

Financing:

SERI funds: CHF 7 million per year

enabling a leverage effect in competitive grants and in-kind contributions of CHF 6.1 million per year.

Governance:

Selection of resources by the SIB Board of Directors based on assessment by an international scientific advisory board, under the oversight of the SIB Foundation Council. The SERI subsidy is under the oversight of SERI with an evaluation by the Swiss Science Council.

3.2. Connecting Switzerland to international life science data infrastructures

Switzerland is a trusted partner in several European and international initiatives (Appendix A1.3). SIB is a founding node of ELIXIR, the European infrastructure for life-science information. As the largest ELIXIR national node, SIB is major contributor to ELIXIR platforms and activities. SIB is also a founding partner of the Global Biodata Coalition (GBC), a forum for research funders to better coordinate and share approaches for the efficient management and growth of biodata resources worldwide, as well as the Global Alliance for Genomic Health (GA₄GH). SIB collaborates closely with the European Bioinformatics Institute (part of the European Molecular Biology Laboratory).

Impact:

- Reinforcing the integration of Switzerland to the rest of Europe and the world. SIB has a full member status within ELIXIR and GBC.
 - Enabling the participation of Switzerland to large international infrastructure projects and to the development of common data governance policies and services.
 - Avoiding isolation and potential misalignments or duplications, leading to Switzerland lagging European counterparts.
 - Access to staff exchanges, community and capacity building activities funded through ELIXIR.
- Linking SIB members distributed across 28 Swiss institutions to European counterparts. For instance, this activity has established strong links between Swiss researchers with European training facilities, as well as with biodiversity, 3D protein structure - highly relevant for drug design-, single-cell omics, and federated human data communities.

³ <https://www.embl.org/documents/document/embl-ebi-impact-report-2021/>



- Increasing interoperability of data and processes and reducing duplication through alignment between ELIXIR and the Swiss bioinformatics community, which is essential for open research data (Appendix A1.1).
- Pan-global partner projects such as ELIXIR-Beacon, ELIXIR-Cloud and AAI, federated European Genome-Phenome Archive (Appendix A1.3 and Appendix A1.5), stemming from ELIXIR and GA4GH.
- International recognition of SIB Resources and added value for the development of life sciences.

Financing:

SERI funds: 0.5 million per year

enabling a leverage effect in ELIXIR/EU grants and in-kind contributions by involved SIB members of 0.2 million per year.

Governance:

ELIXIR, GBC, EMBL and GA4GH have their own governance structures. SIB is involved in the leadership of ELIXIR, and SERI is represented on the boards of ELIXIR, GBC and the EMBL Council.

3.3. Training in bioinformatics and biological/health data science

SIB offers a range of education and training programs for bioinformaticians/computational biologists and more broadly for life scientists and physicians, which have helped to develop a skilled workforce in this area in Switzerland. SIB's training activity is characterized by its emphasis on practical, tailored, expert-led instruction that is accessible to all of Switzerland and beyond (in particular through e-learning). SIB is providing topical and high-quality courses on the latest methods, tools and languages to the community by building on its national network and its capacity to get both affiliated members and employees to deliver courses. The training program has turned into a big success, so that SIB is today a leading provider of bioinformatics training and education in the national and international landscape (Appendix A1.4). As depicted in the landscape, SIB complements the BSc/MSc teaching programs of universities, is involved in swissuniversities training projects, and has several ongoing international projects with training component.

Impact:

- 60 training events in 2022 (50% in person, 50% streamed), spanning 126 days of teaching, attended by a total of 14,01 researchers (51.8% women; 74.82% from CH, based in 16 different cantons; 3.6% from companies).
Collaborations with universities, CUSO, and NCCR programs - NCCR RNA & Disease, NCCR AntiResist and NCCR Microbiome - with whom the SIB training group organises courses⁴.
This is a great way for to gain international perspective and visibility around bioinformatics training.
- Increase of expertise and competitiveness of the Swiss workforce: SIB's training activities help to develop highly skilled bioinformatics researchers and professionals in Switzerland, which has a strong biotech industry that leverages bioinformatics to develop new drugs and therapies.

