SciLifeLab

Report to the SciLifeLab International Advisory Board 2023

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1. Welcome and Introduction

We want to warmly welcome the SciLifeLab International Advisory Board (IAB) to the fifth biannual IAB visit. We appreciate that new members are now joining the IAB, and will try to ensure that the documents and presentations at this site visit will provide sufficient background to enable the new IAB members to catch up with the dynamic developments over the past 10 years. This year, the IAB site visit will take place at the Uppsala location, due to the logistics arrangements. The previous visits have always had a major role in the development of SciLifeLab, and we again expect excellent discussions on the past developments and the future challenges and opportunities. The IAB reports to the board of SciLifeLab, which is the highest decision-making body at SciLifeLab.

We have carefully prepared for this visit and present here the documents that form the basis for the visit. These include a summary of events and actions that have taken place since the last (virtual) IAB visit in 2021, as well as more broadly over the last four-year government funding period (2021–2024) when many major developments have taken place at SciLifelab. We include an updated response to the previous suggestions from the IAB. Many IAB suggestions have been acted upon or are being acted upon. In some cases, we will discuss the challenges on why realizing the suggestions has been complicated because we do not "control" the matter. Indeed, it is important to realize that many aspects at SciLifeLab do not only depend on the board, but on i) the government mandate for SciLifeLab, ii) conditions of each funding body and iii) on the participating universities, which employ all SciLifeLab-associated scientists and infrastructure personnel.

In terms of the future, there are many opportunities and challenges to discuss. The next government research bill is expected to provide SciLifeLab a four-year budget frame (2025–2028). This research bill is the first one under a new government, and the current Ministry of Education has said they will promote excellence, internationalization and innovation. We have indicated our suggestions to the government on future directions for SciLifeLab. While we believe the attitudes and opinions regarding SciLifeLab are today positive across the country, SciLifeLab may well be impacted by reorganization of the government's entire research funding organization as well as the creation of a new infrastructure (funding and management) organization.

For the future, there are of course increasing opportunities in life science and fantastic developments in technologies and data science, including AI, that SciLifeLab has and will continue to capitalize on. How do we best promote and package these positive aspects for SciLifeLab? In the next chapters, we will also list some other challenges and opportunities that SciLifeLab will face, and that we would like to discuss with the IAB.

SciLifeLab board, to whom IAB reports, has a new composition, with Ylva Engström as a chair. There will also soon be a new SciLifeLab Director with a start date of July 1, 2024. Hence, a lot of things are happening at SciLifeLab internally, but also in the life science scene nationally and globally, and all these will have ramifications on the future of SciLifeLab. We will be happy to discuss all these and get excellent advice from the IAB.

Ylva Engström, Chair of the Board
Olli Kallioniemi, Director
Mia Phillipson, Co-Director

Contents

Appendices

1.1 Abbreviations

BSEK	Billion SEK
CS	Campus Solna
CSC	Campus Solna Committee
CSD	Campus Solna Director
CTH	Chalmers University of Technology
DC	SciLifeLab Data Centre
DDD	Drug Discovery and Development platform
DDLS	SciLifeLab & Wallenberg National Program for Data-Driven Life Science
DDLS RS	DDLS Research School
EBI	European Bioinformatics Institute
ELSI	Ethical, Legal, and Social Implications
EMBL	European Molecular Biology Laboratory
ERC	European Research Council
ERO	SciLifeLab External Relations Office (part of SciLifeLab Operations Office)
ESS	European Spallation Source
FAIR	FAIR: for data to be Findable, Accessible, Interoperable and Reusable
FTE	Full-time equivalent (staff)
GMS	Genomic Medicine Sweden
GU	University of Gothenburg
HOP	Head of Operations
IEC	International Evaluation Committee
ID	SciLifeLab Integration Director
InfraLife	Infra Access for Life Science Sweden
JIF	Journal Impact Factor
KAW	Knut and Alice Wallenberg Foundation (the largest private funder of scientific research in Sweden)
KI	Karolinska Institutet
KPI	Key Performance Indicator
KS	Karolinska University Hospital (Karolinska Sjukhuset)
KTH	Royal Institute of Technology (Kungliga tekniska högskolan)
LiU	Linköping University
LU	Lund University
MAX IV	Max IV Laboratory
MCSA	Marie Curie Support Action
MG	SciLifeLab Management Group
MoU	Memorandum of Understanding
MNCS	Mean normalized citation score
MSEK	Million SEK
NBIS	National Bioinformatics Infrastructure (equal to SciLifeLab Bioinformatics platform)
NGI	National Genomics Infrastructure
NRM	Swedish Museum of Natural History
NSC	National SciLifeLab Committee
OO	SciLifeLab Operations Office
ORCID	Open researcher and contributor ID
ORU	Örebro University
PALS	Program for Academic leaders in Life Science
PB	Planetary Biology
PD	Platform Director
PCO	Platform Coordination Officer
PLP	Pandemic Laboratory Preparedness
PoC	KAW proof of concept call
PM	Precision Medicine
PP(top10%)	Percentage of papers in the top 10% most cited
PSD	Platform Scientific Director
RED	Research Environment and Development
SLU	Swedish University of Agricultural Sciences
SU	Stockholm University
UmU	Umeå University
UU	Uppsala University
VR	Vetenskapsrådet (The Swedish Research Council)

1.2 International Advisory Board Members

Søren Brunak (Chair)
Novo Nordisk Foundation Center for Protein Research, University of Copenhagen, Denmark

Ruedi Aebersold
ETH Zürich, Switzerland

Jo Bury
VIB, Belgium

Sirpa Jalkanen
University of Turku, Finland

Janet K. Jansson
Pacific Northwest National Laboratory, USA

Iain Mattaj
Human Technopole Foundation, Italy

Svante Pääbo
MPI for Evolutionary Anthropology, Germany, Okinawa Institute of Science and Technology, Japan

Kjetil Tasken
University of Oslo, Oslo University Hospital, Norway

Sara Teichmann
Wellcome Sanger Institute, University of Cambridge, UK

Photo: Mikael Wallerstedt

2. Executive Summary

We summarize here some of the many ongoing developments at SciLifeLab, not just over the past 2+ years since the last IAB visit, but during the last research bill period of 2021–2024. In line with the government's focus on "Excellence - Innovation - Internationalization" for Swedish research, SciLifeLab holds a key position within all areas with regards to remaining and developing as a key asset in the life science field. Many things have happened at SciLifeLab and over the past four years the organization has changed more than perhaps ever before since its launch. This is a summary of some of the major developments, with a few selected recent SciLifeLab highlights from 2022–2023 in *Figure 1*.

2.1 Recent Developments at SciLifeLab

- The launch of the 3.1 BSEK 12-year SciLifeLab & Wallenberg National Program for Data-Driven Life Science (DDLS) is well underway and about to enter its second funding period, which brings funding to new programs. Nineteen group leaders have been appointed as DDLS fellows and 20 other ones are being recruited. National PhD and postdoc programs in DDLS will be starting soon and will help to prepare Sweden for the paradigm shift in life science with data and AI opportunities.
- We have set up four new national SciLifeLab sites in Lund, Gothenburg, Linköping and Umeå. This has had a significant impact on how SciLifeLab is now increasingly appreciated as a fully national organization, and the energy and excitement at the new sites bring many additional capabilities to SciLifeLab as an organization.
- The national coverage of the infrastructure units and their user base has continued to expand. There is increased participation from the larger universities outside the Stockholm-Uppsala area and also a continued strong user base from health care and the industry.
- We have launched a platform-based infrastructure organization, where each platform can dynamically evolve, implement new technologies and create synergies in between the 4-year funding periods. Several new successful service units have been launched, such as in the spatial biology platform, an area where SciLifeLab is a strong player globally.
- We have improved life science data handling, data pipelines and FAIR data sharing by organizing the work at the Data Centre and the four new National Data Science Nodes of the DDLS program. This work is still in the beginning, but promises to broadly facilitate life science data handling as well as making use of the data.
- We have initiated SciLifeLab capabilities focusing on Precision Medicine (PM), Planetary Biology (PB), and Pandemic Laboratory Preparedness (PLP) in order to bring together SciLifeLab infrastructure, data and research in a targeted manner to a broad group of potential users, collaborators and stakeholders. This has turned out to be an excellent way for SciLifeLab to be visible and to participate in relevant strategic research discussions. The PLP will be discussed separately below.
- During the COVID-19 pandemic, we repositioned the infrastructure and coordinated research, technologies and data to help society, support health care and deliver data important for strategic decision making in how to handle i) the spread of the infection and ii) the national vaccination program. This provides a model on how a national infrastructure can contribute to critical challenges or acute crises in the society and go from a "peace-time to a crisis-time" operation. In 2021, SciLifeLab received a government assignment to lead a program on Pandemic Laboratory Preparedness (PLP) and establish a national capability together with academia, health care and the Public Health Agency.

- SciLifeLab has progressed well in its translational infrastructure, such as the clinical genomics and proteomics, where SciLifeLab has functioned as a technological backbone to other organizations, e.g., the health care regions and the Genome Medicine Sweden organization. The DDD platform has continued to screen new ideas from academia and turn them into drug discovery innovations, with a fantastic track record of successful "exits".
- SciLifeLab has secured several collaborative EU grants and worked with the government to coordinate projects on European Health Data Space, on e.g., health data integration.
- SciLifeLab has set up a comprehensive collaboration with the European Molecular Biology (EMBL) and have since held multiple meetings and workshops together on e.g., planetary biology and data science.
- SciLifeLab has started, again with support and in collaboration with KAW, a new Proof of Concept (POC) funding program that selects up to 10-12 projects annually for coaching and funding from the Wallenberg Launch Pad organization to enable industrial development and bridge to venture funding.

Therefore, the foundation of SciLifeLab remains largely the same but its impact and footprint have grown substantially. While SciLifeLab is still primarily a national infrastructure, we now have had many other synergistic tasks and roles. However, the execution and integration of these new roles are still at an early phase and significant opportunities are not yet fully realized.

2.2 Future Challenges and Questions to the IAB

After a rapid growth and expansion period in the past four years, there are of course a lot of things that still remain to optimize the aforementioned advances at the SciLifeLab-level. We are working on several topics, including the five major topics that IAB brought up last time, in order to execute this ongoing phase of SciLifeLab development.

As will be discussed in this document in great detail, there will be many opportunities to make use of the SciLifeLab "model" to promote technology- and data-driven life science. A constant flow of new technologies will increase throughput and reduce cost, in the same manner as has happened with next-generation sequencing. At the same time, developments in AI have and will open new opportunities for data- and AI-driven research that the SciLifeLab organization can tackle. How such exponential developments happening in parallel will converge will be hard to predict, but developments will most likely continue to be rapid. Therefore, SciLifeLab's agility, with support of the funding from KAW as well as strategic governmental initiatives, has been absolutely essential to launch new technologies, instruments, capabilities and new sites This will be even more important in the future and hence we emphasize that SciLifeLab should continue as an agile and dynamic organization in the rapidly changing world.

The practical challenges for SciLifeLab in the next funding period may well be more political than scientific and technological. We need to succeed to get the expanded SciLifeLab opportunities known to the government, to our stakeholder organizations and to the broad life science community and it will be critically important how we position ourselves in light of some of the major changes at the national level that are likely to happen.

First, SciLifeLab is not alone in the life science space and will need to position itself well. There are major developments underway to create a similar national infrastructure organization for health research in the translational, clinical and health care setting, including the Genomic Medicine Sweden (GMS). These developments are partly inspired by the success of SciLifeLab as an infrastructure and the new organization may adopt a similar national structure. SciLifeLab has been participating in these important efforts and is eager to continue contributing with its technology- and data-driven capabilities. However, this new organization, if it is realized, will be a healthcare focused effort, and will require dedicated infrastructure funding. Hence, while we support these important developments that partly have their origins in SciLifeLab, we hope the new health care infrastructure can be initiated with separate new funding.

Second, in the next few years, the government is planning a new system for managing research funding. This is tentatively fusing over 30 separate government "units" to launch three funding and research management organizations: i) basic science and infrastructure (likely the national research council VR), ii) a new strategic research organization, and iii) innovation support (likely today's Vinnova organization). If realized, how this will impact SciLifeLab is again not known, but the effects could be significant, both in the positive and negative direction. SciLifeLab has today distinct operations under all these three areas, and hence it may be difficult to maintain an integrated SciLifeLab, if the funding and steering functions are separated under three funding and steering organizations with different goals. For instance, bringing SciLifeLab entirely under a national infrastructure organization could make it more difficult to maintain the unique synergies between technologies, data, research, recruitment and innovation.

Third, SciLifeLab should aim to maintain its role as an infrastructure and collaborative project across all Swedish universities, and hence the steering documents for SciLifeLab need to be updated to reflect the new role that already de facto exists. At the same time, the founding universities of SciLifeLab should, and hopefully will, continue to play a key role in the future development. They could engage more at the strong local SciLifeLab-associated research centers in Stockholm (Campus Solna) and in Uppsala (Navet) and leave the national infrastructure and data matters to be managed by the national SciLifeLab board.

In the IAB meeting, we would also like to discuss the challenges of operating SciLifeLab as a fully national organization, with infrastructure, research and data roles. There is some balancing to be done with the national infrastructure having to be broad, inclusive and well balanced, while excellence in the research mission requires exclusivity and focus on specific topics.

We also would like to discuss with the IAB on the challenge of dividing, in a fair, balanced manner, the limited infrastructure support between the platforms in the next 5 years. e.g., genomics, proteomics, other omics, bioimaging, single cells, spatial biology and functional studies as well as the translational platforms and capabilities.

We present to the IAB, as part of this document, a draft of the updated 10-year roadmap for the SciLifeLab IAB to comment on. Predicting the future when creating a 10-year roadmap has become even more difficult in an increasingly unpredictable world where multiple exponential trends converge. We hope that the IAB will help SciLifeLab not just to navigate the very critical next 2-4 year-period, but also to help us chart the future opportunities in the 10 year span of the roadmap.

Therefore, we summarize five general questions for the IAB as follows. In addition, various sections may contain more specific questions that IAB can choose to comment on (although many may be too specific and not very strategic for IAB to discuss).

1. **Comment on how to best communicate and develop the unique advantage and the diverse new roles of SciLifeLab,** so that we best manage major changes that the government may undertake in the research funding area.
2. **Please advise SciLifeLab in maintaining its role in the context of translational research and clinical diagnostics.** In an era where a new clinical infrastructure may be set up at a national level, we will need to navigate the translational health space well.
3. **As IAB has previously had strong opinions on the group leader definition at SciLifeLab, as well as on the role of the Campus Solna, we hope to revisit all these organizational aspects given the changes as well as the inclusive/exclusive or infrastructure/research dimensions.** We present as an appendix to the IAB document a plan to reorganize the SciLifeLab Group Leader concept (see *Appendix* M). This will not only be based on research excellence, but focuses very much on the contributions of group leaders to the national SciLifeLab organization.
4. **Something that we discuss a lot at SciLifeLab, but cannot easily change in the context of the regular infrastructure evaluations, concerns the division of funding to the various infrastructure platforms.** Taking your collective views of science and technology trends, how do you feel about the division of infrastructure budget between the 10 different platforms currently and into the future? Is SciLifeLab active in too many topics today?
5. **Please comment on the draft new Roadmap for SciLifeLab,** see *Section* 4 and *Appendix* A.

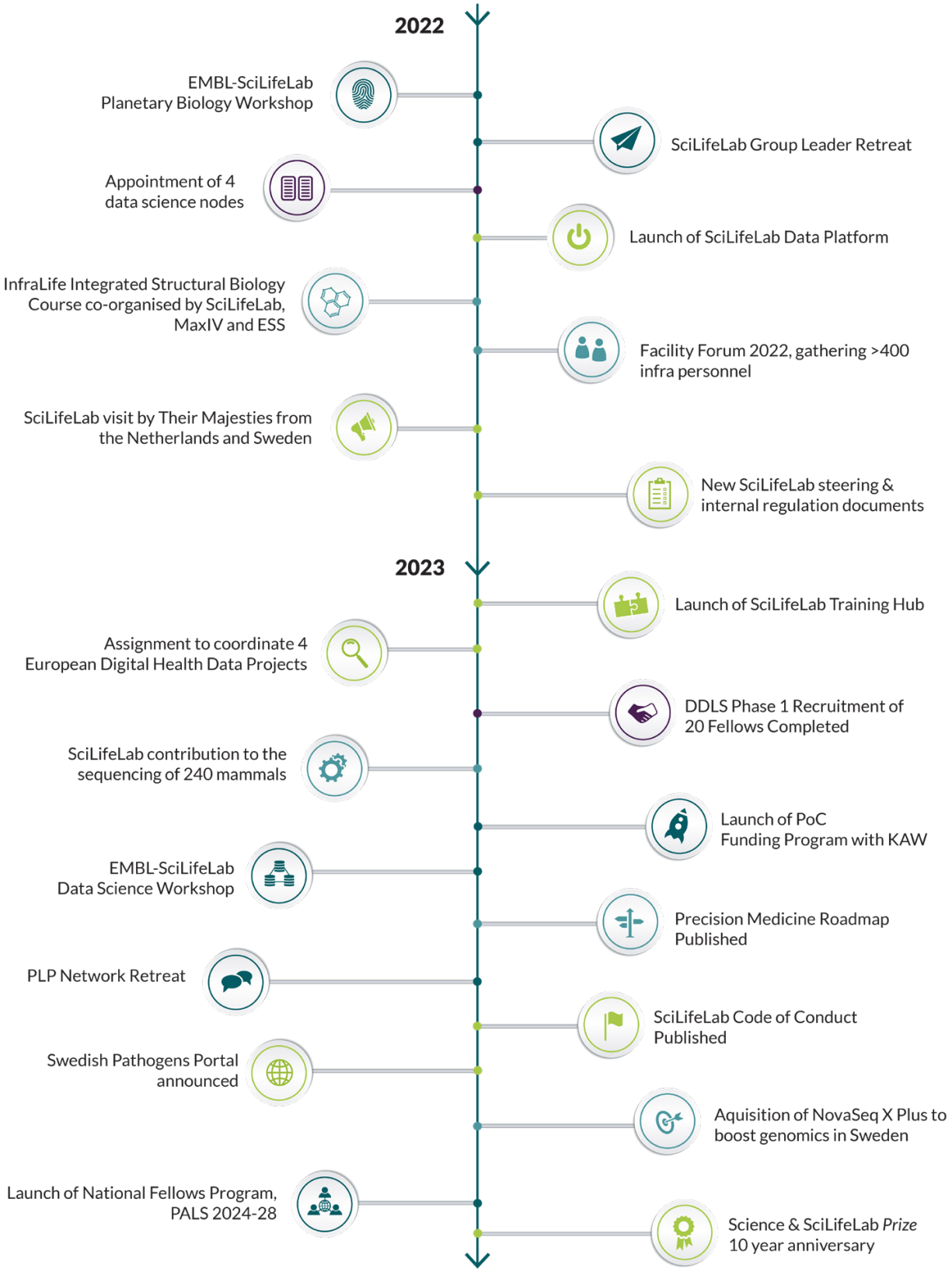


Figure 1. A few selected SciLifeLab highlights 2022–2023

Photo: Mikael Wallerstedt

Photo: Mikael Wallerstedt

3. Updated Response to IAB comments 2021

This is an update to the previous version that was sent to the IAB and other stakeholders and published June 2022 [1].

SciLifeLab answers (A) *are in regular font, the original IAB comment in italics. The response by SciLifeLab has been generated by the Leadership, the Management Group and Operations Office, referring to the "we" in the responses below, after consultation with major stakeholders and after approval by the board. For clarity, sections have been renamed* 3.1-3.7 (*from* 4.1-4.7).

IAB's Five Major Recommendations 2021

1. *Complete the integration into a* ***truly national research infrastructure*** *with a strong Hub and distributed Nodes with complementary strengths.*
2. *Provide a mechanism for* ***independent quality management*** *for the research that is served by SciLifeLab infrastructure, promoting excellence across the board.*
3. *Leverage the integrated capabilities that have proven their value in the pandemic response to support large-scale* ***visionary research.***
4. *Integrate the different fellows into a* ***Swedish young investigator program*** *with international recruitment based on excellence and competitive mid-career support.*
5. ***Leverage Campus Solna*** *to train the next generation of interdisciplinary leaders needed to move Swedish life science to the forefront internationally.*

A: We want to thank the IAB very much for their insightful comments. In discussions with the board, the rectors, the management group and other stakeholders, these comments have been considered valuable and relevant. We are excited about the positive tone in the report and the impressive dedication of the IAB towards ensuring that SciLifeLab will continue to be a success.

We do not respond here to the five major recommendations above as they will be individually discussed later. However, we agree that these five points are key observations. In this report, we have responded to all individual comments given by the IAB, many of which have led to actions. We also comment on suggestions that may have been based on misunderstandings, or where the suggested changes may take more time to execute or will even be difficult to realize.