⁴ In 2021, Summer School on Computational RNA Biology for the PhD Training Network members and the NCCR RNA & Disease; in 2022 the Spring School Bioinformatics and computational approaches in Microbiology co-organized by the NCCR AntiResist, NCCR Microbiomes and the SIB PhD Training Network.



- A reference in Europe - involvement in ELIXIR training, EU grants, GOBLET network- and worldwide - part of the Education Committee of the International Society of Computational Biology, ISCB. SIB's training group is involved in several EU and Swiss projects, e.g. FAIRplus, Swiss Data Stewardship Environment.
- Open training at avant-garde of technology, with a blended learning approach that combines in person and online learning resources.
- Increased access to EU grants since Switzerland is out Horizon Europe framework.

Financing:

SERI funds: CHF 0.6million / year

enabling a leverage effect in registration fees, grants & in-kind contributions of 0.4 million / year

Governance:

The SIB training group has its own advisory committee ([members listed here](#)) and reports to the SIB executive director, who is under the oversight of the Board of Directors and the SIB Foundation Council. The SERI subsidy is under the oversight of SERI with an evaluation by the Swiss Science Council.

3. 4. Federation of Swiss bioinformatics research

SIB's network of affiliated group leaders (currently 88 groups across 28 institutions) and members (currently ~900) is an important component of its mission. By fostering collaboration and knowledge sharing, bringing together the resources and expertise in bioinformatics across the country, SIB contributes to drive progress and innovation in this rapidly evolving field. Furthermore, the common affiliation behind the SIB brand reinforces Switzerland's visibility in the world. National cohesion and international impact are achieved through the organisation of conferences and topical meetings, international awards, promotion of remarkable outputs, leading role within various ELIXIR committees, a national PhD network, as well as SIB focus groups and thematic meetings.

Impact:

- Increased inter-institutional collaboration and national cohesion in bioinformatics, to increase efficiency and avoid duplication of efforts.
- Increased international visibility, reputation, and attractiveness for Switzerland⁵ (~500 publications and ~70k citations per year with SIB affiliation).
- Development of SIB open resources in tight partnership with affiliated SIB groups, thus benefitting from the network's input as a raw substrate for new SIB resources (activity #1).
- The inclusion of the entire Swiss bioinformatic community provides legitimacy to SIB's international representation role in ELIXIR (activity #2).
- The network is also key to the success of the SIB training activity (activity #3), with SIB members involved in both teaching and learning.
- The network enables SIB to leverage the diverse expertise represented by 88 groups in research projects or collaboration with the industry.

Financing:

SERI funds: 0.5 million per year

enabling a leverage effect of in-kind contributions by the SIB members at 28 institutions.

⁵ <https://www.sbf.admin.ch/sbf/en/home/services/publications/data-base-publications/publications-08-20.html>

Governance:

- New SIB group leaders are voted in by the Council of Group Leaders and are ratified by the Foundation Council.
- The 28 institutions with SIB group leaders are represented at the Foundation Council.

4. Contribution of SIB to innovative national life science research infrastructure

Besides the four unique contributions outlined above, SIB has a successful track record of establishing nation-wide infrastructure for life science data. Between 2003 and 2017, it established and operated Vital-IT, a competence centre in bioinformatics for the universities of Geneva, Lausanne, Fribourg, and Bern as well as the EPFL. It operated a high-performance computing cluster for life scientists at these universities. This gave the impetus to these institutions to launch core facilities from 2017 onwards, freeing up Vital-IT to focus on cutting-edge bioinformatics to complement local services—including data stewardship and data analysis capacities available for national and international research projects.

In the period 2017-2024, SIB has been establishing the secure BioMedIT compute infrastructure for medical data and is contributing to the development of SPHN by operating its Data Coordination Center. This will be handed over to SAMS from 2025 onwards.

Since 2018, SIB co-develops the Swiss Pathogen Surveillance Platform to gather, annotate and share SARS-CoV-2 sequences collected in Switzerland to support variants tracking and epidemic surveillance by the FOPH as well as to share these sequences with the international research community.

Today, SIB's activity in establishing and operating research infrastructures for the life sciences is no longer unique but is rather done in partnership with the other actors. For the period 2025-2028, one of SIB's aims is to facilitate open research data in the life science domain in partnership with the relevant stakeholders. For instance, one project is the establishment of a Swiss Federated European Genome-phenome Archive (EGA) within a Swiss consortium (under the governance of SPHN, and involving notably SWITCH and the H2030 Genome Center, Appendix A1.5) that aligns to our European counterparts.

SIB also submitted a project to the SERI roadmap for infrastructure enabling the sharing and interoperability of biological research data in the country (see box below).

Impact:

- Collaborative, reliable, innovative, and neutral partner to establish new infrastructure at a national level - bridging cantonal universities and university hospitals, ETH domain, and other research institutions across Switzerland. Increased efficacy and efficiency in establishing new infrastructures spanning the country.
- Proximity to - and buy-in from - researchers through the network of 900 SIB members and international involvements (see activity #2) to ensure the developed infrastructure follow the needs of the research community and a vision on future needs is built.
- Agile structure enabling rapid infrastructure/platform implementation for emerging needs, such as the Swiss Pathogen Surveillance Platform (SPSP), which enable Switzerland to be among the leading countries worldwide for COVID-19 data deposition and sharing⁶.
- Lead in the implementation of the Swiss Federated EGA project and alignment to Europe through ELIXIR.
- Development and maintaining of a skilled and recognised workforce.

⁶ It ranked 4th worldwide at the height of the pandemic, and is now at the 5th place (<https://www.covid19dataportal.org>).

Financing:

SERI funds (excluding SPHN/BioMedIT): 1.1 million per year enabling a leverage effect in competitive grants (including ~10 EU projects), collaborations, and services of 4 million per year.

Governance:

- SPHN and BioMedIT have their own oversight boards, which will in the future be unified under the Swiss Academy of Medical sciences, itself being evaluated by SERI.
- The Swiss Federated EGA will be under the governance of the SPHN/DCC and will be aligned to the other European EGAs through the ELIXIR network.
- The remaining Centre of Excellence activities are overseen by the SIB management, SIB Board of Directors, SIB Foundation Council, as well as SERI.

SwissBioData ecosystem: a new research infrastructure submitted to the 2023 SERI roadmap

For the period 2025-2028, SIB aspires to be a key contributor to the SwissBioData ecosystem initiative to facilitate FAIR and open research data in life sciences across 18 institutions (Appendix A1.6). The new research infrastructure received top marks in the scientific review by SNSF.

Additional requested budget for SIB. SERI funds: 2.35M/y. Leverage effect: SIB plays an enabling role in this project (total 22.5M/y, including user fees)

Impact:

- Coordination of 54 data producing and data processing units across Switzerland, thereby facilitating collaboration, increasing quality of service, and reducing duplications.
- Support for researchers to FAIRify their data, workflows, and artificial intelligence models.
- Building on SIB's successful track record in helping build national-level research infrastructure (the evaluation panel for the Swiss Roadmap for Research Infrastructures stated: "The fact that SwissBioData ecosystem is coordinated by SIB is a great insurance for that the infrastructure will be successful and fulfil its commitments").
- In areas of strategic importance (digital transformation and big data, open research data)
- Reduces barriers to sharing and reusing data thanks to user support and standardisation

Governance:

- SwissBioData ecosystem will have a board with representation by the 18 member institutions, with UniBE as leading house.