Now that the scope of SciLifeLab has expanded much beyond the infrastructure role on one hand and beyond the Stockholm and Uppsala-centric mission on the other, SciLifeLab often means different things to different people. The recommendations are therefore often interpreted somewhat differently by the various representatives, stakeholders or members of the SciLifeLab community across the country. This demonstrates the importance of our task to formulate and communicate a plan of prioritized actions for the various aspects of SciLifeLab. We also need to promote branding, understanding and awareness of the overall mission and role of SciLifeLab in the life science ecosystem in Sweden.

a) Our recommendations in 2019 *were strategic and long term with the intention to be useful as guidance for the second decade of SciLifeLab. Therefore, many of them remain valid at this time and it is also not surprising that not all of them could already be fully implemented, especially with the major effort required to respond to the pandemic in the two and a half years since our last visit.*

A: We will continue to execute the past IAB recommendations as well, and many actions are indeed still underway based on the suggestions from the 2019 IAB visit.

b) On the infrastructure side, *big steps towards a more inclusively governed and better integrated national infrastructure have been made. This process is not complete, but on a very good trajectory and has allowed SciLifeLab to incorporate four new national sites in Umeå, Lund, Gothenburg and Linköping and succeed in renewing and increasing the government's funding commitment underpinning the national infrastructure mandate.*

[1] scilifelab.se/wp-content/uploads/2022/06/Response-to-the-IAB-comments-2021.pdf

A: Now fully started, the launch of the new national sites has indeed been very important and energizing to the national SciLifeLab community. The new sites will have a major impact on the role of SciLifeLab as a national infrastructure and as an organizer of national collaborations in technology- and data-driven science. The launch of sites has helped many universities to feel that they are an integral part of the national SciLifeLab organization. The new sites are also serving as a welcome reference to the old Stockholm and Uppsala sites to continue their development. The inauguration of new sites took place during 2023, and major festive events took place at each site, with up to 200-300 participants.

c) On the research side, *progress on the SciLifeLab core research, pioneered by the four founding universities in pooling their life science research activities under one umbrella, has been much slower or even stalled. Some of our advice to improve the operational management of Campus Solna have been implemented by creating the Campus Solna Committee and appointing a Campus Solna Director. Unfortunately, however, our recommendation to the four host universities to take the second step, after their first pioneering founding decisions over ten years ago, and create a truly integrated joint centre of research excellence that attracts, supports and retains the best junior PIs internationally in Sweden, have not been followed.*

A: Campus Solna Committee (CSC) has actually existed under another name almost since the launch of SciLifeLab. However, the role of a dedicated Campus Solna Director (CSD) was launched in response to the 2019 IAB report. We strongly support the IAB view that it will be important to take the next steps in developing Campus Solna (CS). Indeed, many positive actions have taken place and others are still underway and the new IAB recommendations enforce and stimulate the ongoing plans. In the past three or more years, decisive actions have been taken to fix the practical challenges pointed out in 2019 in regards to the CS. This process is still ongoing. Also, there are discussions underway to expand SciLifeLab CS to encompass the Beta-building, which would alleviate the current acute space shortage. Several aspects of the IAB envisioned center of excellence have been realized, such as through the recruitment of new SciLifeLab and DDLS fellows. However, there is room for improvement to make the entire CS research community better integrated and dynamic, across universities, but also across infrastructure, research and data science. Plans underway at the new SciLifeLab sites in Gothenburg, Linköping, Lund and Umeå to create synergistic, dynamic and complementary research environments (including the ongoing key role of Uppsala), should also energize plans at CS, which needs to keep pace. As the largest and only SciLifeLab site with three universities colocalized, CS needs to continue to set an example of how SciLifeLab can create new collaborations and technology- and data-driven research opportunities that would not otherwise be possible.

d) Disappointingly, *the commitment to support the core SciLifeLab research by the universities' SFO funds has not (yet, we hope!) been renewed, due to delays in agreeing on the overall program with the government.*

A: The danger that SFO funds earmarked for SciLifeLab would be discontinued during the past government research funding cycle did not materialize. Hence, SciLifeLab associated SFO funds have remained intact during the current 4-year cycle (2021–2024). The priorities of the government for the next funding cycle (2025–2028) are not known, and the concern for losing SFO funding may indeed reappear. Government decisions on SFO will be done for all SFO funded projects (about 2 Billion SEK/yr to many SFOs across all universities and all fields of science) and hence there will not be a SciLifeLab-specific decision. One possibility is that the SFO will be given to the universities as basic funding, in which case the link to SciLifeLab may be lost.

e) Although de facto, *Campus Solna exhibits many aspects of an internationally leading research environment, the IAB remains baffled that this is not embraced more enthusiastically as a strategic joint research center of excellence with continuous evaluation and turnover of group leaders. We are concerned that it is insufficiently supported both strategically and as a consequence also financially, because such a forward-looking model would attract much additional funding from the outside. We will therefore come back to this topic in our 2021 recommendations.*

A: We agree that SciLifeLab Campus Solna (CS) can be improved, and have extensively discussed IAB comments. This topic will again be presented and discussed at this IAB meeting. Here is a clarification of the background to the concept of CS and how it is governed. This makes it better possible to see what is possible and what may be difficult. First, at CS three separate universities, and national infrastructures hosted by the universities, are together "under one roof". However, it is not a joint institute, but more like a research program or "biocentre" format. Each university retains its own legal, financial, HR and other administrative functions for its staff at CS. In addition, there is a small CS site support for about 1,300 people now located at CS. The host universities are committed to maintain and develop CS and have placed some of their best research groups there. The combination of 8 new SciLifeLab fellow positions and 12 DDLS fellow positions together with the developing national infrastructures add to the dynamic nature of CS. It is important to note that the total SFO funding to CS is about 120 MSEK / yr and to a large extent is used for SciLifeLab fellows' support. Therefore, SFO funding alone cannot support a research center of the size of CS. With the exception of the fellows' funding packages, virtually all of the other research at CS is supported by rent and bench fees that are paid from external grants of the CS PIs and infrastructure units. Hence, beyond the infrastructure units receiving national

infrastructure funding and fellows' programs paid by SFO, CS research is otherwise mostly supported by the rent and bench fees that the resident scientists pay using their competitive research grants.

SciLifeLab SFO funding is allocated in four separate funding streams, one at each of the four founding universities, where decisions are independently made by the local SciLifeLab committees. At Campus Solna, KI, KTH and SU individually control their SFO funds and allocate a fixed part to common costs at CS. Joint programs across the universities have been initiated at CS, including RED research grants (project, equipment and postdoctoral fellows). Now, the IAB suggests the creation of a truly integrated research center by pooling all SFO funds across university boundaries. This unfortunately poses some serious administrative and legal challenges, such as the fact that the SFO funds may eventually be converted or transferred to base funding for the respective universities. This will naturally make universities very committed to retain these funds in their own control and in their own budgets. If the SFO funds will become part of the university base budgets in the future, their earmarking may also end. In such a case it would be of paramount importance that those funds remain to be used at SciLifeLab and that they are not diverted to other urgent fiscal priorities.

The way that universities govern their activities at SciLifeLab Campus Solna depend to a large extent on decisions that were done at the launch phase of SciLifeLab as well as on the scope of the life science sector in the founding universities. This contributes to the challenges of joint planning today. For example, KTH has placed an entire large department at CS and considers CS as a full-fledged extra KTH campus. Hence, KTH does not have a rotational model for their staff, be they fellows or other PIs. In contrast, research staff at CS affiliated with KI are members of one of more than a dozen different departments and since KI is right next door, fellows can easily be in contact with their departments, even when located at CS. Most KI fellows have continued to stay at CS even after their fellow period is over. SU, with five departments represented at CS, is the only university that has expected that SciLifeLab fellows should relocate to their home departments once their fellowship terms expire. Obviously, CS research is much more than fellows and there are more than 100 research groups at CS. To a large extent they are not subject to rotation and many senior groups have stayed at CS since its launch phase. It is also worth noting that at KTH, the proportion of life science PIs that are located at CS is substantial (est. 50% of the total), while at SU it is also notable (est. 10%), while at KI this percentage is in the 1-2% range. Hence, the relative impact of the CS part in comparison to the total life science research at the three CS universities is quite different, which also explains some of the challenges and differences.

We understand the IAB would like to see more synergy and joint activity and pooling of the resources as well as dynamic turnover. However, SciLifeLab CS configuration is deeply dependent on the specific and variable strategies chosen by each university to develop their SciLifeLab CS plans and activities. We are happy to discuss this question with the IAB in the upcoming meeting. We do agree that SciLifeLab Campus Solna should become a truly progressive example. In particular we like the IAB advice that SciLifeLab should strive for more than to be an "extension" of current departments or faculties and their existing research profiles and practices.

f) DDLS is a major new initiative *for SciLifeLab, squarely placed in a critical area for the future of life sciences and well aligned with other major investments by the Knut and Alice Wallenberg Foundation (KAW) into artificial intelligence and molecular medicine. Due to the volume of the DDLS program it will make up almost 50% of SciLifeLab's future resources. Integrating and aligning DDLS with SciLifeLab's other activities is thus a significant challenge. At the same time, it is a major opportunity and our recommendations are to seize it to increase SciLifeLab's added value for Sweden.*

A: We agree with the IAB's view that DDLS is a major opportunity for SciLifeLab and a way to develop new collaborations across the country (11 partners), within and across four research areas as well as cross-disciplinary interactions between national infrastructure, life science and data science. The DDLS program has now gotten off to a good start and we look forward to describing the early steps undertaken to the IAB. We also held a targeted virtual advisory board meeting on DDLS on June 21, where IAB members Jan Ellenberg and Søren Brunak participated. This generated many excellent suggestions that we are contemplating to adopt in the phase two and beyond in this 12 year program. The DDLS advisory report is available in *Appendix K* along with our responses.

g) In our view, *the continued strategic engagement of the founding universities will be key to realise SciLifeLab's full potential, especially on the research side.*

A: We agree that the role of the founding host universities is important, particularly for research. Each university has strongly contributed in the past to the recruitment of young PIs, to research, training and to data science. Each university participates in SciLifeLab in several ways: i) recruiting SciLifeLab fellows to tenure track position, which, after the SFO funding is over, will continue as regular faculty, ii) earmarking and allocating other SciLifeLab SFO funds (KTH, KI, SU and UU) to promote SciLifeLab associated activities, and iii) placing other prominent PIs in the SciLifeLab milieu, who use their expertise and external funds to build the academic environment of SciLifeLab.

3.1 SciLifeLab Mission and Overall Governance

a) Continue to develop the mission *of a research organisation based on the strong national infrastructure platform.*

A: We agree that it is of utmost importance to continuously brand and communicate to the life science community that SciLifeLab is a national infrastructure, with cutting edge technologies and expertise and that there are also life science research programs and opportunities in data driven life science at SciLifeLab. It is important that the scientific community, stakeholders, and political decision makers have an updated view of what SciLifeLab stands for. SciLifeLab is quite well known already as a national infrastructure. On the other hand, many people in Stockholm consider the SciLifeLab name to refer to the Campus Solna as a research center and a building. It is therefore important to constantly brand and communicate to the life science community about these various national roles of SciLifeLab, with the national infrastructure as the foundation of SciLifeLab, with new national sites, national meetings, community and public engagement (e.g., participation in the Almedalen Week), training events, the DDLS program, capabilities and national grant programs all promote such awareness building.

b) Simplify the governance *and make it more inclusive for the national RI and coordination/training missions and more functional and effective for the core research mission.*

A: If SciLifeLab was a legal entity and if all funds for SciLifeLab were under the control of the SciLifeLab board, it would be easy to form a simple governance across all the various functions. While the governance of SciLifeLab looks complex, there are also reasons why that is the case: i) the multiple funding streams to SciLifeLab are different and distinct, and each funding source typically requires its own steering and accountability, ii) the different aspects of SciLifeLab engage different stakeholders. There are up to 12 universities/partners, sometimes acting individually (SFO funds at each university), as a group of eleven (national infrastructure or DDLS), as a group of four (4 founding universities), or as a group of three at a time (Campus Solna). iii) There are also different types of communities (infrastructure, research and data), iv) the separation of the governance makes it easier to manage conflicts that could appear otherwise. For example, the national infrastructure funding is managed and governed by separate bodies as the SFO, which makes use of the infrastructure in research. v) The multiple steering, reference and advisory boards at SciLifeLab will keep the operations transparent and make universities, academic entities, research groups and individual PIs more committed and engaged. Finally, we also point out that SciLifeLab is a large organization, with over 300 SciLifeLab group leaders (estimated 2000+ staff in research groups), 500 FTEs in infrastructure, soon 400 FTEs in data-driven science and about 1,800 users of infrastructure per year.

c) Seize the integration *and re-structuring opportunity DDLS provides, rather than creating two parallel structures.*

A: We fully agree with this comment. DDLS strongly promotes a fully national mode of SciLifeLab, including fellow communities, postdocs and PhD students and the research school. DDLS also relies on the SciLifeLab organization in a number of functions, such as leadership, operations, training, data center and bioinformatics and all of DDLS functions are governed under the national board. Much of the data that DDLS handles is derived from SciLifeLab infrastructure. DDLS also brings additional opportunities to unite partners, such as the data handling, data science nodes, as well as fellows communities, see e.g., description of the Program for Academic leaders in Life Science (PALS). Hence, DDLS brings many opportunities for deeper integration of partners, disciplines and scientists across the country.

d) Define the international benchmarks *you are aiming for, in terms of ranking and comparable institutions. SciLifeLab is unique, but there are role models for its different missions that should be defined, i.e., the research, infrastructure and training missions.*

A: We agree that it makes sense to develop role models and benchmarking models for the different components of SciLifeLab. We have compared our operational models to EMBL, VIB, Technopole, Crick, Broad, Janelia, Riken, Elixir and many others. Even if there is no exactly similar operation, there are some similar infrastructure organizations, fairly similar joint research efforts and also several data science centers or national data science programs. At the same time, compared to most international peer organizations that are legal entities located primarily at one site, SciLifeLab as a whole is i) more infrastructural in nature, ii) has a more prominent national role, national footprint and mandate and iii) hence, it is the combination of research, infrastructure, data, training and other components that makes SciLifeLab unique and something that is hard to define by the combination of individual benchmarks. While scientific benchmarking is relatively straightforward, it is not easy for SciLifeLab, which is only a second affiliation for the group leaders coming from multiple universities. We look forward to discussing this matter with the IAB, and determining how to implement such models.

3.2 National Infrastructure Mission

a) Further extend the governance *to a truly national and inclusive system that represents all sites.*

A: We agree with this. The board composition is already national and is dictated by the SciLifeLab founding documents. The board currently includes equal representation of host vs. non-host members. At the level of the management group, following the current 4-party agreement of SciLifeLab, currently only host universities are represented. However, we have started to include the directors of the new sites as adjunct members in many Management Group meetings and at the Strategic Council meetings which originally only included representatives of the 4 host universities. On the other hand, the National SciLifeLab Committee (NSC, which used to consist only of representatives of non-host universities) will now include representatives of both "host and non-host" universities, hence making SciLifeLab governance across universities as equal as possible. However, the steering documents of SciLifeLab need to be updated to reflect this new national role of SciLifeLab. The steering of the DDLS program is also already fully national as is the DDLS reference group.

b) Set up a system *for adding/phasing out SciLifeLab sites or Nodes and giving them complementary profiles and strengths and represent them in the governance.*

A: We agree and are working to execute this suggestion as regards to the functions, complementary profiles, and evaluations. We hope the sites will continue to contribute to the national SciLifeLab organization, but that each will also evolve to have their own unique complementary contributions. As mentioned above, activities at the new SciLifeLab sites have ramifications also to the existing sites (Campus Solna and Uppsala). The new sites are increasingly participating in the steering of SciLifeLab, but the official SciLifeLab regulations will need to be updated to keep up with the evolution of SciLifeLab. These regulations still reflect the original four university model of SciLifeLab.

c) Include the quality *of the research supported as a key performance indicator for infrastructure evaluation, in order to move from quantity to quality.*

Introduce a transparent quality management process *of the research that is supported by the infrastructure, that is used by default.*

A: New statistics will be presented in this IAB visit on the citation metrics of SciLifeLab infrastructure users. We think that these results are in line with our main criterion for selecting, supporting and operating national infrastructure units that "facilitate world leading research that otherwise would not be possible".

Nevertheless, these two suggestions have raised a lot of discussion among the staff of the research infrastructure. Many feel that from the infrastructure units' and platforms' point of view, quality and quantity are not distinct goals, but that they are intermixed in many ways. A certain quantity of services is needed (e.g., critical mass of users and high no. of projects) to be able to provide consistent and high quality results at lower prices (e.g., based on volume discounts from vendors). In addition, quality includes the entire chain from study design to sample preparation and ends in data analysis and publication. In parallel, proper data management must aim for data to be as fair and open as possible.

The infrastructure units also point out that as a national infrastructure, often also receiving research council (VR) infrastructure funding (this is the case for eight of SciLifeLab's ten platforms). These units cannot deprioritize or not serve scientists who contact them for support with VR-funded research projects. After all, almost all research carried out by SciLifeLab infrastructure is supported by peer-reviewed grant funding that the PIs have received. Some infrastructure units (primarily genomics-related) are also concerned on how to organize the evaluation of the constant flow of 1,000s of projects per year (3,700 projects last year). Evaluating every one of them would lead to a much slower service and longer turnaround. As the short time to results is often the most important expectation from the users of infrastructure, many units carry out most small projects without an external review and often know relatively little on the projects and the types of samples.

Some units and platforms already exercise extensive project prioritization, including external peer review. For example, the entire function of the DDD platform is based on careful evaluation and prioritization of projects from the academic user community. DDD discusses and provides advice to all projects, but only chooses a minority of the projects for resource-intensive DDD services. Also, the bioinformatics platform operates their long-term projects (WABI) through an open call that only accepts 10-20% of the applications. Therefore, following these examples, we will continue to consider opportunities for prioritization of quality, considering the diverse situations depending on the unit, the services and the users.

This challenge also links to another major paradigm shift that we will actively promote; making SciLifeLab infrastructure-generated data as open and FAIR as possible. Overall, the IAB's recommendations for quality assurance are already in place in several units, but each unit is different and it is not easy to come up with SciLifeLab-wide recommendations.

d) Provide a national project *to facility matching mechanism for each platform, i.e., not only for virtual services (in bioinformatics this is working exemplarily) but also for physical services, so national users can easily find the SciLifeLab site and facility best suited for their needs. The virtualisation of many physical services during the pandemic provides an opportunity to do so.*

A: We agree and will consider this with the platforms. The infrastructure coordinator and the new platform coordinators already to some extent serve in this role, but this could be further developed into a consultation/advice system for technology and service questions. Large platforms, such as genomics also already provide such advice. Finally, the launch of Capabilities (see later sections) serves such a role as well.

e) Provide a pan-platform *user consultation mechanism, so projects that need support by multiple technologies, in different facilities and platforms, can be well planned and effectively supported.*

A: This is another important and highly relevant suggestion that we have begun to address. A general aim since many years is to foster staff-scientists at SciLifeLab infrastructure to act as experts for the entire repertoire of technologies and to guide users to the right facility and to promote cross platform services. The infrastructure and platform coordinators will play a key role here as well. Also, in the areas of Precision Medicine and Planetary Biology, and in Pandemic Laboratory Preparedness, we are creating systematic services across platforms. This includes integrating sample preparation and IT solutions to track samples and projects, and to enable layering research data and meta-data on individual samples.

f) Collaborate more closely *with the relevant European infrastructures beyond bioinformatics/ELIXIR, e.g., INSTRUCT, Euro-BioImaging, in order to synergise the national and European levels of RI coordination and make full use of the new European infrastructure access and training programs for the Swedish community.*

A: We agree, and several connections already exist with ESFRI and ERIC infrastructure, but we will try to make them more apparent and describe their role. SciLifeLab has had close ties over the years with ELIXIR, where SciLifeLab Bioinformatics (NBIS) is the Swedish node. DDLS will add new elements to collaborations with both ELIXIR and EMBL-EBI. Also, many DDLS scientists work with bioimaging and bioimages, which could add capabilities for Euro-BioImaging. SciLifeLab translational scientists and relevant infrastructure (e.g., DDD, CBGE) are engaged in EATRIS, as well as EU-OPENSCREEN. Sweden is not a member of some of the relevant ERICs, such as INSTRUCT. We are discussing this concern with the Swedish research council which has the overarching responsibility for the national memberships in all ERICs.

g) Further promote a "happy marriage" *between new technology development and challenging research applications for all platforms. This is a key mechanism to drive methods ahead and stay at the cutting edge, that should be built into the platform operations. The internationally leading example of the SciLifeLab spatial and single cell biology platform should be used as a paradigm to create a mechanism to promote this for all platforms, such as seed funding for suitable projects and aggressive use of the 20% top-sliced capacity for technology development with the most innovative researchers.*

A: We agree and there is indeed strong support for the role of technology development in the SciLifeLab community and among stakeholders. We have also seen powerful examples and track records in the past of technology development, such as the spatial and single cell biology platform that IAB pointed out. Funding for technology development has arisen from SciLifeLab Technology Development Projects (TDPs) and from external grants that the research community has acquired. However, such grants are often not sufficient to implement the technology in practice as infrastructure service. This is why the 20% effort from the platform budgets is a major contribution towards cutting-edge capabilities and towards engaging with the research community as alpha and beta users. Moreover, SciLifeLab is now engaged in developing the entire pipeline from technology development to promoting innovations, such as proof-of-concept funding, alpha-beta testing, test-beds, and links to startup and venture funding. SciLifeLab could have a major role here and this is one of the topics we will promote for the next government research bill, see *Appendix B. Summary of SciLifeLab's comment to the Swedish government regarding the next research bill, 2025–2028.*

h) The SciLifeLab group leaders *and especially fellows are often the ones that engage in technology development with the platforms. This should be embraced and promoted, especially to the fellows, rather than hidden as it might give the appearance of "privileged" access, which is not the case.*

A: This has been discussed in the past, but privileged access to the infrastructure for internal group leaders is against the concept of our national infrastructure mandate. This does not allow us to prioritize internal users or SciLifeLab's own research. Hence, we have suggested that group leaders should take part in technology and application development, as well as early users and infrastructure units to set up joint grant-funded research collaborations on technology development. Some SciLifeLab fellows are already closely associated with platforms and act

as key scientific and technological experts. This can promote interactions between researchers and the infrastructure, without compromising equal access to routine infrastructure services by any eligible scientist from anywhere in Sweden.

i) Improve the credit and visibility *the SciLifeLab brand gets for major new technologies and services, the press coverage often only refers to the host university involved and not to SciLifeLab.*

A: It is true that we sometimes see news that arise from SciLifeLab-associated group leaders only mentioning their primary university affiliation. This is an important issue to consider between SciLifeLab communication and the host university communication departments, but also to discuss with SciLifeLab associated scientists. We have recently considerably strengthened the SciLifeLab communication office, which actively works on this topic. We are aware that if SciLifeLab is not mentioned, it may become more difficult to ensure continued support from the government in the future. We are also promoting the SciLifeLab brand through stronger co-branding of the SciLifeLab name and association in grants and contracts that formally allow only the legal entity to be shown.