5. Synergies among the SIB activities

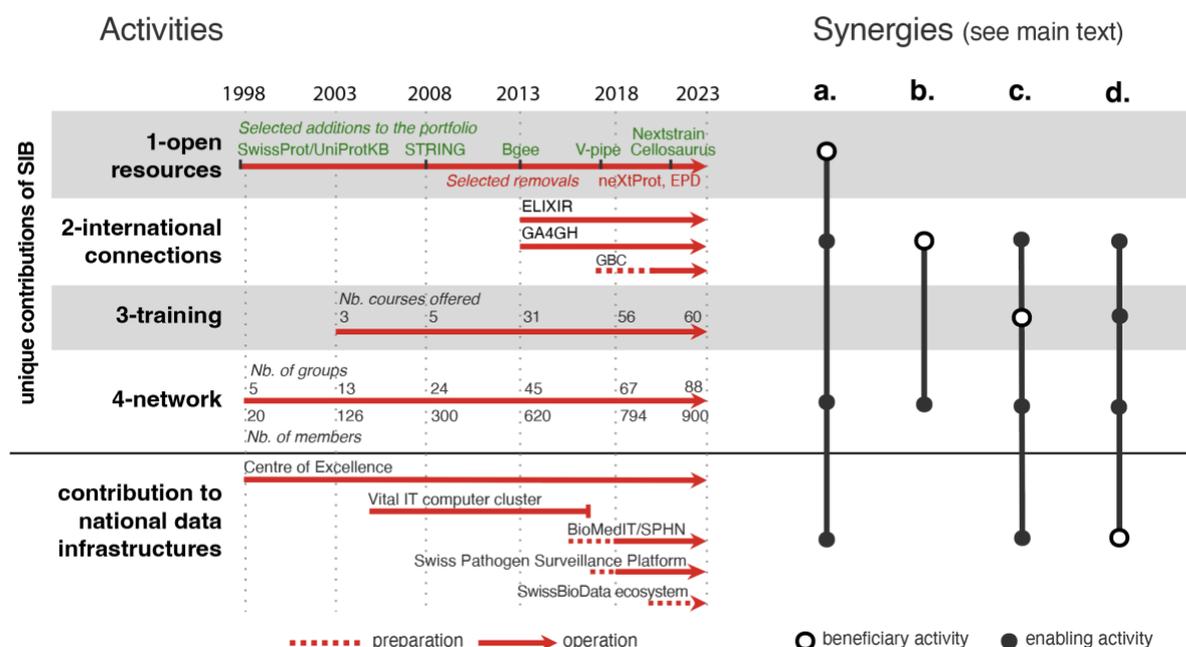


Figure 1. Evolution of SIB's core activities and synergies detected amongst them. On the left, the evolution of SIB core activities is depicted up to the current date. On the right, the synergies and cross-links for each of the activities is analysed and discussed further in the text.

The activities outlined above (Figure 1) are complementary and synergetic as follows:

- Open resources are developed in tight partnership with affiliated SIB groups, and thus the network provides the raw substrate for new SIB resources, and the continued involvement of affiliated group leaders enables resources to remain at the cutting edge and close to the evolving needs of researchers. Open resources also benefit from the international connections through ELIXIR and the Global Biodata Coalition.
- The inclusion of the entire Swiss bioinformatics community through the network provides legitimacy to SIB's international representation role as the national ELIXIR node. This is reflected in the high level of engagement of the Swiss research community in European grants, collaborative projects, tool development, standard establishment, staff exchanges, and data FAIRification activities.
- Training builds on the network, with SIB members involved in both teaching and learning. Furthermore, dedicated teaching staff being embedded within our centre of excellence ensures that courses remain highly relevant to practice. Training is also an important component of national data infrastructures, such as SPHN. Finally, international connections enable teaching to remain at the cutting edge and aligned with training activities in Europe and worldwide. As an example, SIB contributes to establishing a national Data Stewardship curriculum by building on existing initiatives from our counterparts abroad (as in the UK and Netherlands), drawing on expertise within the network.
- SIB's track record in establishing successful national data infrastructures is enabled by 1) the proximity to life science researchers and institutions in Switzerland through the network; 2) links to similar infrastructures abroad through international connections, and 3) a strong training group. For instance, the proposal for the SwissBioData ecosystem research infrastructure involving 54 units from 18 institutions builds on the network (with all participating institutions being also part of the SIB foundation council, see Box in part 3.4), SIB training (responsible for an entire work package), alignment with international infrastructures for data FAIRification, standards, and resources.