3.3 Research Mission

a) General: *Renew and increase the funding commitment (SFO) by the four host universities.*

A: As mentioned, the former and the current government have so far decided to continue the SFO funding program for SciLifeLab and other SFO programs across the nation. We will be in close contact with the host universities and will monitor the situation. Government decisions on SFO will not be done for SciLifeLab SFOs, but simultaneously on all SFO programs, and we have continuously communicated to the government the key importance of SFO to a national infrastructure like SciLifeLab.

One should note that the host universities also provide substantial in-kind support to SciLifeLab (e.g., all PIs associated with SciLifeLab are engaged at one of the host universities and the majority receive full salary support from the host universities and not from the SFO funding). Also, there are specific funds from the universities for e.g., technology, instruments and local core facilities that indirectly also support SciLifeLab scientists and infrastructure units. Last, several programs, such as DDLS, will require add-on support from the host universities to cover the compulsory indirect costs and overheads that KAW funding will not cover. Nevertheless, it is the SFO funding that the government provides that is most critical for the future of the SciLifeLab Fellows programs (and for e.g., Campus Solna).

b) Consider, if the additional universities *that have joined SciLifeLab's infrastructure, several of them with physical sites (Nodes), could contribute to the research funding as well. Bringing more partners in could potentially take inspiration from the Uppsala model on how to run SciLifeLab beyond Stockholm.*

A: This is a relevant suggestion and opens a new opportunity now that universities outside of Mälardalen (Stockholm-Uppsala Region) could support and build their local SciLifeLab sites as an integrated site and key part of the national SciLifeLab, somewhat akin to the Navet in Uppsala. We are keen to work with each of the new SciLifeLab sites so that they could also leverage the benefits of the combination of infrastructure, data science (DDLS) and their own high-profile research areas. This could be accomplished by combining national infrastructure support, local research funding (e.g., future SFO support at each university as there are many SFO funded programs at other universities as well), and data support (e.g., national DDLS funding) at each new site. This could also engage related activities, such as the KAW-supported WCMM centers or relevant local core facilities at each site, and even health care associated regional funding. The hope is that there will be local and national synergies across all of these functions at each SciLifeLab site. An example of this development is Umeå University, whose Nordic EMBL Partnership MIMS (Molecular Infection Medicine Sweden) is participating in the SciLifeLab Pandemic Preparedness Program and plays a major role in the DDLS research area Epidemiology and Biology of Infection (DDLS EBI), such as hosting a National Data Science Node. The new sites should develop their own models that best fit their environments, but do this in collaboration and linked with their national status at SciLifeLab. Also, we have seen that the new sites can inspire and inform each other and also CS and the Uppsala SciLifeLab site in terms of how they develop the SciLifeLab operations at their sites. Overall, this suggestion is not only actionable but has led to developments that will be presented to the IAB during this visit.

c) We would expect that *if all Swedish universities speak with one voice, the government will move quickly to establish the SFO framework and that an overall increase is possible, especially in the light of the large KAW investment into DDLS.*

A: As indicated already, we are somewhat hopeful about the future of SFO funding. This is also of keen interest to all universities as there numerous SFO initiatives besides SciLifeLab, also outside of the life sciences. As mentioned, SFO funding may well be converted as the basic funding for the universities, and at that point formal earmarking to a specific purpose may be removed. Hence, we will need to maintain a positive attitude towards the host universities in the future in any case to ensure the future funding for SciLifeLab.

d) Now that the SciLifeLab fellow model *has served as a blueprint for large scale Wallenberg investments, the host universities should take the next pioneering step, rather than being driven by the agenda of private funders. For strategic ownership by the host universities it is worth highlighting, that currently the SFO support via host universities to SciLifeLab makes up only 20% of its total resources.*

A: The SFO support indeed represents about 20% of all "basic" funding earmarked for SciLifeLab, considering the combined total funding from National/DDD, SFO and DDLS. The SFO funds are primarily used to finance SciLifeLab fellows' support with the remaining being used for other common actions (e.g., postdoc and instrument calls) and CS common funds. Also, as indicated earlier, SFO funding is not the only way that host universities support SciLifeLab.

SFO support is also important because research at universities in Sweden is completely dependent on PI-derived external funding. Universities are not allowed to retain major surplus funds, and hence they have minimal "free resources" to transfer towards specific new research initiatives. We note that the host universities do provide other types of support for SciLifeLab-associated research, infrastructure and data functions. Host universities will also continue to fund all the SciLifeLab and DDLS fellows after their 5-year term is over. This type of funding is difficult to quantify as it is not considered "SciLifeLab funding". However, this means that the total in-kind funding via the host universities to the SciLifeLab community is much greater than the dedicated SFO research support.

e) We advise the host universities *to create a jointly funded interdisciplinary research Hub at the Campus Solna coordinated by SciLifeLab. It will attract much more funding from the outside, than the universities have to invest themselves and become a magnet to attract and retain international talent to Sweden. In line with the Krantz report, KTH might be in a natural position to lead such an effort jointly with the other host universities.*

A: This is an important suggestion as a potential future Campus Solna model, and indeed research at CS belongs to the host universities to drive, while the national infrastructure (and DDLS) primarily belong to the national board (with 11 parties participating) to steer. We are open to more discussions on how to accomplish this at CS, where three universities are involved. For example, given how the SFO funding is allocated by the government, the three host universities in Stockholm must administer and account for their own SFO funding as separate legal entities. However, there are possibilities to work towards this model in other ways. A recent example includes the establishment of a long-term (six-year) Campus Solna Budget, which includes allocating 5 MSEK / yr of SFO funding from each of the three universities as CS Common Funds (total 15 MSEK / yr). Common Funds finance, e.g., Research Environment and Development (RED) grants that support postdoctoral fellowships, early-stage technical development, projects and minor shared equipment. The implementation of Common Funds provides a paradigm for other future joint activities, which should be coupled with other activities and suggestions (see below).

f) Such a Campus Solna SciLifeLab hub *will provide a unique interdisciplinary life science environment, where all cutting-edge technologies and major directions of life science are integrated. It would be a major asset to the host universities and to Sweden, allowing to train the urgently needed next generation of trans-disciplinary life scientists, in a flat scientific hierarchy based on small innovative groups, continuous evaluation and turnover. All host universities would immensely profit from this second step in their joint effort and set a future model for new investments by other funders such as KAW.*

A: We agree to aim towards an ambitious future model for the Campus Solna (CS) as an example for the new SciLifeLab sites across the country. The three Stockholm universities realize that SciLifeLab CS is a significant asset to their organizations, and particularly to the potential to contribute to the recruitment and training of next-generation scientists. The need for evaluations and policies governing the turnover of research groups at CS has been recognized. As discussed earlier, the three host universities in Stockholm have not synchronized their SciLifeLab activities, including such issues as how to cover rental costs, space allocation and the localization of research groups to CS. Consequently, each university developed their own models. This has hampered efforts to achieve a mutually acceptable joint organizational model. As mentioned previously, CS is more like a biocenter where three separate legal entities (KTH, KI and SU scientists) rent space. It has not been an accepted vision to make CS into a fully integrated joint research center. Despite this, CS has none-the-less been a highly successful joint venture and currently space shortage is an acute concern. A solution to acquire more space by including the Beta-building is under evaluation. CS is the most important life science campus for KTH and the second-biggest campus overall. In contrast, for KI <1-2% of its faculty is affiliated

at SciLifeLab-CS while SU is somewhere in the middle in the stats. Hence, it has not been easy to achieve consensus from the participating universities for new initiatives and ideas and it is much easier to maintain the present model of CS. The new plans for CS are described as a separate chapter in the IAB report, and we have devoted extra time at the IAB meeting for further discussions about the CS.

g) An easy first step towards this *is to provide more delegated authority to the new Campus Solna Director and committee to run the campus effectively. We recommend that this includes for example the authority to assign space and instrument access to SciLifeLab fellows and to the most productive and impactful SciLifeLab scientists - even if this means reducing space allocations to other group leaders that are occupying 'historical' space in Campus Solna.*

A: The steering documents for SciLifeLab (Agreement on collaboration regarding SciLifeLab ("four-party agreement")), Campus Solna (Agreement on collaboration regarding activities within SciLifeLab at Campus Solna ("the three-party agreement")) and Rules of Procedure for the National Center Science for Life Laboratory (SciLifeLab) were revised in 2022, see *Appendices P-R*. A major update of the 3-part agreement was the inclusion of a defined role for the Campus Solna Director (CSD). The CSD reports to the Campus Solna Committee (CSC) and to the SciLifeLab Director. CSD introduces and CSC decides on space allocations at CS and is the responsible entity for setting the level of common services and common costs, which universities pay with SFO funding. Hence, the allocation of space is now the responsibility of CSD and CSC. The two buildings comprising SciLifeLab CS, Alpha and Gamma, are now 98% full with fully financed "tenants". The level of funding available to some of the successful groups is larger than can currently be accommodated in relation to space availability. Indeed, ensuring that research and infrastructure groups have sufficient space to reach their full potential at CS represents a pressing challenge and accommodating the new SciLifeLab and DDLS fellows at CS is a major challenge.

The use of SFO funding remains independently decided and was not intended to underwrite the creation of a jointly funded integrated SciLifeLab Campus Solna center of excellence. Instead, the SFO funding was allocated separately to each of the three Stockholm universities for them to arrange their research activities in SciLifeLab to the best of their abilities.

The Campus Solna Director and Campus Solna Committee are establishing strategies for Campus Solna space use and while doing so, take into account the national SciLifeLab strategies and changes. CSC has conducted an internal review of all research groups at CS that focused on fit to the Campus and to the SciLifeLab community as well as regarding the engagement of scientists in the community.

The national and local (CS) aspects of SciLifeLab need to be seen in a synergistic manner. At the same time, it seems likely that Uppsala and the other national sites do not support the creation of a single center of scientific excellence in Stockholm under the SciLifeLab brand. Hence the IAB's suggestion for CS is good, but there are both internal (Stockholm Trio universities) and other (UU and other universities) opinions that are not favoring a joint center of excellence plan. SciLifeLab stands for collaboration and inclusivity at a national level, and hence an exclusive center of excellence is not an easy proposal.

h) The SciLifeLab group leader definition *is a step forward, but seems to be very "soft" and has no system for quality management or turnover. We recommend to set up a system for obtaining and renewing the status of SciLifeLab group leader and building in an external evaluation by default, to avoid inflating the numbers (189 is already very high!) and losing the "mark of excellence" that being a SciLifeLab faculty member must have to be meaningful.*

A: We agree with the IAB statement that the current SciLifeLab group leader definition is "soft", broad and inclusive, and without strong expectations or responsibilities towards SciLifeLab. Reaching a degree of harmonization has been a long process i) between Stockholm universities, ii) between Stockholm and Uppsala or iii) across the new sites. The IAB is also right in that there is also at the moment no external scientific review and not many expectations for the associated group leaders to "earn and maintain the status" of a SciLifeLab group leader. With infrastructure leaders, DDLS fellows and all new sites eventually included, there are now >300 group leaders associated with SciLifeLab across Sweden. The most important criterion has always been a clear role and association with SciLifeLab activities, such as infrastructure, technology development, or belonging to e.g., fellows' communities. Now that the new sites have nominated their first SciLifeLab group leaders, we realize that over the years, and due to historical reasons, the criteria applied have been different across the various sites. In Stockholm, an expectation for the SciLifeLab group leader has been location at Campus Solna.

We have now started a plan for a new SciLifeLab group leader definition that is processed and approved by the management (and will be discussed with the board). This document is included as an appendix (*Appendix M*) and can be discussed at the IAB meeting. This constitutes one definition that should be applicable to all sites and does not depend on a presence at a particular location.

i) In addition, we advise to consider *to integrate the Unit and platform leaders into the SciLifeLab faculty program at the same level as research faculty, to ensure they get the recognition they deserve for their important role.*

A: We agree and this has already been accomplished. Since we have 40 infrastructure units and there are several co-leaders, realizing this suggestion has actually added a very large number of group leaders (63 Heads of Unit, 10 Platform Directors, also, the community includes the SciLifeLab Site Directors, altogether adding about 80 group leaders).

j) The impact assessment of publications *resulting from SciLifeLab's own research has to be better stratified in order to assess SciLifeLab's impact on the quality of Swedish life science: We suggest the following four categories: i) entire Swedish life science community, ii) SciLifeLab infrastructure enabled community, iii) SciLifeLab group leaders, iv) SciLifeLab fellows.*

A: We agree and this is roughly how publications are already classified and will be shown in this IAB report. As the new group leader definition was just started three years ago and is still evolving (see above), the classification of all SciLifeLab group leaders was not visible in the statistics. We have to be cautious in changing the definitions of the group leaders too often, as the statistics from year-to-year will then not be comparable.

k) SciLifeLab Fellows: *Assuming a renewal (and hopefully increase!) of the founding universities commitment, the highly successful SciLifeLab Fellows program should maintain its core strengths but must address some of its structural problems in the next phase.*

A: We appreciate this comment. Several new practices are being adapted for the SciLifeLab recruitments, such as coordination of recruitments across universities, publicly open lectures, and coordination of space arrangements (at CS). However, fundamentally the SciLifeLab fellow recruitments represent four different processes at each of the universities, where many departments and faculties are involved. The universities first need to come to a consensus decision on the research areas for the recruitment and the host department of the fellow. This is because the fellows' positions are tenure track employments that the departments will be responsible for decades to come. Hence, SciLifeLab has no formal role in these decisions, but serves an advisory role via the Integration Directors and the Scientific Directors of each host university, who also are members of the SciLifeLab management team. KI is only recruiting under a very broad topic "molecular life sciences", but with a focus on (bio)medicine. At UU and SU, fellows are also recruited in natural sciences, including ecology and biodiversity, evolution, mathematics and computation, and these universities prefer to define a specific topic for each SciLifeLab fellow call. KTH also has relatively narrow topics for the SciLifeLab fellows calls from the technical development/engineering angle. Together the diversity in recruiting strategies has created an interesting mix of fellows. On the other hand, when universities recruit SciLifeLab fellows based on their own interests in a relatively narrow area, housing all such fellows together at CS has sometime resulted in challenges and lack of critical mass in the CS environment for the fellows.

The DDLS Fellows recruitment follows quite a distinct process. Due to the KAW's instructions, SciLifeLab board will approve each recruitment across the country and the SciLifeLab/DDLS representatives participate as adjunct members in the DDLS fellow recruitment committees and in the interviews. The link to SciLifeLab/DDLS is here much stronger for DDLS than in the case of the SciLifeLab fellows.

We will discuss and try to see as to what extent the practices started with the DDLS Fellows program could be adapted in the SciLifeLab Fellows program and how the various programs could be harmonized. According to the early decisions by the SciLifeLab board (e.g., board from June 18, 2013), the board should also validate each SciLifeLab fellow position to be announced under the brand of SciLifeLab. This practice has been given up for a variety of reasons long before the current management and the current board. The board could decide to reactivate this decision to enhance the coordination and synchronization of the SciLifeLab Fellows program, but that is not an easy decision to make now. This could further complicate an ommercy long process at each university and "compromise the autonomy" of the universities on their own tenure track recruitments. Also, recruitment is only one step in the "career cycle" of a fellow, and similar arguments and counter-argument apply to e.g., tenure decisions (see next topic).

l) Introduce a comparative evaluation *between all fellows recruited each year, by default with external members in the search committee and a clear primary objective for excellence and thereafter good fit to university departments for future tenure perspectives.*

A: There are indeed differences in the procedures of recruiting and evaluating Fellows across universities and across sites (e.g., Stockholm CS vs. Uppsala), but the outcome has in any case been an excellent group of fellows (based on 18 ERC grants received so far, other grants and publications) that the host universities and SciLifeLab can be proud of. Currently each university recruits SciLifeLab fellows based on their own interests and at their own "pace" in a relatively autonomous process. At CS the prospective recruitments are discussed across universities ahead of time, to ensure space availability and fit with the research environment. The calls for new fellows are based on funding decisions within each of the four SciLifeLab committees (governing the SFO funds at each university), with input from departments or faculties. At KTH, SU and UU, a host department is usually predefined, and is responsible for the long-term career support and hosting of the fellow, sometimes by an associated faculty. At KI, the process is based on broad calls and the host department is defined based on the department that represents a good match (fellows can usually choose their host department at KI).

SciLifeLab does not currently have much of a role in guiding the recruitment of SciLifeLab Fellows or their tenure process. The decisions are up to each university as a legal entity and the process is governed by government regulations on tenure-track scientists that only host universities as employers can exercise for their own staff. Each university already relies on external international ad-hoc reviewers to evaluate applications from SciLifeLab fellow candidates, although this is not coordinated between universities.

m) Develop instruments for fellows *to collaborate with each other, especially across host universities, for example a joint postdoc recruitment program, prefunded for the first year and with a pool of 3-year fellowships for the best candidates.*

A: This is an excellent suggestion and many developments are underway. The SciLifeLab committees at the three founding universities in Stockholm have agreed and committed to long-term support for Common Funds (5 MSEK / yr / univ; total 15 MSEK / yr) to finance postdoctoral fellowships, shared equipment and early-stage technology development project grants at CS. This initiative was implemented precisely to promote and stimulate collaborations between CS groups. In Uppsala, the SciLifeLab committee allocates funding to similar purposes, again including postdoc grants. These programs are not restricted to the SciLifeLab fellows as applicants, but apply to all group leaders. We have also now launched PALS (Program for Academic Leaders in life Sciences), which has a 10 MSEK budget from KAW for the SciLifeLab, DDLS and WCMM fellows to launch collaborations between fellows. Also, several mechanisms exist in the DDLS program to enable joint collaborations of the fellows and the rest of the community.

n) Increase transparency *and remove inconsistencies between departments/ universities regarding the tenure system.*

A: The tenure system is regulated by the government and the regulations apply to all universities and all fields of research, and as such the rules should be the same for all. In practice the rules are implemented somewhat differently at each university. However, it is difficult for SciLifeLab to impact on the tenure processes due to the fact that they are core university functions across all fields of science, and that tenure i) is governed by established government tenure regulations, ii) is coupled to financial and HR responsibilities of the universities and departments, iii) is a process that universities want to retain full autonomy for since tenure decisions dictate their future permanent faculty. In the DDLS program, we are also considering launching an (international) advisory body for the DDLS fellows to advise, mentor and follow their progress. This could also help and support the tenure process of DDLS fellows, at least in an informal, advisory manner, and it could even be extended to the SciLifeLab fellows.

o) Ensure that SciLifeLab fellows *are not at a disadvantage compared to their university peers to apply for international funding through their host universities.*

A: Since we do not know the background of this comment, it is difficult to give an exact reply. There is nothing in the SciLifeLab fellows' program per se that places fellows in a disadvantageous position, but it is possible that other factors, such as departmental budget limitations, availability of matching funding or lab space, the remaining years of fellows' own position, etc. may have in individual cases led to host university departments in not approving a particular application for external funding. SciLifeLab does not control the department practices that apply to external grants to the fellows. It is the head of the department that controls and has to accept all applications for external funding. Often such applications require co-funding or have other terms that the department head has to approve or disapprove in advance. SciLifeLab management group is happy to discuss any matters of this nature if they are brought to our attention, either case by case or as a matter of principle. Based on discussions with fellows, it does not appear there are wide-spread issues in this regard, but we will continue to explore and monitor the situation.

p) Provide competitive mid-career support *packages (similar to an ERC consolidator grant) for the most successful fellows and options for fast-track tenure to be competitive with international offers and retain them in Sweden. This will furthermore lead to spawning of new visionary research ideas that make best use of the SciLifeLab infrastructure.*

A: This is a good suggestion and has been discussed. Indeed, support to mid-career scientists would be positive, given that there are virtually 100s of young scientist PIs being recruited and also many research grant programs deal favorably with young PIs. However, there is hardly any dedicated support at the next step. In some of its programs, KAW has offered extension terms to fellows in a competitive process. SciLifeLab fellows have been extraordinarily successful in acquiring external funding, but often when their "young investigator" status is over, there will be increased competition. Some university representatives have expressed hesitance towards just funding to the very best fellows. Those are the ones who already have group sizes of 15+ people and they will likely go on to win ERC consolidator grants and other senior grants. And if the bar is lowered to create a "consolidator fellow" package, it is not as much of an excellence-process anymore.

3.4 Capabilities

a) The pandemic response *provided an excellent example of switching to "war time" mode and bundling all technology platforms, in order to deliver pandemic services in close coordination with clinics.*

Transfer of this excellent blueprint *for long-term preparedness and linking all omics capabilities to clinical samples more broadly is excellent and forward looking.*

A: We agree and indeed, we should not lose the lessons from the pandemic, as a way to react to a future crisis or as a way to carry out science more quickly, openly, efficiently and collaboratively based on sharing data, samples, technologies and experience. The Pandemic Laboratory Preparedness program (PLP) will ensure that this line of research and mindset of fast translation to practice has been able to continue from 2021–2024. The future of the PLP program is not guaranteed and we have made new justifications for continued funding in the government research proposition (*Appendix B*).

b) Define better for which grand challenges, *e.g., major diseases in Sweden, these capabilities will likely deliver impact in "peace" times.*

A: The PLP capabilities in "peace time" will mostly contribute to research on infectious disease, virology, or antibiotic resistance. Epidemiology and biology of infection is one of the four research areas of the DDLS program (DDLS EBI). It will also contribute to the application of new methods to study infection and the microbiome, such as metagenome sequencing for research and diagnostics. The SciLifeLab PLP program and the DDLS EBI research areas have multiple links in common, such as national data handling based on the portal created for COVID-19, now expanded to other pandemic threats and even to pathogens in general[2].

PM programs today tend to focus on e.g., rare diseases, cancer and microbiome, and the dominant technology has been genome sequencing, also at SciLifeLab so far. However, the future SciLifeLab opportunities in PLP or PM lie in promoting multiple technologies and systems medicine approaches and data.

Lastly, several methods established in the PLP program, e.g., the environmental screen for infectious agents or the network of BSL3 laboratories, are relevant also for the Planetary Biology capability addressing environmental and sustainability challenges.

c) Take note of the rising role *of personalised diagnostics and the closer and closer link to therapy (e.g., theranostics) that this can enable.*

A: We do and we will, thank you for the comment. The SciLifeLab focus on DDD keeps our activities naturally close to therapeutics. New plans are underway to suggest launching a sister program called "Biomarker Discovery and Development" (BDD), which would exactly follow the mindset and advice of the IAB. This will be suggested as a potential topic for the government research bill in 2025–2028, see *Appendix B*.

d) Define a mechanism to identify *and support similar grand challenges or ground breaking research questions in the other capability areas such as biodiversity and cell biology, so that a similar "bundling effect" can be realised there as well. This could synergise with an SciLifeLab branded junior – consolidator – advanced grant funding scheme for the best ideas among SciLifeLab fellows (see 4.3. "Fellows" above).*

A: We agree and the launch of grand challenge initiatives in planetary biology has been discussed. Indeed both the DDLS program and the three SciLifeLab capabilities now launched (PLP, PM and PB) will provide opportunities for launching more targeted grand challenge initiatives with external funding.

[2] pathogens.se/updates/pathogens_portal

3.5 Data Driven Life Science

a) The IAB is delighted *to see the Knut and Alice Wallenberg Foundation creating a large cutting-edge programme together with SciLifeLab.*

DDLS is a very impressive programme, a large scale and timely investment in young PIs, students and postdocs in data driven life science.

A: Thank you for the comment and we do agree about the opportunities and the significance of the program.

b) It could be stated more clearly *that ground-breaking research will develop bottom up from the young PIs. To take the best of those and develop them into "big science", we encourage to consider a junior – consolidator – advanced grant funding mechanism that would also provide mid-career support and retain the best PIs in Sweden (see also 4.3 "Fellows" above).*

A: This is true and we will discuss the consolidator approach with the DDLS steering group and with KAW as a funder. Currently this possibility is not built into the 12-year funding plan for the program. The idea to foster the development of some special DDLS areas into globally significant collaborative opportunities and critical mass of expertise sounds like a very attractive goal for the DDLS.

c) It is pivotal for the success *of the programme to form a very strong and closely networked cohort of excellent PIs and not allow that the large investment disappears into the existing departmental landscape of the hosting universities.*

A: We appreciate this comment and agree with this being a potential risk in the context of 11 partner organizations and 4 research areas. The aim of the DDLS program has been very clearly defined as being a nation-wide joint program where all participating PIs need to engage. Through networking activities on national and local level (e.g., through PALS, connecting DDLS, SciLifeLab and WCMM fellows), but also in subject-specific national networks, e.g., gathering fellows in RA-specific minisymposia), PIs from the 11 partner organizations are also brought together.

d) To ensure this*, we would strongly advise recruitment based on excellence with independent and international evaluation for all candidates recruited into the programme. Only in this way can the DDLS programme as a whole attain a stamp of excellence that will be needed to attract additional investment into this critical area.*

A: All DDLS fellows to be nominated have undergone an international review. In addition, the local recruitment committees at all universities have included a representative of SciLifeLab/DDLS, to ensure quality of the recruitment process, the candidates and the fit with the DDLS program. All DDLS fellow nominations have been also approved by the SciLifeLab board. Following the completion of the first phase of the recruitment in the DDLS program, we can state that the chosen system has worked very well. Obviously, there is always room for improvement, which we can try to accomplish in the second round. There was some variability of opinions by the international reviewers in terms of how they interpreted what data-driven research means. Similarly, the practices and opinions of the local recruitment boards have sometimes varied (often reflecting local interests and needs). We think that the second phase of DDLS fellows' recruitment will be more straightforward as we can build on the experience gained. Furthermore, this process has been an interesting experience for the future in how to build a national distributed competence and research program that could also guide the future aspects of the SciLifeLab Fellows program.

e) Furthermore, by coordinating recruitments *between universities, DDLS provides a unique opportunity to achieve true integration of research activities across universities and make all of them stronger than any of them could be individually.*

A: This is true, and indeed the inclusion of the DDLS steering group observers in the recruitment groups has already had an influence in this direction. DDLS fellows have also started to explore collaborations among each other and with other fellow communities.

f) Finally, we feel that the four research areas *DDLS sets out with are good, but rather broad and sometimes even vaguely defined in terms of the computational science requirements. It might therefore help to quickly built critical mass by focusing the first recruitments on the computational counterparts of experimentally already strong areas in Sweden, including for example spatial and single cell technologies or evolutionary/ecological genomics.*

A: This is true as far as the definition of the 4 research areas goes. KAW wanted to make the fellows' recruitment to be based on excellence, and not on narrowly defined specific research areas. Going forward, each research area will need to define their profile and niche opportunities. Obviously, each university has also had a chance to consider their best areas as potential local environments for each new DDLS fellow. Thus, indirectly this IAB recommendation may have already been realized at the local level. Joint fellows' programs such as the PALS (see below) will foster this development at the national level.

g) Furthermore, we strongly advise integration *of the programme with the SciLifeLab Fellows programme on which it (as well as the WCMM programme) has been modelled as much as possible (see also 4.3 "Fellows" above, and 4.7 below).*

This will allow the DDLS community *to interact closely with the data producing community, especially as more and more quantitative and high throughput data is generated, often by physical colocation.*

A: These two suggestions are excellent and also reflect developments now underway. Despite the differences of the SciLifeLab, WCMM and DDLS Fellows programs, there are many similarities and clearly untapped opportunities for synergy. Over the past 5 years, we already have had close interaction between SciLifeLab and WCMM programs. The annual meetings of the young PIs at WCMM and SciLifeLab, together with the management of each site and infrastructure representatives, have been an excellent opportunity to meet and network among scientists. The new PALS program will be significant to now bring all fellows, including those from DDLS into a joint collaboration program.

h) We would advise to stimulate interactions *between the different research areas within DDLS, as well as interactions with the WASP and SciLifeLab Fellows programme by dedicated funding for joint staff, such as for example shared postdocs or technology development engineers.*

A: We agree, and to some extent such opportunities already exist, such as in the form of dedicated DDLS-WASP joint funding (about 40 joint projects already underway) as well as future calls that will be launched for open PhD student and postdoc positions.

i) To implement DDLS Swedish health data *management and integration has to improve, especially for the Precision Medicine and Infection Biology research areas. SciLifeLab has a key role to address this, setting up a working group with the government to rapidly establish a pilot programme and in the medium-term change policy. The strong support by KAW should be beneficial to achieve this.*

A: We agree and this is among the list of key actions both for the SciLifeLab PM and PLP capabilities and the DDLS PM research area. There is also a new effort to build a DDLS Data Science Node (DSN) for precision medicine at KI in Sweden, which will serve the entire country. There are also currently major ongoing activities in this domain in Sweden, including an effort to launch a new infrastructure for precision medicine (and health data management) at the interface between academia and the health care regions (and industry). SciLifeLab is involved in these discussions that seem to enjoy major interest from the government. This may lead to the launch of a new translational / precision medicine infrastructure for Sweden that mirrors the format of SciLifeLab. At the health care interface, there are many major stakeholders, such as all medical universities, medical faculties and the health care regions as well as private companies. In the context of this potential new national infrastructure, SciLifeLab will need to focus on serving its own key areas, such as technology- and data-driven expertise.

j) DDLS has substantial computational *implementation challenges. We advise to be careful with committing to use large central compute facilities, before the specific needs of life science (e.g., GPU's and bringing compute such as AI models to large data sets rather than the other way around) have been formulated and tested.*

A: We agree and our intention is not to build a major dedicated hardware site or a Data or Compute Center for DDLS, but to complement and facilitate access to services from national e-infrastructures or specific universities. We will make strong use of the Berzelius KAW-funded GPU HPC[3], as well as future new computational service facilities that the government will fund for scientific computing, also to be located in Linköping (naiss.se). Please see *Section 12.2* for more information on this.

k) We furthermore advise to form communities *between the technical staff on the research side ("ResOps") in the DDLS fellows' groups and the technical staff on the infrastructure side ("DevOps") in the Data Centre/DDLS data support team early on.*

A: This is an interesting suggestion to be followed up on. Data Centre has established close direct communication channels with the DDLS fellows to enable technical discussions and early stage testing or hosting. There is also a lot to learn from IT development in managing infrastructures.

l) DDLS puts SciLifeLab in a key position *to establish the first prototypes of future compute services in several key domains of life science. We therefore encourage SciLifeLab to actively contribute to European and international projects in this area.*

A: This is a good suggestion and we are in close communication with e.g., EMBL-EBI, EMBL Data Science Centre, ELIXIR as well as efforts regarding the European Health Data Space for example. The Swedish EU presidency has also involved strong data, IT and digitization themes in the life science and health domains.

[3] nsc.liu.se/systems/berzelius

3.6 Training, Innovation and Career Development

a) Take an enabling role in innovation. *Despite the "professor privilege" and university ownership of IP, SciLifeLab has a key role to play to promote the ommercialization of new technologies and applications and could easily fund this activity from a small part of the proceeds of successful initiatives.*

A: For a long time, we have considered new initiatives in this space, particularly in the context of the DDD. As a consequence of Vinnova-funded initiatives, we now have a close collaboration between innovation offices across the country and the SciLifeLab DDD. This task sounds straightforward, but is not easy to implement IP handling across university boundaries and often against the established and accepted traditions of handling IP in Sweden. As IAB correctly indicates, IP is owned by the scientists, not the university nor SciLifeLab. However, SciLifeLab will continue to discuss this together with all universities. Interestingly, the recently developed Proof of Concept (POC) funding mechanism from KAW seems like an ideal opportunity (see below), for SciLifeLab to have a clear role in innovation practices.

b) The critical gap to address *often is to fund the first mile from the research lab/service platform to a business plan that can be used to attract private investment. The model Novo Nordisk has created with the BII institute may be instructive and worth drawing inspiration from, especially for discussing with KAW for the Swedish innovation landscape.*

A: Together with KAW, which has set up the Wallenberg Launch Pad (WALP) to promote innovations arising from KAW-supported research, we have now launched a SciLifeLab-KAW call for POC grants. 25 MSEK has been devoted annually to this call for the next 5 years by KAW, and there will be an annual call for POC grant ideas. The focus is on innovations arising from KAW-funded efforts, including SciLifeLab, DDLS, WCMM, KAW fellows and KAW grant recipients. SciLifeLab has assembled an evaluation panel to assess such grants.

c) Not only, but especially in innovation, *SciLifeLab has to be able to act as a partner. We recommend that the SciLifeLab board sets up a task-and-finish group that provides a report for the options of a legal representation that would allow SciLifeLab to fulfil its integrating and coordinating activities across its stakeholders at a higher (national) level, without compromising the ownership of the host universities. The legal frameworks of research infrastructure consortia that operate successfully at the European level (ERIC) for similar purposes might provide an instructive example. A similar framework at the national level would allow SciLifeLab to partner effectively with industry and the health care sector, which is critical for its future success. Finally, such a framework, that formally provides national coordination, would also be eligible for European funding streams that individual universities are typically not eligible for.*

A: It is important that the IAB lifts up this issue. SciLifeLab operates today as a government funded "program" with no legal status or legal representation. A lawyer dedicated to SciLifeLab matters started at KTH, and hence can for the first time represent SciLifeLab when discussing with other universities. However, all these developments take time, involve a number of stakeholders, and multiple legal teams at different universities (that e.g., cannot react to requests from SciLifeLab board or that often have a rapid turnover of staff) and need to be constantly motivated and driven forward. The recent Kranz investigation suggested that KTH as a primary host be given more mandate to act as a primary legal host, but this is not uniformly accepted by other host universities and no changes are currently being planned. The recent government request for SciLifeLab to assume a role in coordinating the European Health Data Space applications from Sweden to the EU was very successful. This represents one way that SciLifeLab has started to realize its potential as a coordinator of research activities in Sweden towards EU funding opportunities.

d) It is critical that career development f*or technical and service staff is addressed to prevent losing these highly skilled and sought-after colleagues that the whole infrastructure operation critically depends on. This need has been highlighted in several IAB reports and is recognised by the stakeholders, but we can see no sign of concrete action, using the complex university governance of SciLifeLab as an excuse. In our view it is paramount that this is addressed and finished, even if it is in a pilot form where SciLifeLab would test and spearhead a mechanism before it gets generally implemented in the Universities.*

We thus strongly recommend *that the SciLifeLab Board establishes a task-and finish-group on this subject, with a clear goal, roadmap and timeline, for example taking inspiration from the KI model that is starting to be implemented.*

A: This is important as departure of infrastructure staff to industrial positions has continued or even grown over the past several years. The situation has been particularly difficult for the DDD platform. An infrastructure staff scientist program has just started at KI with a promising model, and other universities are following KI's example. The discussion will continue at SciLifeLab, where the infrastructure director has had a major role to advance this topic with all the stakeholders. This matter belongs to each individual university, which all have their own processes for taking these issues forward.

In order to promote career development for staff-scientists across the infrastructure, SciLifeLab Training Hub will co-create a catalog of training activities where topics targeting the development of staff-scientists in Research Infrastructures is a particular focus. These efforts will be in line with e.g., the efforts in ELIXIR where development of People and Nodes are a particular highlight for its next work programme (2024 - 2028).

e) Regarding training, *the plans are very promising. We advise to integrate the DDLS related training activities into the overall SciLifeLab training programme.*

A: The DDLS research school and the SciLifeLab training hub are closely linked. SciLifeLab Training Hub has a seat in the DDLS research school management group and will assure that the SciLifeLab training program and activities from the Training Hub are integrated into the Research School activities where appropriate. In addition to PhD training courses, SciLifeLab Training Hub has the mission to upskill the entire life science community in technology-data-driven topics.

f) We furthermore recommend *to collaborate with European level training role models such as EMBO courses as well as EMBL's International Centre for Advanced Training to build on best practice and realise synergies between national and European initiatives.*

A: The SciLifeLab Training Hub has a broad range of connections and collaborations across both the national arena and the European landscape. Training Hub is closely connected to EOSC and to ELIXIR (Training Platform) as well as EMBL (via the MoU).

◆ 3.7 Continuing to Shape the Second Decade of SciLifeLab

a) SciLifeLab has set out *an excellent 10-year forward looking strategy and roadmap and has proven its value for Sweden in a "baptism by fire" bundling all its capabilities to respond to the pandemic in a "war" time mode.*

In switching to "peace" time and implementation of the 10-year strategy, we recommend to focus on promoting the quality of Swedish life science research across the board, led and enabled by SciLifeLab with the aspirational goal of Sweden being ranked as one of the five leading European countries by the end of the second ten-year period of SciLifeLab operation.

To achieve this, it will be important to use the opportunities the new resources provide to continue to shape and integrate SciLifeLab's activities into a truly national, transparent and inclusive organisation. SciLifeLab must keep the visionary strengths it was founded on to integrate ground-breaking interdisciplinary life science and the infrastructure to enable it across universities. ***But significant change is needed in order to move forward and attain international leadership by integrating and simplifying its governance and operation, rather than trying to reform and continue to patch up a system that is too complex already.***

A: We appreciate all the IAB comments, particularly the conclusions, and we will make sure that the SciLifeLab board and all the stakeholders pay attention to the last statement (bold highlight done by SciLifeLab).

Version information:

- Original version prepared by the leadership and Management Group of SciLifeLab for the board on March 2, 2022
- Discussed by the board of SciLifeLab with suggested changes, March 9, 2022
- Revised and sent to the stakeholders for a round of comments, April 1, 2022
- Extensive revisions completed based on stakeholder input, May 23, 2022
- New version of the IAB response approved at the board meeting on May 31, 2022 and sent to the IAB
- Updated version of the Response to IAB prepared by the leadership for the IAB meeting, Feb 7-9, 2024, approved at the board meeting on November 8, 2023

Photo: Mattias Pettersson

Photo: Mikael Wallerstedt

4. Updated SciLifeLab Roadmap

For a full version of the draft of an updated SciLifeLab Roadmap, see Appendix A. Below is a short excerpt of the draft, focusing on the strategic objectives.

◆ 4.1 Strategic Objectives

The updated strategic objectives are:

1. Provide excellent and impactful life science infrastructure

SciLifeLab is committed to providing access to cutting-edge technologies, highly skilled staff scientists with technology expertise and multiple infrastructure services for its broad national user community. This will empower research endeavors across universities, health care, industries, and other life science disciplines in Sweden that would not otherwise be possible. SciLifeLab will keep the national infrastructure up to date through rigorous evaluations, technology development and agile adoption of new technologies. SciLifeLab supports and operates infrastructure at all major universities and has dedicated sites at Campus Solna (KTH, KI, SU) in Uppsala (UU, SLU), in Lund, Gothenburg (GU and CHT), Umeå (UmU and SLU) and in Linköping (LiU).

2. Facilitate the transformation of life science data into knowledge

Data-driven life science (DDLS): Open Data, AI, and knowledge. Life science is in a major transition that enables the data-driven research paradigm to be developed. SciLifeLab coordinates a national 12-year DDLS research program funded by the Knut and Alice Wallenberg Foundation. DDLS seeks to change how life science is practiced in the future, energized by data- and AI-driven opportunities. This includes recruitment, training, research school and collaborative programs as well as promoting open, real-time data sharing and rapid data cycles. As DDLS is hosted by SciLifeLab it derives benefit from the links to the data-producing infrastructure.