6. Conclusion

The SIB Swiss Institute of Bioinformatics plays a critical role in advancing data-intensive life science research in Switzerland and beyond. The institute's unique role within the life science domain on developing open resources, connecting Switzerland to data infrastructures, providing postgraduate training, and fostering a Swiss network has helped position Switzerland as a leader in this field. SIB also cooperates with others to establishing innovative research infrastructures. The synergistic approach of these core activities has contributed significantly to Switzerland's competitiveness and standing in life sciences research. Going forward, SIB should continue to focus on these core activities to strengthen and defragment the life sciences' data ecosystem in Switzerland.

Appendices

A1. Landscape analyses

A1.1 Swiss Open Research Data landscape

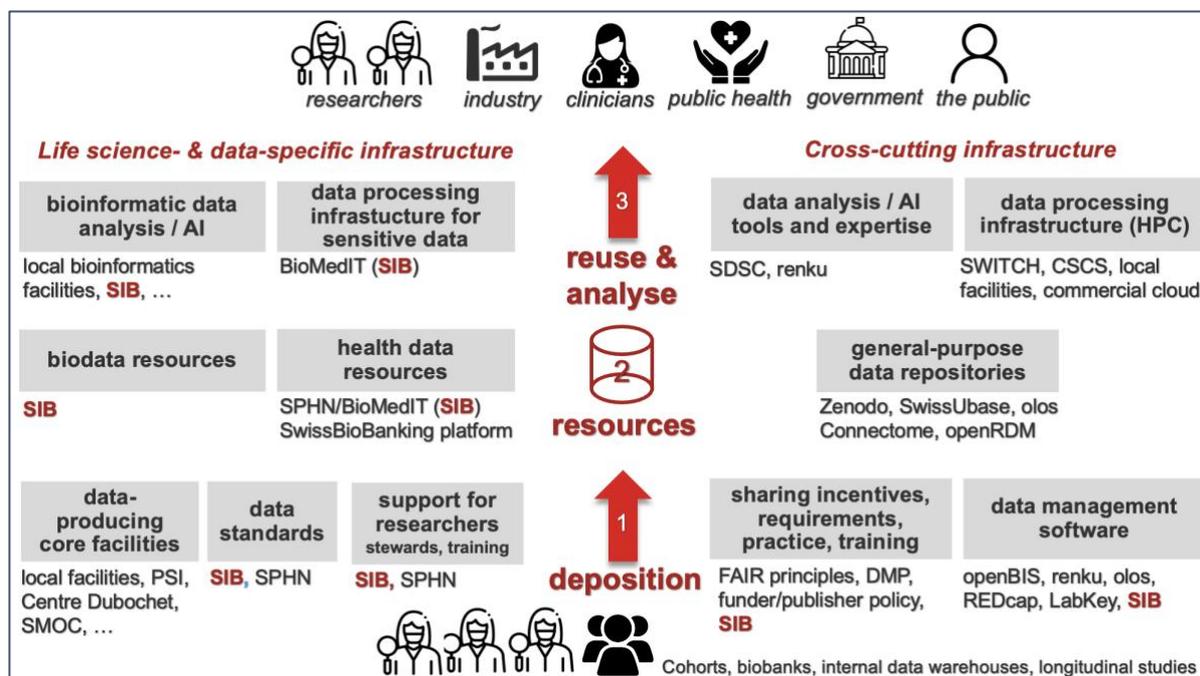


Figure A1.1 Swiss Open Research Data Landscape. Data stemming from different sources is produced, standardised, and deposited (1) and can be fed into a series of resources (2) so that it can be reused for further data processing by a variety of stakeholders. SIB is particularly active in all these phases in the Life Sciences domain on the left part of the diagram. There are also other cross-cutting infrastructures, i.e. not specialized in life science data, that are part of ORD landscape, which are depicted on the right side of the diagram, and to which SIB contributes.

A1.2 Biodata resources landscape (databases and knowledgebases)

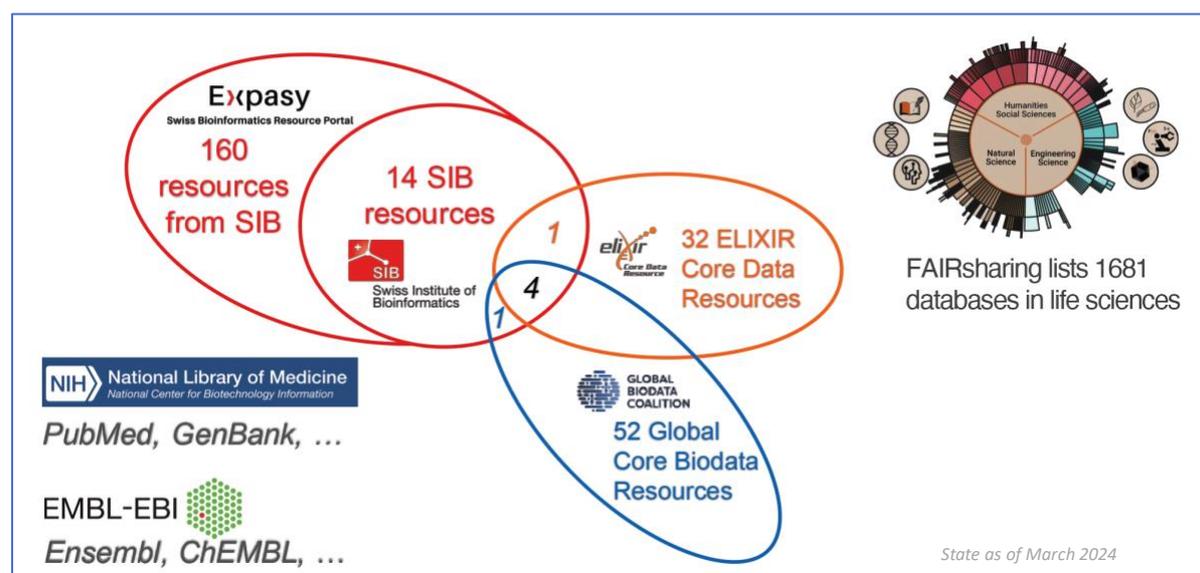


Figure A1.2 Biodata resources landscape. The SIB network develops around 160 resources, from which 14 are part of SIB's resource portfolio. From these 14 resources, 4 have European recognition as ELIXIR core data resources standards and 3 have world-wide recognition as critical resources for the life sciences according to the Global Biodata Coalition. The rich worldwide ecosystem of resources encompasses 1681 resources according to FAIRsharing.org, with other prominent actors being the National Center for Biotechnology Information at the NIH and the EMBL-European Bioinformatics Institute.