3. Strengthen capabilities, research communities and global partnerships

Currently, there are about 300 research group leaders with an association to SciLifeLab, across all sites, with a dedicated Campus Solna shared by KTH, KI and SU in Stockholm. SciLifeLab will continue to develop infrastructure in the best research environments, and conversely, strong research infrastructures promote cutting-edge research. SciLifeLab will develop technology- and data-driven capabilities in broad research areas that currently include: i) Precision Medicine, ii) Pandemic Laboratory Preparedness and iii) Planetary Biology. We bring together the technology and data infrastructure as well as researchers and all key stakeholders to promote these capabilities. SciLifeLab stands ready to repurpose its infrastructure to help the society in acute crises, as demonstrated during the COVID-19 pandemic. We will also foster bottom-up research communities to be formed in specific research areas, supported by SciLifeLab infrastructure and the DDLS program. SciLifeLab is keen on forming international collaborations to enrich research and acquire diverse expertise, and will continue to build on the strong partnership with EMBL as a model.

4. Attract scientific excellence and provide advanced training

SciLifeLab will continue to host a truly successful program focusing on recruiting and hosting young tenure-track SciLifeLab fellows at KTH, KI, SU and UU. Now the national DDLS program is underway to recruit and host computational biology group leaders at 11 partner organizations. We will provide joint networking and training programs to the various national fellow communities. The SciLifeLab training hub supports technology- and data-driven training with the help of cloud and AI technology. We arrange national PhD and postdoc training as part of the DDLS program and are increasingly considering life-long learning in technology and data-driven topics.

5. Support innovation and bridge-building for the benefit of society

As a national infrastructure, SciLifeLab is connected with 100s of academic, health care, government, international and industrial organizations as users, but also as contributors and collaborators. Some of the SciLifeLab platforms focus on translational and clinical research towards health care and industry applications. These include clinical genomics and the clinical proteomics and immunology platforms that promote diagnostic development across the country. The Drug Discovery and Development (DDD) platform has been a success story by screening hundreds of drug discovery leads and bringing them forward as dozens of licensed or venture-backed early-stage drug leads. These efforts are now complemented with the Proof of Concept grant program funded by the Knut and Alice Wallenberg foundation, which seeks to develop deep life science-based innovations to the marketplace. Building on all of these efforts, SciLifeLab is a powerhouse for strategic research initiatives, contributing to the health of people and the planet, to innovation and enterprises, and hence society at large.

Their Majesties of Sweden visiting SciLifeLab in October, 2022.
Photographer: Mikael Sjöberg

5. Organization and funding

5.1 Organization

As a national infrastructure and collaborative organization across many universities, supported by several independently organized governmental and private funding sources, SciLifeLab as an organization has evolved from the original Stockholm-Uppsala centric model towards a complete nationally located model, where most, but not all functions operate under the National SciLifeLab Board. SciLifeLab is in a unique position in that it has its own line-item for the national SciLifeLab infrastructure funding in the governmental budget. The official legal, administrative and financial host organization of SciLifeLab is KTH, though KTH shares this responsibility with the other founding universities SU, UU and KI through a formal agreement signed by all four parties. The current SciLifeLab organization structure is outlined in *Figure* 2. The description below also describes the many components of the SciLifeLab organization that have evolved in response to the growth of the SciLifeLab organization, and that are tailored towards ensuring i) that university-specific SciLifeLab SFO funds are governed by each corresponding legal host; ii) that the SciLifeLab Stockholm Campus Solna organization is governed well across the 3 participating parties and together the national infrastructure; iii) that in each program we engage those stakeholders that are involved in each corresponding SciLifeLab function or activity. For the most recent addition, the DDLS program (see *Section* 9) was placed directly under the SciLifeLab Board. However, due to the nature of the privately funded DDLS program (KAW Foundation), with 11 equal partners and specified scientific profile, the board has delegated the task to operate the DDLS program to a distinct DDLS steering group.

The name and brand of SciLifeLab has over the years evolved into an umbrella, or a network, of various SciLifeLab associated activities such as SFO-funded research at each of the original four founding universities, Campus Solna-specific funding arrangements, the national infrastructure and the DDLS-program. For example, the original strategic research funding (SFO) still resides as a separate funding source at the four founding universities. As this funding comes directly from the government to the four founding universities it is not possible for the national board to govern these, however, most other functions exist under the national board.

The recent (2019) government investigation on government funding of infrastructures, ("Stronger focus on future research infrastructure", SOU 2021:65), indicated how the current organizational model of SciLifeLab has worked very well, and strongly suggested not to make changes to such a well-functional organization. However, clarifying KTH's role as the main organizational host for e.g., contractual purposes was lifted as a possibility to improve SciLifeLab's potential to act as a unit representing all. The new and sitting government's ambitious plans suggest a major reorganization of research and innovation funding in Sweden in the next 5 years, where the National Research Council (VR) is suggested to handle all academic research and infrastructure matters, and where many separate research organizations under the government are brought all together under one "strategic research" organization. Thus, there will be strong forces for reorganizing or "simplifying" research funding and infrastructure management and "to avoid overlaps". Hence, it is possible that well-intending rational decisions at a high government level may be made that also will put the current multi-faceted model of SciLifeLab in danger. For instance, if SciLifeLab were to be placed under VR infrastructure funding, it is possible that it would become just a pure infrastructure player, and loosing the benefits of research integration, data integration, and links to innovation, capabilities, communities and sites etc. that are all many of the reasons for the success of SciLifeLab.

5.1.1 Organizational Bodies

Board. The SciLifeLab Board is the highest deciding body with the overall responsibility for national coordination and infrastructure funding. The Board also controls the DDLS funding, as stipulated in the donation letter from KAW. The Board is composed of the Chair and eight additional members of whom four are representing the founding universities KTH Royal Institute of Technology (KTH), Karolinska Institutet (KI), Stockholm University (SU) and Uppsala University (UU), three other Swedish universities, and one industry representative. The Chair and industry representative are appointed by the government, while remaining members are appointed by the KTH Board.

Founding University SciLifeLab Committees. Each of the four universities have dedicated SciLifeLab Committees, either chaired by or with the SciLifeLab Integration Director as committee member, that govern the SFO at the respective university and coordinate interactions with the national infrastructure, other founding universities, Campus Solna, and in the future also the DDLS program.

National SciLifeLab Committee (NSC). The NSC has been reformed and now consists of representatives of experts from across Sweden, with the task to oversee the national perspective of SciLifeLab infrastructure.

Management Group (MG). The MG consists of the SciLifeLab Director, Co-Director, Infrastructure Director, and four Scientific Directors, representing each of the founding host universities, as well as the CS Director. New appointed member from 2023 is the Scientific Director Aristidis Moustakas, UU.

DDLS Steering Group (SG). The DDLS Director leads the steering group, which is the executive DDLS leadership that prepares decisions for the SciLifeLab Board. The DDLS SG also has close links with the 11 partner organizations through a national reference group with members close to the leadership at these organizations. Currently the SciLifeLab Director and the DDLS Director is the same person but may not necessarily be so. Newly appointed members since 2021 are Tuuli Lappalainen and Sara Hallin.

Campus Solna Committee (CSC). The CSC is responsible for campus-specific operations at Campus Solna and consists of Integration Directors (IDs) and Scientific Directors (SDs) linked to KI, KTH, and SU, and the Infrastructure Director. Co-opted member is the CS Director.

Operations Office (OO). The Operations Office supports the SciLifeLab Board, Directors, MG, the infrastructure, and the research community in coordinating, administering and the execution of proposed actions. OO also supports the DDLS Steering Group and the DDLS program.

Data Centre (DC). Data Centre (DC) coordinates and supports activities throughout the SciLifeLab infrastructure life cycle of data; from project planning, data production, data analysis, data sharing, to publishing and reuse of data. DC works closely with MG, OO, all platforms, and also with the universities and the broad research community on data management and training. DC also has a major role in DDLS and its functions.

SciLifeLab Sites. SciLifeLab now has six official sites in Gothenburg, Linköping, Lund, Stockholm, Umeå and Uppsala. The majority of SciLifeLab's research infrastructure, the surrounding research environment and the fellows activities are located at the Stockholm and Uppsala sites. These two sites are also the base for SciLifeLab's management and operational support. However, SciLifeLab is increasingly a distributed operation, and as part of strengthening the coordination of the national mission, Gothenburg, Linköping, Lund and Umeå are also official SciLifeLab sites from 2021. The four sites receive targeted national funding to coordinate infrastructure, data and other support functions for SciLifeLab at the universities concerned.

SciLifeLab Training Hub. SciLifeLab Training Hub is established to consolidate and coordinate the training efforts across the SciLifeLab ecosystem, giving the life science community easy access to the SciLifeLab infrastructure knowledge, skills and expertise.

Members of SciLifeLab's current leadership and stakeholders are outlined in Appendix S. SciLifeLab Leadership, Stakeholders and Committees 2023.

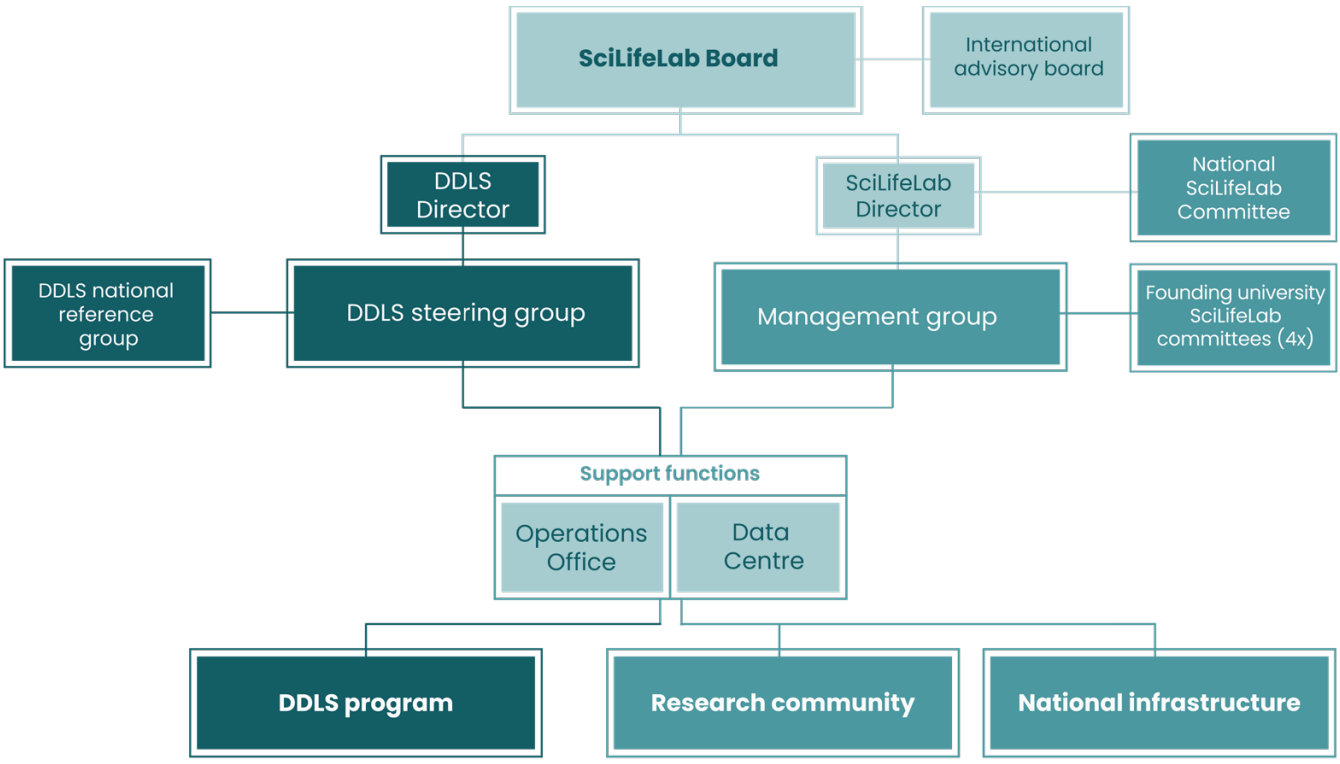


Figure 2. SciLifeLab organization. Efforts in capabilities, training, and external collaborations are transversal and involve all three pillars of SciLifeLab: infrastructure, research community and data. The SciLifeLab Sites connect all SciLifeLab functions.

Photo: Mikael Wallerstedt

5.2 Funding

Up until 2019, the core SciLifeLab funding consisted of three separate funding sources from the government: national infrastructure funding (National), Drug Discovery and Development funding (DDD), and strategic research area funding (SFO) to the four founding universities. The SciLifeLab Board is the deciding body for the National and DDD funding, while the SFO funding is distributed directly to each of the four universities and is controlled by the SciLifeLab committees at these universities.

In 2020, new non-governmental funding sources were also introduced thanks to generous donations from KAW. The first funding was given in response to the global COVID-19 pandemic. This program was extended in late 2020 to continue for two more years and is now incorporated into the Pandemic Laboratory Preparedness capability, described in *Section* 8.2. Through a major 3.1 BSEK donation from KAW, a national program on data-driven life science (DDLS) was then launched in 2021 (see *Figure* 3 and *Section* 9).

The four-year SciLifeLab budget from the government increased for the current budget period 2021–2024. In addition to increased base funding to the infrastructure of 150 MSEK for 2021–2024, SciLifeLab obtained funding from the government for Pandemic Laboratory Preparedness, 130 MSEK over 4 years (2021–2024). Thus, the total national infrastructure funding, including the DDD, was 309 MSEK for 2021, and will gradually increase to 344 MSEK in 2024. The SFO funding has been about 165 MSEK/year (distributed across the four universities), and while its future levels are not known, we are positive towards its continuation as well. Thus, taking all sources of funding together, we will see a doubling of the SciLifeLab baseline funding by 2024, as compared to the level in 2020 (see *Table* 1 and *Figure* 4).

In addition to the funding streams described above, the SciLifeLab infrastructure is also supported by considerable funding from additional sources, including grants from VR, non-governmental funding agencies, universities and user fees. External funding to SciLifeLab infrastructure units is described in more detail in section 6. *Infrastructure*. In addition, SciLifeLab has over the past few years successfully obtained several external grants to support projects and/or collaborative efforts involving SciLifeLab initiatives and SciLifeLab Operations Office.

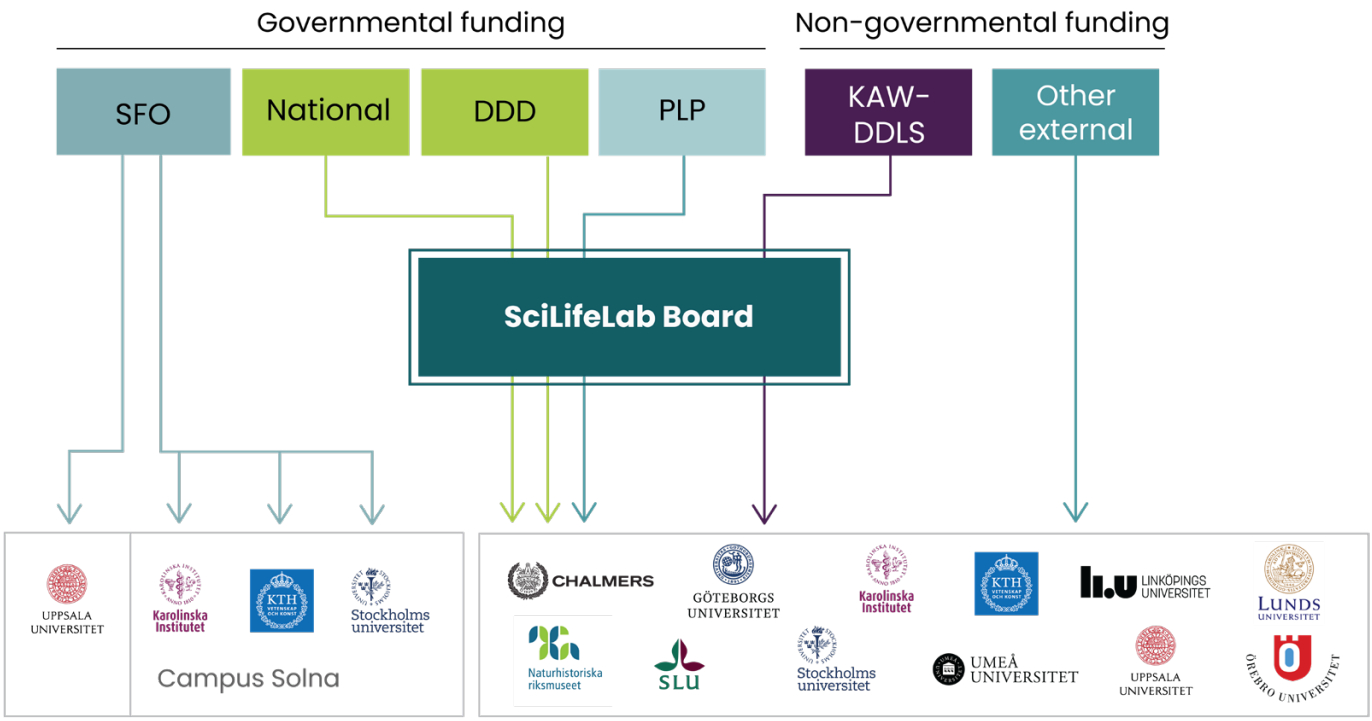


Figure 3. Funding streams to SciLifeLab

These include VR funded joint project InfraLife between large-scale research infrastructures SciLifeLab, MAXIV and ESS, as well as the EU-DIGITAL TEF-Health project (60 MEUR total budget, 10 MEUR to Sweden) and Vinnova funded national coordination of four EU-DIGITAL projects (see *Section* 12.1).

For SciLifeLab to operate seamlessly, these independent funding streams need to be managed according to the regulations from the source. This has required significantly increased and improved financial coordination processes (e.g., dedicated financial controllers for the government, SFO and DDLS parts), as well as an intensive and transparent dialogue with the SciLifeLab Management Group, DDLS Steering Group, participating universities and the Board. *Figure* 3 explains how the distinct funding flows, the recipient universities and how the funds are managed.

Table 1. Funding to SciLifeLab 2020–2024 (MSEK). To note is that this compilation does not account for the SciLifeLab communities' individual research funding.

	2020	2021	2022	2023	2024
Governmental funding (MSEK)					
Base funding NAT incl DDD	274.7	279.5	282.4	286.7	298.1
New NAT		30.0	30.0	40.0	50.0
PLP		40.0	30.3	30.7	31.8
SFO*	161.8	164.5	166.3	168.5	174.4
Sum	*436.5*	*514.0*	*509.0*	*525.9*	*554.3*
Non-governmental funding (MSEK)					
COVID-19 program	35.0	87.5	52.5		
DDLS		7.5	40.4	177.9	320.4
Sum	*35.0*	*95.0*	*92.9*	*177.9*	*320.4*
Total	*471.5*	*609.0*	*601.9*	*703.8*	*874.8*

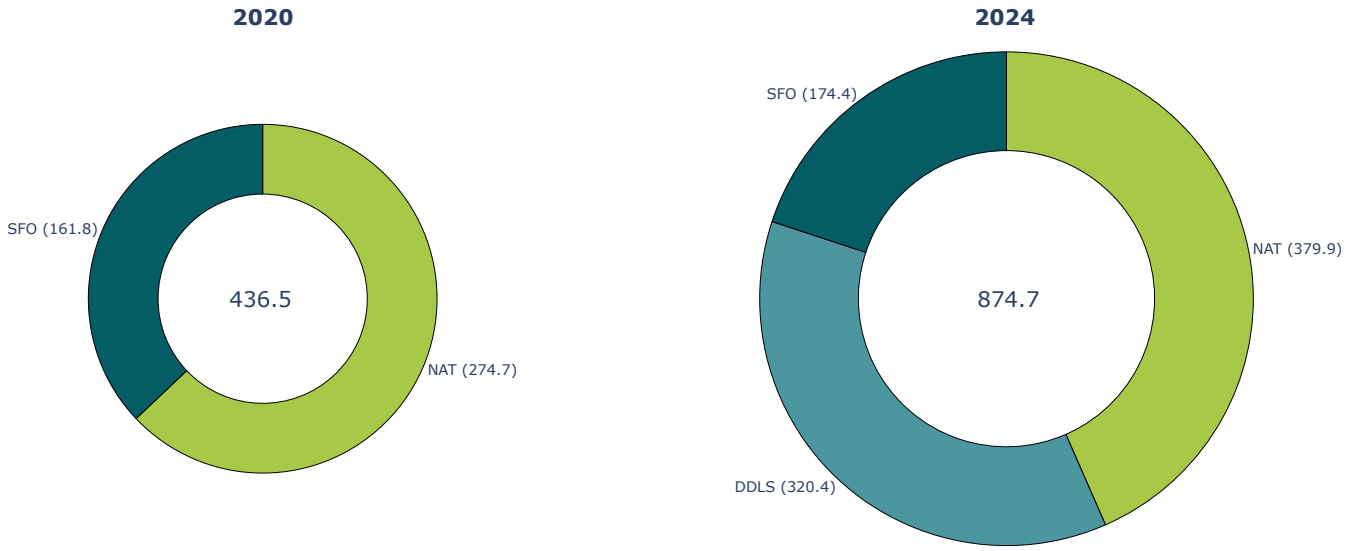


Figure 4. From 2020 to 2024, SciLifeLab total funding will increase 100% from 436.5 MSEK to 874.7 MSEK

Photo: Mikael Wallerstedt

6. Infrastructure

6.1 Introduction

The SciLifeLab research infrastructure, established in 2013, constitutes the backbone of SciLifeLab and is funded directly from the government. Together with the synchrotron radiation facility MAX IV and the European Spallation Source (ESS), both located in Lund, SciLifeLab is considered by the government as one of the three major national research infrastructures in Sweden, and the only one entirely dedicated to life science. The primary mission of the SciLifeLab infrastructure is to facilitate impactful research discoveries in Sweden by providing cutting-edge, unique, and complementary technologies, resources, and expertise to the life science researcher community. The infrastructure collaboratively assists users in projects ranging from basic to translational research and is well equipped to support large-scale research initiatives and societal grand challenges.