A1.3 International relations

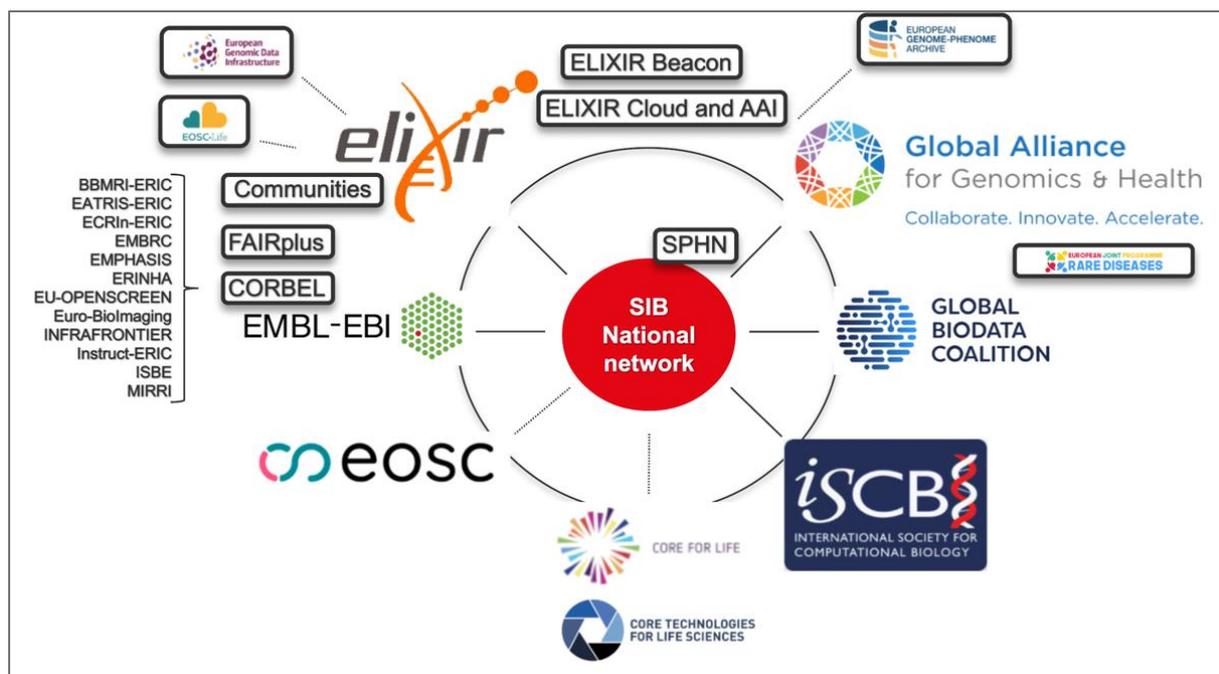


Figure A1.3 International relations. SIB has consolidated partnerships to international networks, namely ELIXIR and GBC, and provides links to its national network that promote further collaboration. Through collaborative projects, such as CORBEL and BY-COVID, additional partnerships with international ERICs and other networks have arisen.

A1.4 Training landscape

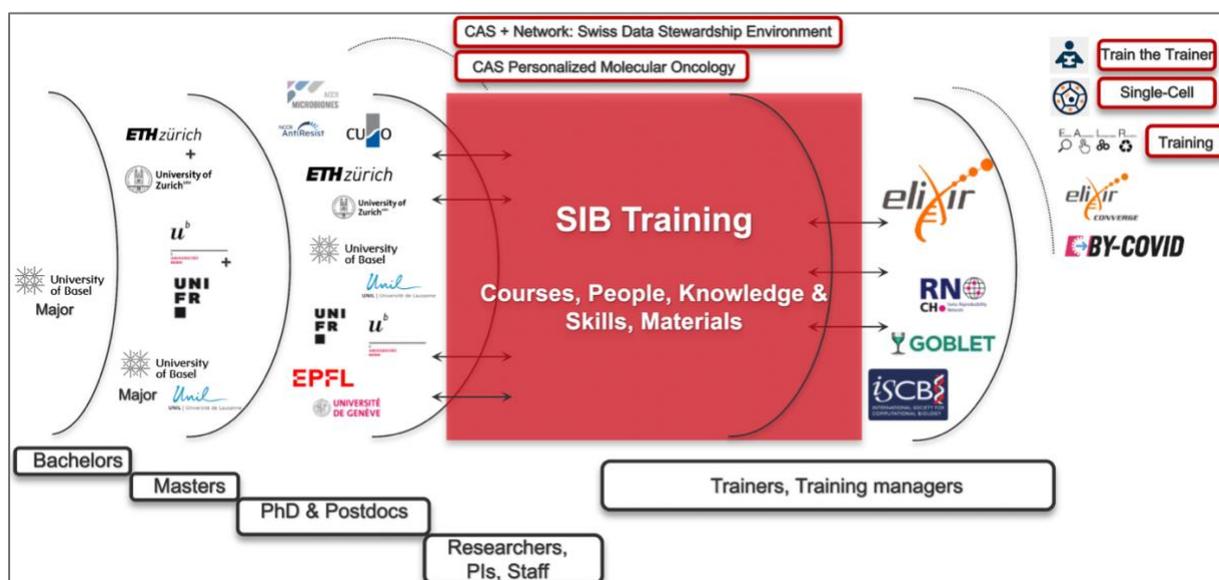


Figure A1.4 Training Landscape. The SIB training group provides a postgraduate training programme for the Swiss scientific community. This training offer complements that of high education institutions and connects Switzerland to international networks such as ELIXIR and GOBLET amongst others.

A1.5 Swiss Federated EGA

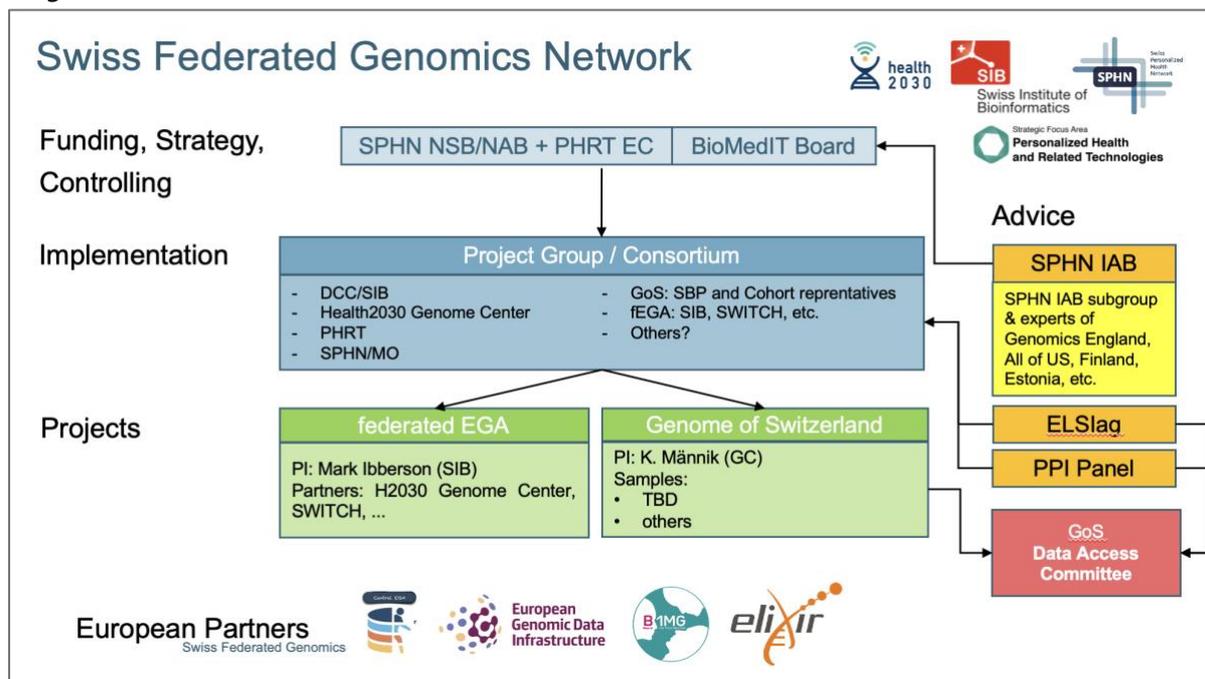


Figure A1.5 Swiss Federated EGA. SIB will be leading the data coordination centre of the Swiss Federated EGA platform in collaboration with partner institutions. This is part of a larger effort entitled “Swiss Federated Genomics Network”, under the joint governance of SPHN, PHRT, and BioMedIT. The Swiss Federated EGA project will align Switzerland's efforts to ongoing European initiatives such as the European Genomic Data Infrastructure, or the Beyond 1 Million genomes project.

A1.6 SwissBioData ecosystem



Figure A1.6 SwissBioData ecosystem (SBDe) initiative. SIB aspires to be a key contributor to the SBDe initiative to facilitate FAIR and open research data in life sciences across 18 institutions in Switzerland.