In accordance with the four-year funding cycle of SciLifeLab, an internal "Midterm Checkup" of the infrastructure was performed in October 2022. The report submitted from the infrastructure platforms and units for the Midterm Checkup is provided in *Appendix C* and for detailed information about the recent development and plans for individual platforms and units we refer the IAB to this document.

The SciLifeLab infrastructure is organized into 10 platforms, which in turn comprises over 40 units in total, *Figure 5*. The composition of the platforms is primarily based on units sharing a common user base (capability type platforms) to maximize the cross-unit synergies. While built around platforms, SciLifeLab strongly emphasizes the importance of cross-platform interactions and collaboration to guide and serve users in an optimal fashion. The infrastructure operations are distributed over 11 universities across Sweden as illustrated in *Figure 6*.

We will in this chapter present the latest infrastructure statistics and metrics, highlight recent developments, and describe the SciLifeLab funding of the infrastructure for 2023. We will also briefly describe the process for the next international evaluation of the infrastructure that will take place in April 2024 and share our thoughts on opportunities and challenges for the infrastructure operations beyond 2025.

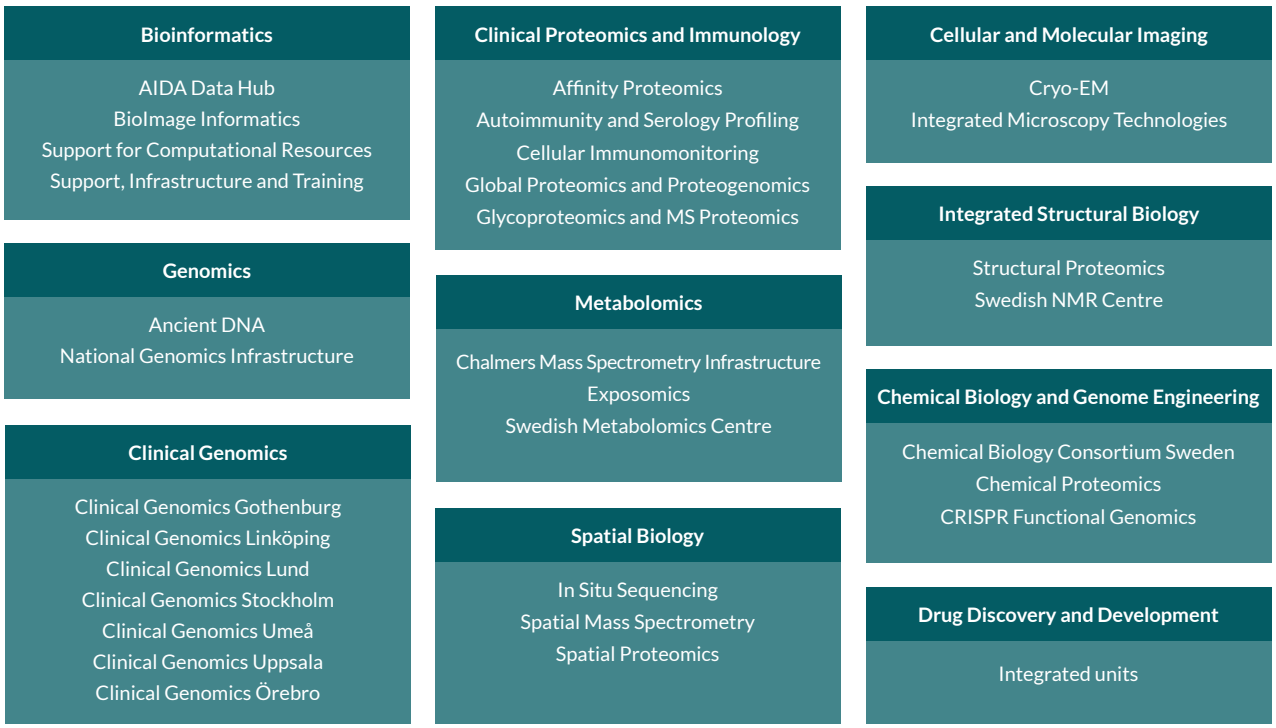


Figure 5. SciLifeLab infrastructure platforms

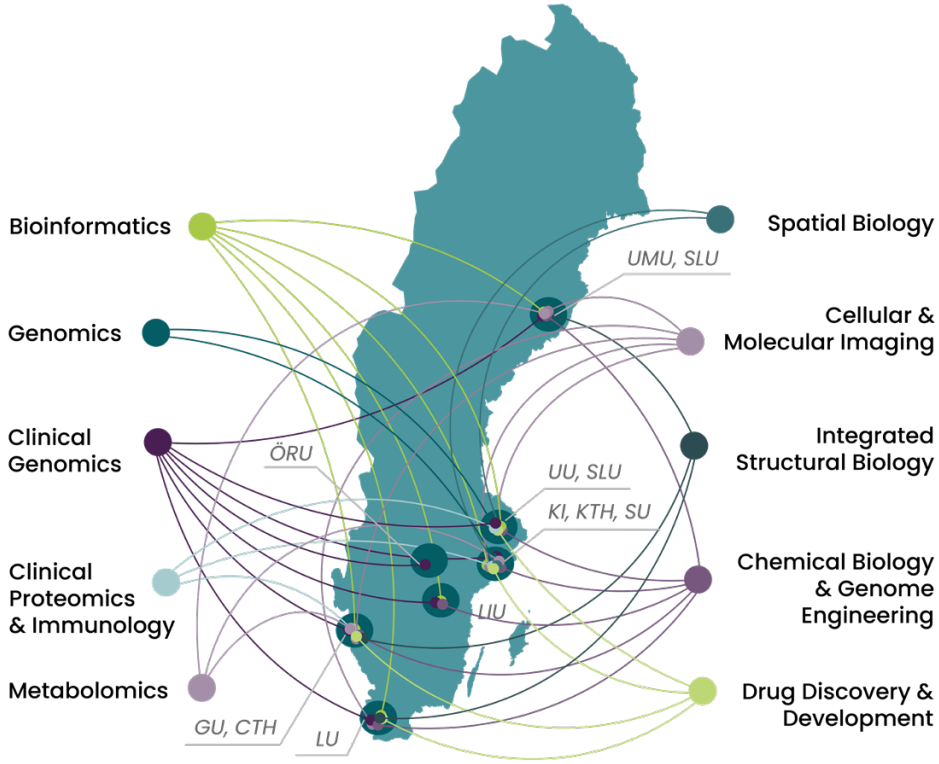


Figure 6. Distribution of platform operations across Swedish universities

6.2 Infrastructure Statistics and Metrics

The number of infrastructure users and their distribution across universities and non-academic sectors as well as the volume and impact of infrastructure user publications are key metrics that SciLifeLab monitors annually for each unit as well as for the whole infrastructure. The analyses presented in this section are global statistics for the whole infrastructure based on data reported from the units for 2022 and previously. A full report containing output and metrics for the individual infrastructure units for 2022 is given in *Appendix D*.

6.2.1 User Base

In 2022, there were close to 1,800 individual users of the SciLifeLab infrastructure (spread over 3,700 projects), and almost 1,600 of the users were from academia. The distribution of the academic users for 2022 based on the affiliation of the PI is shown in *Figure 7*, and notably, 61% of users were from universities or institutions outside of the SciLifeLab founding universities in Stockholm and Uppsala (KI, KTH, SU and UU), including 8% from international universities. In comparison, in 2017 the share of academic users outside the founding universities was only 40%. We believe the current distribution of users demonstrates that the infrastructure has reached its potential as a true national asset for scientists and that it is also internationally competitive.

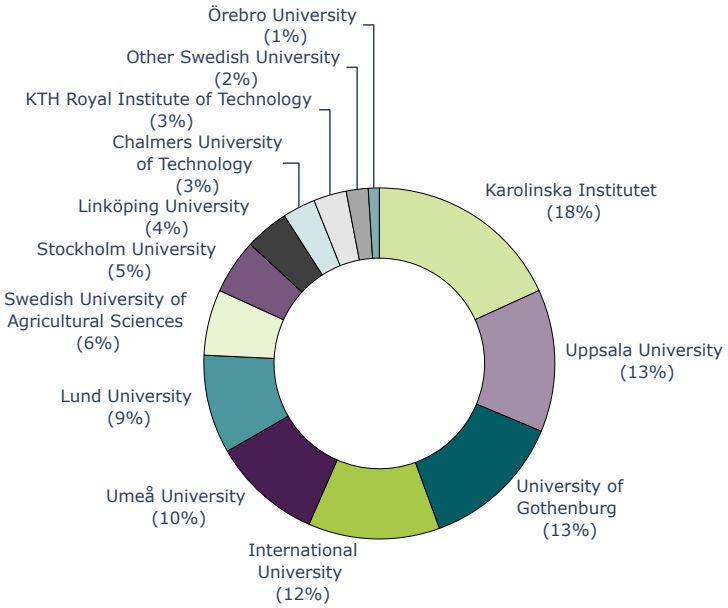


Figure 7. Distribution of unique academic infrastructure users 2022 (n = 1,561) based on affiliation of the individual PIs.

The SciLifeLab infrastructure is also open towards non-academic researchers, and our recommendation is that up to 15% of the infrastructure services should be devoted to users from healthcare, industry, and other sectors. For the units on the Clinical Genomics platform that typically serve many healthcare users on a full-cost model, the fraction of non-academic users can be higher. Calculations based on estimated resource allocation for 2022 reported by the units, normalized by the total infrastructure FTE resources, show that 14% were spent on projects from healthcare users (72 unique users), 3% on industry projects (85 unique users) and 1% on projects from other governmental organizations (29 unique users).

Distribution of affiliations for all unique users across infrastructure units for 2022, illustrated in *Figure* 8, further demonstrates the utility on a national level and across sectors.

6.2.2 Infrastructure User Publications

The infrastructure units report the publications resulting from their service projects with external users and from their internal technology development. In the SciLifeLab Publication Database, publications are labeled either as service (user-initiated projects where the infrastructure unit is mentioned in acknowledgement of the publication), collaborative (user-initiated collaborative project with unit staff as co-author of the publication) or technology development (unit-initiated technology development projects with unit staff as corresponding author of the publication). Publications may be labeled by more than one infrastructure unit, for example if one unit is collaborating with a research group and the project receives regular support services from a second infrastructure unit. For impact calculations, publications are only counted once.

For the years 2021–2022, a grand total of 1,668 infrastructure user publications were reported from the units. The number of papers remained relatively constant for 2016–2020, around 600 annually, but increased significantly for 2021–2022, *Figure* 9. The increase can partly be explained by the inclusion of new SciLifeLab infrastructure units starting in 2021 but is most likely also related to research on COVID-19 that was rapidly published, especially in 2021 (the trend is also seen for affiliated researchers, see *Section* 11.

Of the 1,668 reported publications for 2021–2022, 77% were labeled by the units as service, 26% as collaborative, and 5%[5] as technology development by at least one unit, respectively. Thus, the vast majority of infrastructure-reported publications are indeed resulting from services or collaborative support to external parties. This is consistent with the years 2017–2020.

Figure 8. Distribution of the overall unique users 2022 from universities, healthcare, and industry (n = 1,771) across all SciLifeLab infrastructure units. The size of the circles corresponds to the number of users.

[5] The sum exceeds 100% since part of the publications involved two or more units and contained different labels.

Figure 10 shows that the number of citations received by infrastructure user publications increases over time. This indicates that newer papers receive citations at a higher rate than the natural 'drop off' in citations for older papers.

The impact of the publications 2017–2022 was also analyzed based on citations compared to other publications in the same field and period. We have used PP(top 10%), the fraction of published papers found among the top 10% most cited in the same field and time period. The impact of infrastructure user publications is high, with PP(top 10%) = 21% for the years 2017–2020. In the reported subcategories – service, collaborative, and technology development publications – PP(top 10%) were 22%, 20%, and 22%, respectively. In comparison, the Leiden Ranking of over 1,400 universities only has fourteen going above 20%.[6]

Traditional metrics are useful for understanding the impact of publications on the research community, but are not reliable for the most recent 2 years. Alternative metrics, e.g., Altmetrics scores, are instead based on the number of mentions on social media, blogs, and press releases, among others. They are considered measures of the attention received (whether positive/negative), rather than impact. They can be used to give a more up to date measure of the likely impact of publications.

We used Altmetrics scores to assess the level of attention received by infrastructure publications. These scores can be affected by the age of a publication, as well as the publishing journal; older publications have had more time to be mentioned on multiple platforms, and certain journals will attract more attention to the items

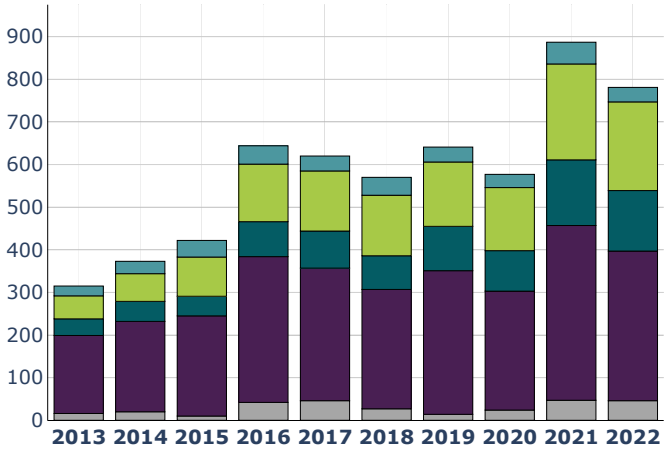


Figure 9. Infrastructure user publications 2013–2022 with Journal Impact Factor (JIF) distribution: JIF > 25 (blue), JIF 9–25 (light green), JIF 6–9 (dark green), JIF < 6 (purple), JIF unknown (gray)

Figure 10. Number of citations received in each year for infrastructure user publications 2017–2022

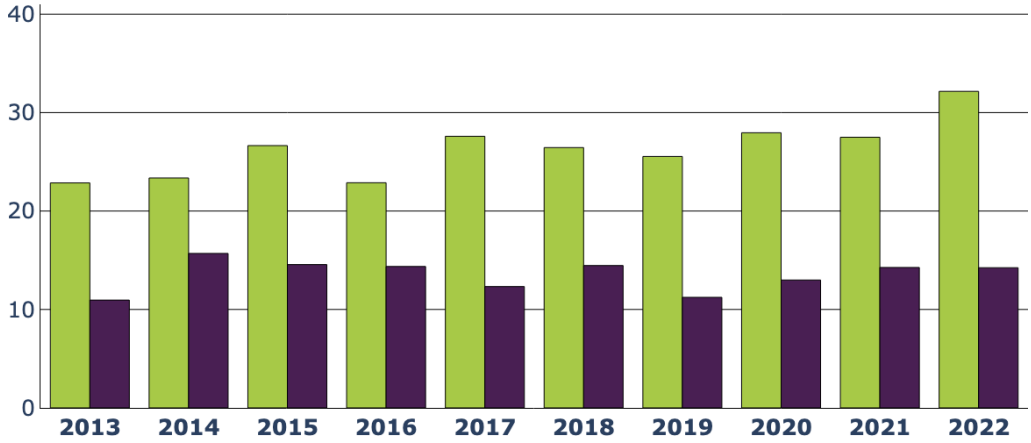


Figure 11. Percentage of infrastructure unit publications from each year that are ranked in the top 10% of Altmetrics scores (according to the Altmetrics Explorer database in June 2023). The percentages were calculated in two ways; by comparing to publications of a similar age (green), and by comparing to publications of a similar age and published in the same journal (purple).

[6] Rockefeller Univ., MIT, Princeton Univ., Stanford Univ., *UCB, Harvard Univ., Caltech, and Duy Tan Univ.* are ahead of the SciLifeLab aggregated score.

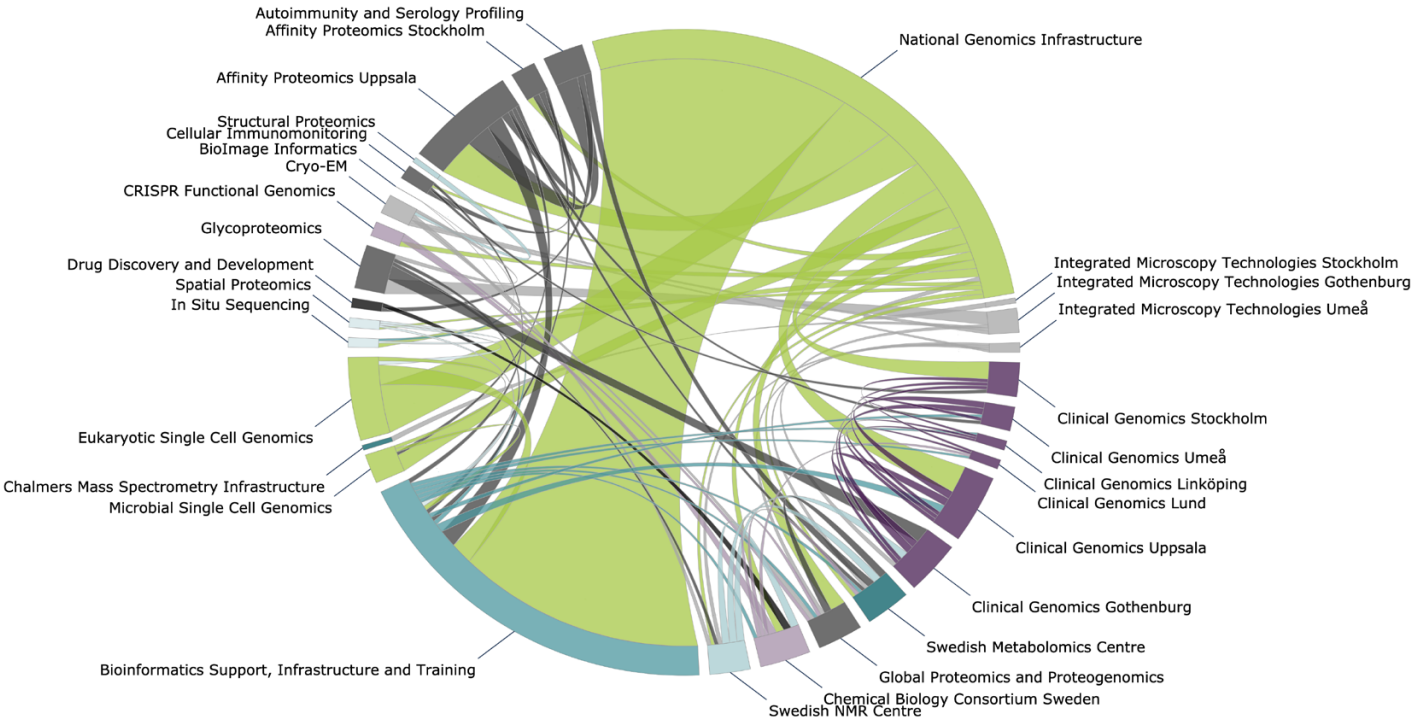


Figure 12. Circos plot illustrating cross-unit use based on infrastructure user publications 2021–2022 with two or more units involved (n = 151). The length of the circle segments corresponds to the number of cross-unit publications for each unit, and the ribbons connect the units that contributed to the publication with service, data, or analysis. The arcs of the plot are colored according to the SciLifeLab Platform. Publications based on use by a single unit only and those involving the Bioinformatics unit ScoRe (with only one additional unit) are not shown.

that they publish. *Figure 11* shows the percentage of publications that ranked in the top 10% of Altmetrics scores. Specifically, it shows both i) the percentage of infrastructure publications in the top 10% when compared to publications of a similar age, and ii) the percentage of infrastructure publications that are in the top 10% when compared with publications of similar age and published in the same journal. In either case, an average performance would be indicated by a score of 10%. It is clear that publications involving SciLifeLab infrastructure units performed above average, and thus drew more attention than average in society. Please note that the measurement of Altmetrics is experimental.

An important mission of the SciLifeLab infrastructure is to promote and increase multidisciplinary research using several platforms, units, and technologies for addressing scientific questions. In this respect, SciLifeLab is unique, even internationally, in providing complementary capabilities covering a broad range of technologies for life science research. SciLifeLab monitors cross-unit usage based on the papers published by infrastructure users. Here, we have analyzed the publications for 2021–2022, and of these 151 (9%) involved more than one infrastructure unit (excluding the Bioinformatics unit Support for Computational Resources[7]), *Figure 12*. Since the organization of infrastructure platforms and units has changed over time, it is difficult to compare the level of cross-unit use across years. However, when looking at collaborations between units for 2021 and 2022, it is evident that the number of infrastructure user publications with two or more units involved were similar, see *Figure 13*.

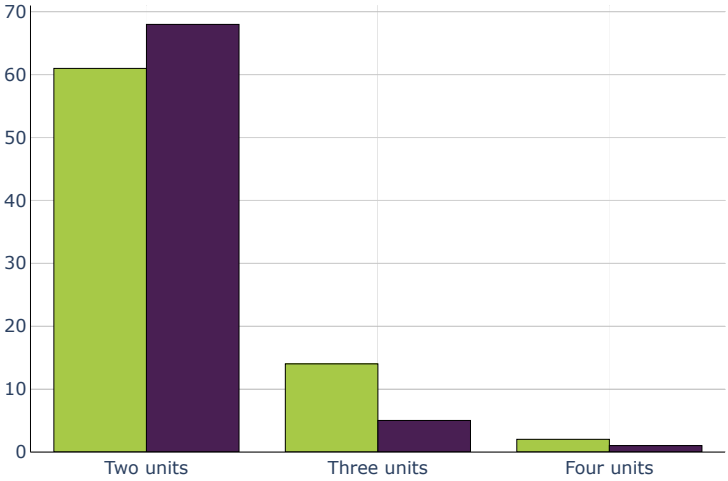


Figure 13. Number of infrastructure user publications with two or more units involved. 2021 in green, 2022 in purple

[7] The unit primarily facilitates access to external e-infrastructure resources via user accounts.

In conclusion, the scientific output from the SciLifeLab infrastructure has remained steadfast at a high level since 2016, including service, collaborative, and technology development publications. All these publication types are very highly cited, as measured by the normalized fraction of the top 10% cited papers, i.e., the PP(top 10%) metric, compared to other universities. While no causal relationships can be drawn, two alternative explanations may both contribute to the scientific impact: i) that the use of SciLifeLab infrastructure improves the likelihood of creating high-quality publications or, ii) that users of the SciLifeLab infrastructure typically are scientists who tend to publish on average in better journals than those who are not users. We hope and anticipate that the proportion of cross-unit publications will grow over the coming years with the increased focus on cross-unit and cross-platform service offerings and by the development of the SciLifeLab capability programs. Additional bibliometric analyses are available in *Section 11*.

6.2.3 Additional Funding and User Fees

An expectation for a successful and sustainable SciLifeLab infrastructure unit is that it continuously receives funding from its host university(ies), other participating universities, and funding agencies besides SciLifeLab. Equally important for sustainable operations are the user fees. SciLifeLab requires that all units charge user fees according to pre-defined and documented cost models. The units are responsible for the preparation and implementation of cost models, including a full cost model for industry and healthcare users.

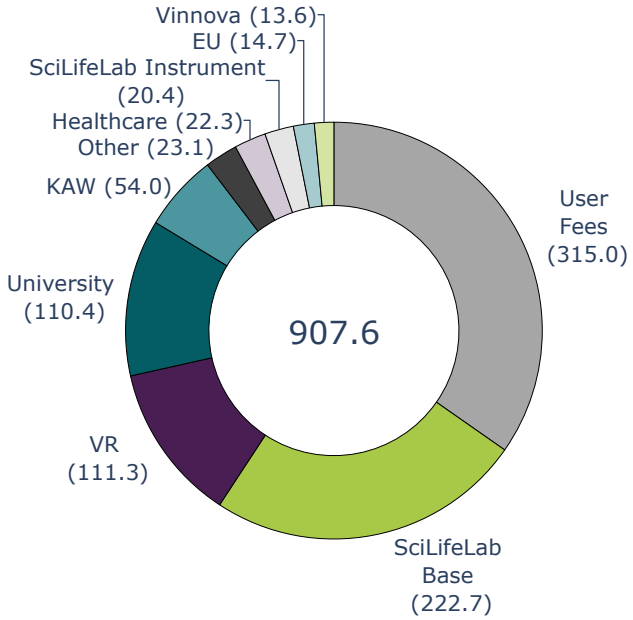


Figure 14. Distribution of all funding sources to the SciLifeLab infrastructure operations 2022 (MSEK)

The total funding from SciLifeLab and all other sources for the infrastructure in 2022 was close to 908 MSEK, see *Figure 14*. User fees amounted to 315 MSEK and many of the infrastructure platforms and units also attracted additional funding from e.g., the Swedish Research Council (VR), KAW, healthcare, their host universities, and other sources. Altogether, the funding enabled an infrastructure work force of about 600 staff scientists and technicians (corresponding to ca 470 FTEs) for 2022. Of these, 70% had a PhD.

6.3 Developments 2022–2023

6.3.1 Implementation of Platform-Centric Operations

Since 2021, the SciLifeLab infrastructure has implemented a platform-centric model for governance and operations, see *Figure 15*. Compared to the previous organization, the platforms are given more mandate to make decisions on the platform level, and all platforms are annually provided with a pot of funding from SciLifeLab that can be used for strategic development of the platform operations. Key to the new organization are the 10 Platform Coordination Officers (PCOs), who have monthly joint meetings with the Infrastructure Director and Coordinator containing mutual updates, strategic discussions, and planning items on the agenda.

A detailed description of the platform organization and governance as well as the general SciLifeLab policies for the infrastructure units are found in the steering document *SciLifeLab Infrastructure General Terms and Conditions for Funding* (*Appendix E*). In addition, the *Platform Specific Terms and Conditions for Funding documents* (*Appendix F*) contain specific missions and expectations given to the individual platforms.

6.3.2 Midterm Checkup 2022

As part of the four-year funding scheme of the infrastructure, an internal Midterm Checkup was arranged in 2022. The aim was to i) follow-up on the recent achievements for 2021–2022 and provide input on the development plans 2023–2024 to individual platforms and units, and ii) form

the basis for the infrastructure budget 2023 including allocation of about 10 MSEK of additional available funding when compared to 2022.

Brief reports and budget requests from the platforms and units together with stats and metrics were compiled into a report to the management, see *Appendix C. Midterm Checkup report.* During October 5–6, 2022, all platforms met with the SciLifeLab MG in separate on-line meetings to receive feedback on their operations and plans.

Based on the Midterm Checkup, the infrastructure budget for 2023 was decided by the Board in November 2022. In short, the additional funding available was used for:

- Increased support to small units with sub-critical funding to improve the conditions to serve users nationally. Additional funding to units that started their operation in 2021 was prioritized.
- Increased support to selected strategic areas (metabolomics, spatial omics, single cell biology).
- Support to cover part of depreciation costs for next generation sequencing instruments at the Genomics platform during a major technology transition (only 2023).

6.3.3 Technology Development and Renewal of Instrumentation

Continuous updating of the technologies and services is essential for maintaining the SciLifeLab infrastructure at the cutting-edge. This is challenging due to the wide variety of technology areas, the complexity of nation-wide operations involving multiple universities, and the frequency of which upgrades of expensive instrumentation are required. To facilitate a continuous renewal, SciLifeLab has established four pillars for enabling infrastructure technology development and equipment upgrades:

1. Infrastructure units are allowed and encouraged to use up to 20% of their SciLifeLab funding for internal technology development, i.e., identifying and implementing new relevant technologies and protocols to complement existing capabilities.
2. SciLifeLab has arranged two calls for Technology Development Projects (in 2018 and 2021) for development and implementation of novel technologies as infrastructure services. Grants can be used to develop technologies in collaboration with external PIs and research groups, and we plan to launch this type of call on a regular basis.

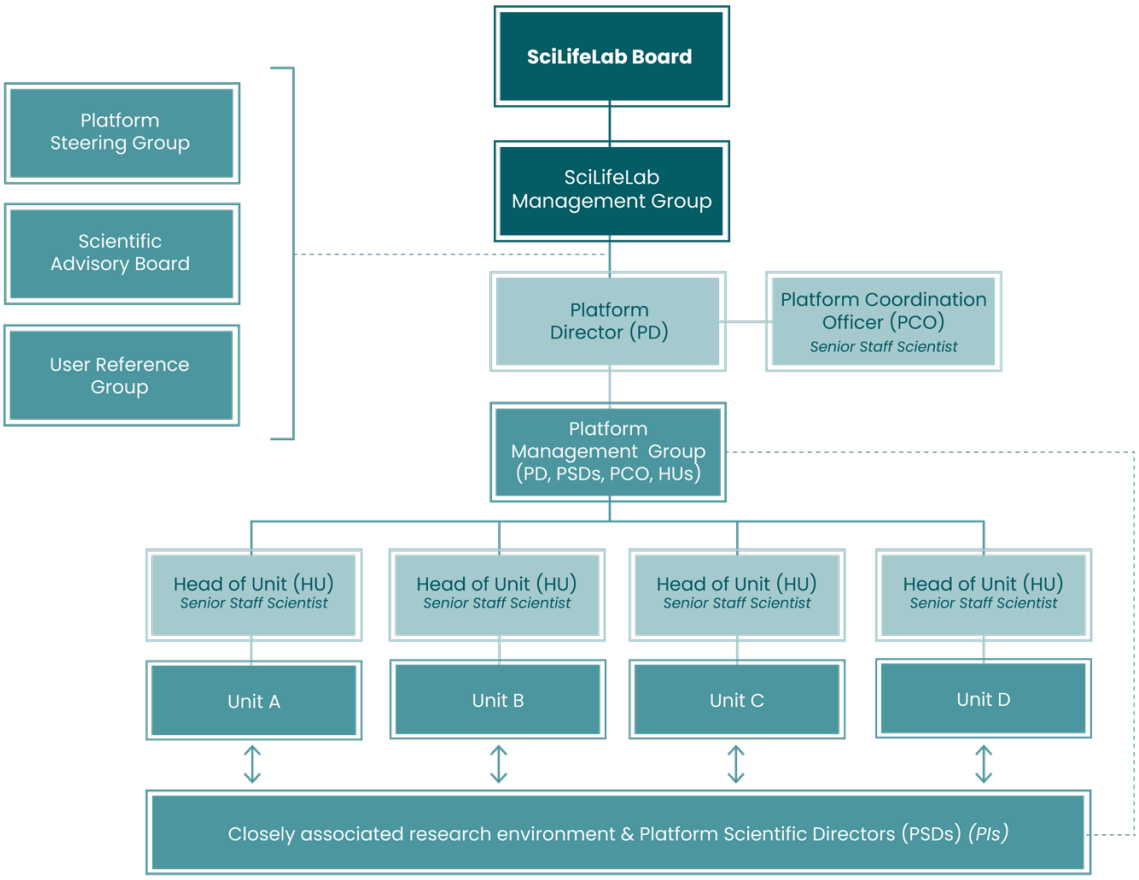


Figure 15. General organization and governance chart for the infrastructure platforms

3. Since 2018 SciLifeLab has also arranged annual calls for funding of expensive instruments (in the range of 2 MSEK and above) for the infrastructure units. We reserve 15–20 MSEK annually from the national budget for this purpose to contribute to instrument depreciation costs.
4. Technology development by the research community closely associated with the infrastructure is an essential part of the SciLifeLab ecosystem. Projects in these research groups are often conducted in collaboration with infrastructure units, frequently resulting in new technologies that can be implemented as service, as well as providing a scientific edge to the services offered.

For 2021–2023, examples of important new technologies, services and instruments are:

- Major upgrade of sequencing capacity at the Genomics and Clinical Genomics platforms by acquisition of four Novaseq X Plus instruments and one PacBio Revio long-read sequencer, funded by instrument grants from SciLifeLab, VR and KAW (2023)
- Installation of a new 200 kV cryo-TEM instrument at the Cryo-EM node in Umeå, partly funded by SciLifeLab instrument grants (2022)
- Installation of a cutting-edge magic angle-spinning, solid phase NMR cryoprobe at the Swedish NMR Centre in Umeå, partly funded by SciLifeLab instrument grants (2022)
- As the first certified lab in Europe, Affinity Proteomics and NGI in Uppsala offer high throughput protein analysis (500 proteins from a 10 ul of sample) based on the proximity extension assay (PEA) in combination with NGS readout to users (2021)

6.3.4 Facility Forum 2022

In October 2022, SciLifeLab arranged Facility Forum for the third time, a conference where all infrastructure staff, leadership and SciLifeLab management are invited. The well-attended two-day event gathered over 450 participants from across Sweden. Part of the program was arranged as an on-stage talk show, where the guests included the SciLifeLab Director, Infrastructure Director, Capability leads, Heads of Operations Office and Data Centre, etc., see *Figure 16*. The event also included scientific presentations, parallel workshops on urgent infrastructure topics, and platform-wise meetings and discussions.

6.3.5 Development of Career Paths for Infrastructure Staff Scientists

As has been highlighted in previous IAB reports, it is of critical importance to develop alternative career paths for the staff scientists that the entire infrastructure operation is dependent on. We have over the years experienced, recently at an increased pace, that infrastructure experts are recruited to positions in industry. This can on one hand be considered as an important KPI, i.e., that the SciLifeLab infrastructure units "train" staff scientists that are attractive for positions outside academia, and hence contribute to society at large. However, this can cause disruptions of services and as a general trend this is worrying. The university governance of SciLifeLab means that implementation of attractive career paths for staff scientists must be formalized by the universities. However, SciLifeLab has actively tried to push the question in close interactions with the university stakeholders. The clear statements from IAB presented to the Board have indeed increased the awareness of the issue across the universities. Karolinska Institutet has recently launched, as the first university in Sweden, a dedicated career path for research infrastructure (RI) experts[8]. Other universities are now interested in adapting similar career path systems and cross-university discussions and meetings on the topic are on-going. From the SciLifeLab perspective, the long-term ambition is that a nationally aligned career track model for RI scientists across all universities is established. At the same time, this career should not exclude the infrastructure scientists of other careers, as currently tends to be the case. Hence, mobility across scientific and infrastructure careers should also be promoted.

[8] news.ki.se/new-career-path-created-for-research-infrastructure-specialists

Figure 16. The Facility Forum Talk Show 2022

6.4 Infrastructure Funding 2023

The current SciLifeLab funding for the infrastructure (National and DDD) from the government is 338 MSEK (about 30 MEUR). The distribution of the total funding is illustrated in *Figure 17*. The direct support to the infrastructure platforms and unit operations is 242 MSEK and the distribution across the platforms is shown in *Figure 18*. The distribution based on the receiving universities (hosts of the infrastructure units) is shown in *Figure 19*.

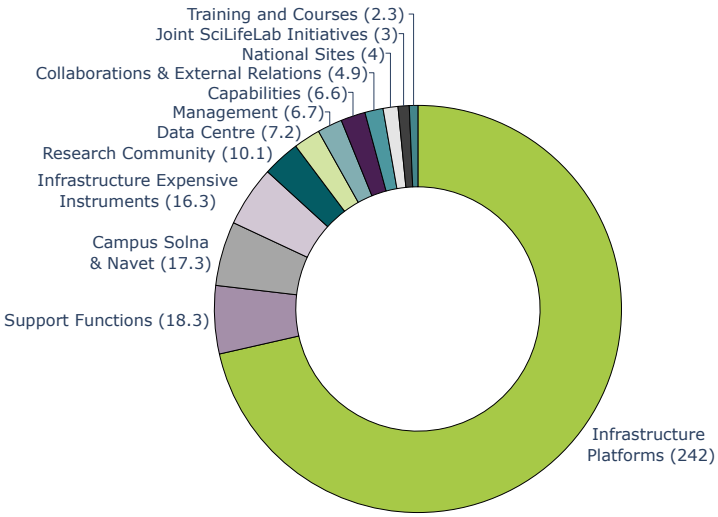


Figure 17. Overall distribution of SciLifeLab infrastructure funding (National and DDD) 2023 (MSEK)

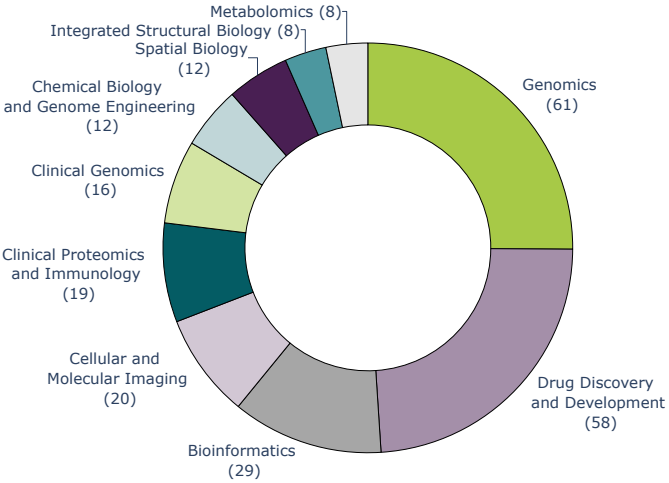


Figure 18. Distribution of SciLifeLab funding to the infrastructure platforms 2023 (MSEK)

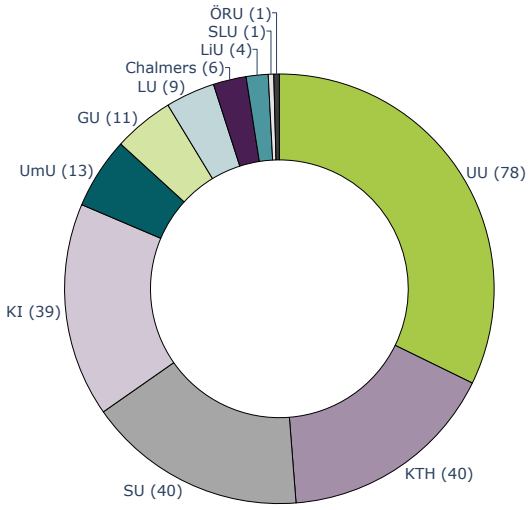


Figure 19. Distribution of infrastructure funding 2023 to the universities hosting the infrastructure units (MSEK)

6.5 Evaluation of the Infrastructure 2024

Every four years, the SciLifeLab infrastructure is evaluated by international experts, Swedish universities, MG and the National SciLifeLab Committee (NSC), and the next evaluation will take place in April 2024. The outcome of the evaluation will eventually form the basis for the SciLifeLab infrastructure budget 2025–2028. The overall process for preparation, evaluation and decision making is summarized below and illustrated in *Figure 20*:

1. Internal platform planning involving assessment of the future needs on new technologies from each individual platform's perspective (on-going)
2. A bottom-up national technology survey open for all researchers in Sweden to propose i) urgently needed cutting-edge technologies and ii) existing core facilities to be incorporated into the SciLifeLab infrastructure (completed in Aug 2023). Decision on new units to be included in the international evaluation was taken in October 2023.
3. Evaluation by the International Evaluation Committee (IEC) (April 2024)
4. Input from all Swedish major universities and the NSC (May 2024)
5. Follow-up review and suggested budget allocation by the SciLifeLab Management Group and Chair of NSC (June–October 2024)
6. Decision on budget and organization of SciLifeLab infrastructure 2025–2028 by the Board (Nov 2024)

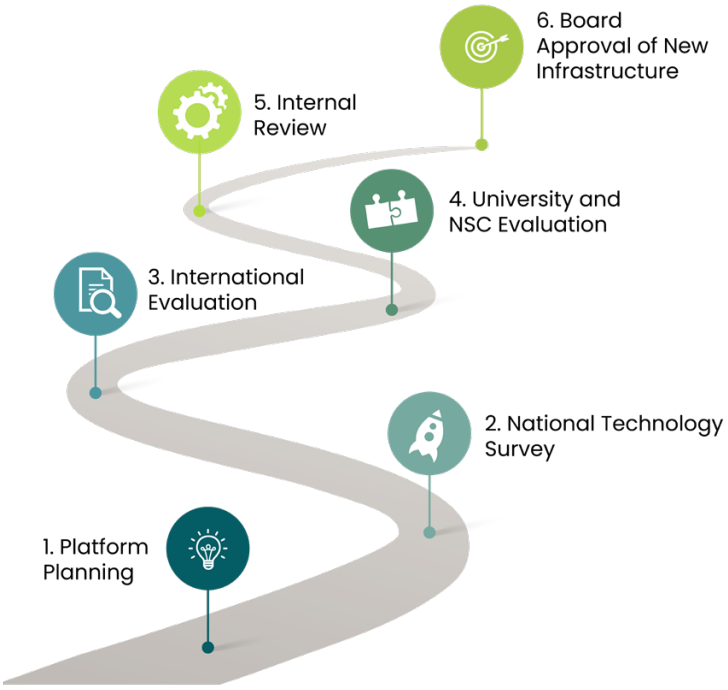


Figure 20. Process for evaluation of SciLifeLab's infrastructure

6.6 Future Plans and Strategies

While exact developments needed to keep the infrastructure in the forefront beyond 2025 are difficult to predict, some underlying strong trends are clear. *First, the research environment remains key to a national infrastructure*: national infrastructure needs the right interacting ecosystem to stay cutting edge, consisting of related research communities, training, data science, and industrial and society stakeholders. *Second, development of technologies will be rapid, exponential and unexpected.* An important aspect of SciLifeLab will be its ability and agility to respond to changes in a globally leading manner and make new opportunities and services available and scaled up rapidly. Sometimes this may mean leading the field and developing entirely new technologies, sometimes acquiring expensive new instruments. The importance of dedicated experienced staff scientist is always key to promote dynamic change. *Third, integration of data handling and analysis.* The exponentially increasing amounts of research data generated by the infrastructure need to be properly handled, analyzed and eventually shared and FAIRly re-utilized. The dramatic AI revolution will continue and will bridge the life and data science communities together and create new opportunities and challenges.

These anticipated developments necessitate the enhancement of SciLifeLab's infrastructure and the SciLifeLab Data Centre with new functionalities. We are optimistic that government funding 2025–2028 will, at a minimum, match the current funding levels. However, the diversified funding model, as depicted in *Figure* 14, reveals that several of our platforms and units are dependent on funding sources besides SciLifeLab. Historically, we have relied on generous support from KAW for e.g. the acquisition of numerous generations of sequencing instruments and the establishment of the Cryo-EM unit. Additionally, the majority of SciLifeLab platforms are also funded as VR national infrastructures and co-founded by the respective host universities. Nevertheless, the unpredictability of these funding sources is a challenge for

SciLifeLab in terms of developing a *long-term sustainable funding model.*

After successfully having implemented a platform centric infrastructure organization and launched *cross-platform* Capabilities there is still a need to additionally promote cross-platform interactions and making infrastructure staff scientists ambassadors for the entire infrastructure. We try to accomplish this in different ways, one being the regular cross-platform meetings we organize, another the biannual Facility Forum conference.

To address the increasing need of *data management and analytics capacity* within the platforms, in particular for emerging and still evolving technologies, we have a close dialogue with the Data Centre and the Bioinformatics platform on how to use our combined capacity in the most efficient way and how to strengthen the platforms' capacity overall.

Infrastructure services constitute an integral part of the necessary teamwork in achieving high-quality multidisciplinary research. Users of the infrastructures are not expected to be experts in data generation nor the analysis of complex technologies, which are essential for addressing the increasingly intricate questions in biology. In general, we strongly endorse a shift towards a system where contributions to *team science* are acknowledged in academic hiring, promotion, and tenure processes.

While progress has been slow, it marked a significant milestone when Karolinska Institutet and, more recently Stockholm University, introduced specialized *career tracks for infrastructure scientists.* We are currently working towards extending similar initiatives to other institutions, and it is important that these new positions continue to evolve and become genuinely appealing alternatives to the traditional tenure track.

6.7 Challenges and Questions to the IAB

- We would like IAB´s input on what strategies can SciLifeLab implement to secure sustainable funding while simultaneously maintaining state-of-the-art capabilities in expensive instrumentation and advanced data handling, ensuring our infrastructure remains at the forefront of scientific innovation in the coming years (2025–2028)?
- Moreover we ask for advice on how to balance the level of support provided to users to enable high quality reproducible research but at the same time maximize the number of users that are given service annually.

Photo: Mikael Wallerstedt

7. SciLifeLab Sites

Since 2022, SciLifeLab has six formal sites in Gothenburg, Linköping, Lund, Umeå, Uppsala and Stockholm. SciLifeLab Stockholm and SciLifeLab Uppsala as the original sites of SciLifeLab, still house most of the national infrastructure staff and units. SciLifeLab is, however, increasingly a distributed operation, and also Gothenburg, Linköping, Lund and Umeå house official SciLifeLab sites since 2021/2022. These four sites receive targeted funding from the national budget to locally coordinate infrastructure, data and other support functions. A main purpose of the national sites is to create effective coordination of the various SciLifeLab activities and associated functions, see *Figure 21*. In addition, each node is expected to cultivate its own profile by leveraging local strengths while connecting to the national SciLifeLab organization. The new sites have started activities and it has been a truly inspiring and energizing effect on the whole SciLifeLab organization. The inauguration of the new sites took place through four highly successful SciLifeLab Site Days during 2023, see full programs in *Appendix G*, and are now expanding the visibility of the SciLifeLab brand at these four cities and also providing complementary contributions to the national SciLifeLab organization. We see this as a very positive and significant development.

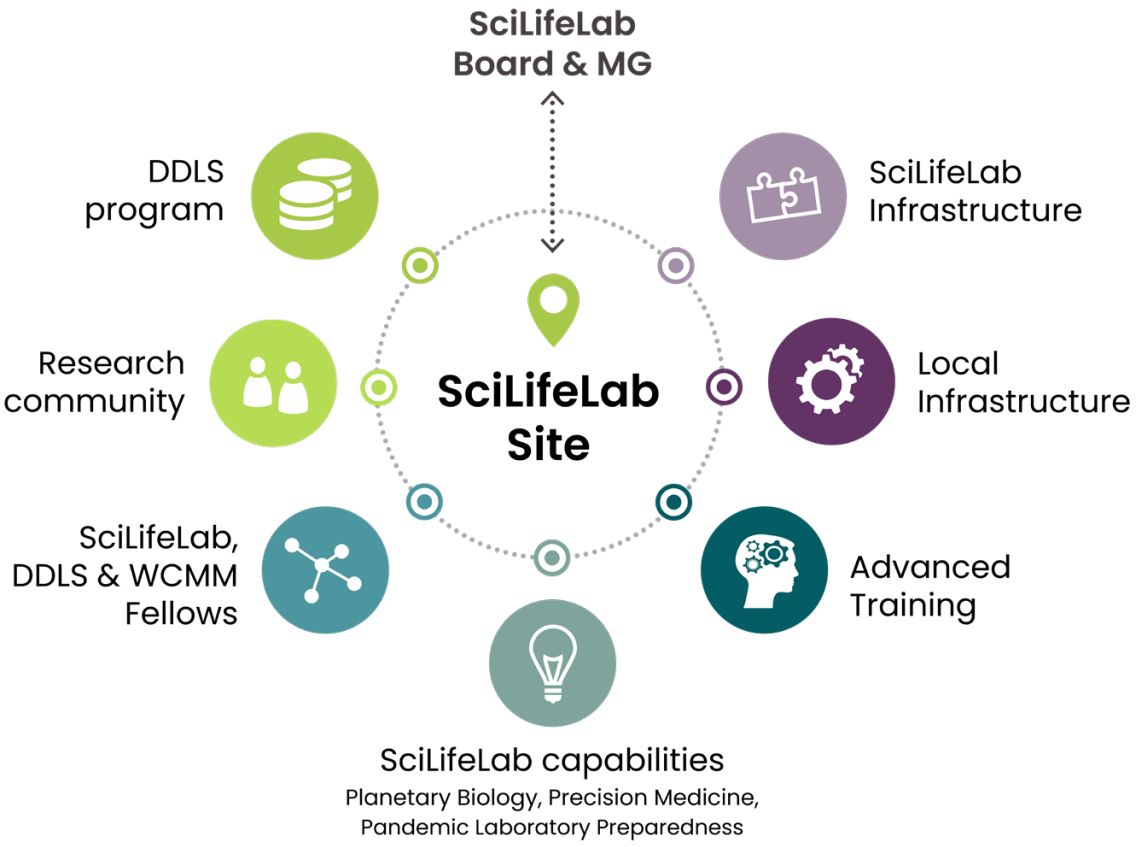


Figure 21. Illustration of the SciLifeLab sites' role and function

7.1 SciLifeLab Site Gothenburg

7.1.1 Introduction

The SciLifeLab site in Gothenburg includes research infrastructure units and activities at both the University of Gothenburg (GU) and Chalmers University of Technology (Chalmers) and has a strong connection to Sahlgrenska University Hospital, the largest hospital in Scandinavia.

The Gothenburg area is strong within life science and has a long tradition of hosting and developing research infrastructures. In addition to the ten SciLifeLab infrastructure units connected to the Gothenburg site, see *Figure 22*, there are many regional and national research infrastructures strengthening the community e.g., Protein Production Sweden, the Marine Infrastructure, the Core Facilities, Biobank Väst, Genomic Medicine Sweden, the NanoSIMS chemical imaging facility, to name a few. The latest SciLifeLab infrastructure addition in Gothenburg is the DDD unit Oligonova Hub that offers researchers in Sweden capabilities for converting ideas and discoveries into new oligonucleotide therapies. Furthermore, Gothenburg is host for the Data Science Node for the DDLS strategic research area Cell and Molecular Biology and one of four Wallenberg Centers for Molecular Medicine (WCMM). The regions is a hub for life-science industry through e.g., AstraZeneca[9], Mölnlycke Health Care[10], Essity[11] as well as many smaller life-science companies and the unique GoCo Health Innovation City[12]. Today over 350 companies with research within 50 fields, including the Nordic Hub of CCRM[13] are hosted within the GoCo arena.

The Gothenburg SciLifeLab site strives to enhance visibility, collaboration, and implementation of research infrastructures within the life science community with an office at the GoCo House.

7.1.2 Developments 2022–2023

Our focus during 2022–2023 has been on coordinating and consolidating the site components, establishing connections to important stakeholders and performing community-building activities. More specifically, the following activities have been executed:

- The management group and guidelines for operations have been set up.
- The site coordinator has participated in ~20 regional/national events presenting SciLifeLab and interacting with the research community.
- A seminar series with focus on available services from SciLifeLab has been arranged and all SciLifeLab units hosted in Gothenburg have presented their research support and activities.
- During 2022 and 2023 there was a nomination process of SciLifeLab Group Leaders within the local research community. 12 Group Leaders with strong connections to the infrastructure were accepted, in addition to the 17 local Group Leaders already affiliated with SciLifeLab.
- The Gothenburg SciLifeLab Day with seminars and workshops on Infrastructure, Research, DDLS and SciLifeLab Capabilities (see program in *Appendix G. Program for SciLifeLab Site Days 2023*) with 250 participants from academia, health care sector and industry was successfully arranged in mid April 2023, see *Figure 23*.
- A Research Data Manager with focus on data integration and interaction with the local actors in data science, including DDLS and DSN, has successfully been recruited to the site.

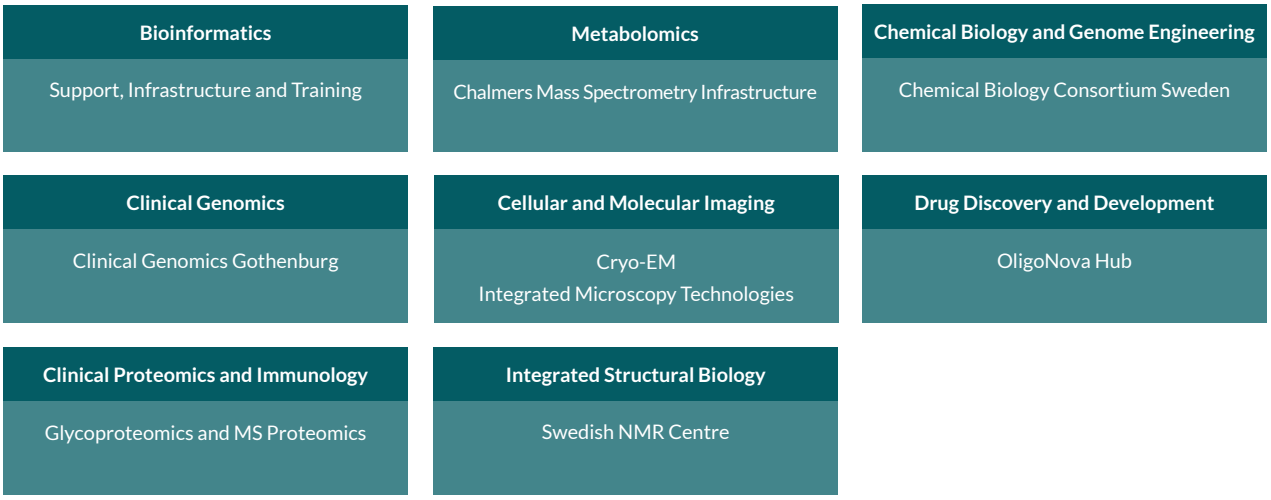


Figure 22. The platforms and units present at the SciLifeLab Gothenburg site

[9] astrazeneca.com
[10] molnlycke.com
[11] essity.com
[12] goco.se
[13] ccrmnordic.se

Figure 23. SciLifeLab Day at the Conference Centre Wallenberg, Gothenburg, April 17, 2023

Figure 24. The SciLifeLab Gothenburg office. This hub contains an office space, a lounge area and a bookable meeting room

- An office hub and meeting point for the site has been constructed at a central position at campus Medicinareberget, in close vicinity to the majority of the infrastructure units and embedded in the vibrant research community. This hub, see *Figure* 24, will be the center for community building activities, administration drop-ins and meetings.

7.1.3 Future Plans and Strategies

- Future plans include the expansion of site activities and establishment of central working groups within four prioritized areas; Infrastructure and Capabilities, Data, Research, and Training.
- The efforts towards making the national resources within SciLifeLab more accessible and visible for the local research community will continue.
- The site will work on strengthening the SciLifeLab portfolio by catalyzing the establishment of new infrastructural services as well as bridging the gap between non-SciLifeLab infrastructures and the SciLifeLab capabilities.
- Enable new collaborations and scientific networks by integrating the research infrastructures into translational research areas.
- Make the research infrastructures more accessible for external actors by presence at GoCo Health Innovation City.
- We will continue to develop close interactions to the national SciLifeLab sites in Linköping, Lund, Stockholm, Uppsala and Umeå.

7.1.4 Challenges and Questions to the IAB

Whereas each site has its own unique needs and opportunities, there are also common challenges and questions shared by our newly formed sites. The main challenges and questions to the IAB common to all new sites (Gothenburg, Linköping, Lund and Umeå) are briefly summarized below.

- We find the initiative to support the establishment of sites very positive. Despite the limited time and start-up resources, all new sites are now fully operational and have initiated ambitious plans to strengthen SciLifeLab activities, both at the regional and national level. To further develop the sites, we see a need to gradually become better integrated in the overall structure of SciLifeLab. This applies both to the management level and at the operative level within all three main pillars of SciLifeLab. As an example, SciLifeLab now has activities at 11 universities but its' steering still follows the original 4-university model. In order for SciLifeLab's national infrastructure to be governed in a more balanced way, enhanced participation of the sites in the management would be needed, which may require SciLifeLab regulations to be changed. We also see a strong need to build up a critical mass of people at each site to ensure sustainability in the long-term development of the sites. We welcome further discussions, both with the IAB and with the existing governing structures of SciLifeLab, on how to best develop the sites further to contribute to the overall objectives of SciLifeLab.

7.2 SciLifeLab Site Linköping

7.2.1 Introduction

Linköping University (LiU) has a strong profile towards the interface between medicine and technology and is hosting the National Supercomputer Center with important applications for life science. In this interface we have recruited eleven young principal investigators in the WCMM (Wallenberg Center of Molecular Medicine) and DDLS programs.

SciLifeLab Linköping started its activities in August 2022. The SciLifeLab platforms and units of this site are found in *Figure* 25. The daily work is run by a management group of one director and one coordinator. To make seamless connections between SciLifeLab, WCMM and DDLS, we have a common steering group led by the deputy vice-chancellor for research. To facilitate direct communications between existing life science infrastructures in the Linköping area we have a larger infrastructure group which meets on a regular basis. There are representatives from i) all SciLifeLab infrastructures at LiU, ii) all other larger life science infrastructures at LiU, including the National Supercomputer Center, and from iii) other stakeholders in Linköping, such as the Swedish National Board of Forensic Medicine (RMV) and Region Östergötland (RÖ).

7.2.2 Developments 2022–2023

- To reach out to all larger research communities in Linköping within the field of life science we have presented SciLifeLab and our activities at meetings at faculty and departmental levels. Vi have also participated in and presented SciLifeLab in yearly retreats (or similar) arranged by several strategic research areas covering researchers from LiU, RÖ and RMV (Cancer, Systems Neurobiology, Forensic Science, and e-Health).
- To increase the interactions between existing infrastructures at LiU, we have gathered all relevant infrastructures in a common infrastructure group. In addition, we have had individual meetings with some of the infrastructures.
- To take responsibility for communication between local and national SciLifeLab activities, the management group has participated in several activities and meetings between the national sites as well as between the national sites and the central part of SciLifeLab.
- On October 10, 2023, a SciLifeLab day was arranged with 280 participants from potential SciLifeLab users in Linköping and from other national SciLifeLab infrastructures, see *Figure* 26.

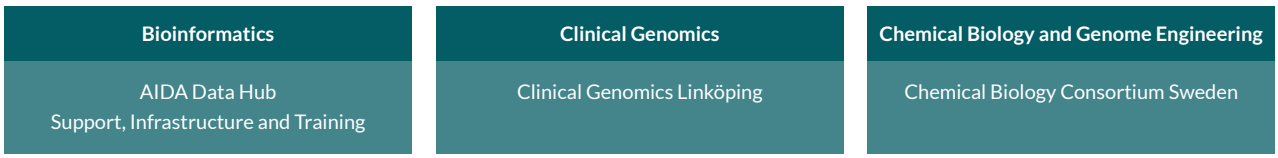


Figure 25. The platforms and units present at the SciLifeLab Linköping site

Figure 26. SciLifeLab Day in Linköping, October 10, 2023

7.2.3 Future Plans and Strategies

- Currently, most life science infrastructures at LiU are run by separate bodies. We will thus explore the possibility of putting some or all life science infrastructures under the same administrative roof. If we fuse them together, we will have the possibility to plan future activities in a coordinated way. However, larger infrastructure organizations can decrease the flexibility, which is why a detailed plan is needed.
- Another goal is to implement infrastructure training for PhD students and postdocs. This will be done in collaboration with Forum Scientium, a research school at LiU in the interface between medicine and technology.
- Traditionally, the universities in Sweden have had clear career paths for the traditional teacher positions, but not for the infrastructure-oriented positions, staff scientists. There is ongoing work at several Swedish universities to initiate non-teacher career paths, and our goal is to work for such a development at LiU.
- We will work to make the National Supercomputer Center easily accessible for life science researchers. As one step towards this we will recruit an additional coordinator with competence in data, computing, and AI to our management group of SciLifeLab Linköping. Another step is to work for an increase in the number of application specialists with life science experience.
- Another nationally unique facility at LiU is the CBCS unit for high-throughput electrophysiology. We plan activities to make this accessible for users from all over Sweden and from different areas.

7.2.4 Challenges and Questions to the IAB

See section 7.1.4, where the main challenges for all new sites are summarized.

7.3 SciLifeLab Site Lund

7.3.1 Introduction

Lund hosts one of Sweden's largest universities with almost 50,000 students, excellent research environments, and several world-class research infrastructures, e.g., MAX IV, the European Spallation Source; ESS, and specialized units within SciLifeLab. Excellent research environments include biodiversity and ecosystem services, cancer, diabetes, epidemiology, nanoscience, neuroscience, and stem cell research. In addition, Lund resides within the "Medicon Valley" region, a life science cluster spanning eastern Denmark and southern Sweden, housing several life science related universities and university hospitals, hundreds of biotech, medtech and pharma companies, and a number of science parks and incubators, which together provide ample opportunities to translate and leverage novel research findings into clinical and societal utility.

In recent years SciLifeLab has significantly expanded its presence in Lund, and now includes multiple research infrastructures, activities in all capabilities and a growing number of affiliated GLs (e.g., from the DDLS and WCMM research programs). The SciLifeLab platforms and units of the Lund site are found in *Figure* 27. Consequently, and based on joint funding from SciLifeLab and Lund University, SciLifeLab Lund was launched as one of four new SciLifeLab sites in 2022. The site currently consists of a director and a coordinator, and a data science coordinator is currently being recruited. Together with the infrastructure units at the site, and aligned with activities within the Data Centre, the DSNs and the DDLS program, the data science coordinator will establish and lead the implementation of a data management plan at the site. The day-to-day activities are led by the Director together with a management group. For more strategic decisions a steering group, with representation from key stakeholders, has also been established.

7.3.2 Developments 2022–2023

Much of the focus of the site thus far has been to become fully operational and organized in alignment with SciLifeLab and Lund University. Main achievements include:

- Organization of SciLifeLab Day in Lund as the official site inauguration, see *Figure* 28.
- Participation in multiple outreach activities to increase SciLifeLab visibility among stakeholders from academia, healthcare, and industry at local, national, and international levels.
- Establishment of communication plan, including the launch of SciLifeLab Lund website and LinkedIn account.
- Promotion of infrastructure personnel career paths through participation in the LU working group.
- Promotion of new cross-technology collaborations, e.g., spatial biology, single-cell, and multiomics applications.
- Participation in HALRIC, an international consortium (20 partners in 4 countries) aimed at further leveraging European cutting-edge research infrastructure for improved healthcare, research and innovation.
- Procurement of new cutting-edge instrumentation by several units (e.g., Glacios 2 at Cryo EM and NovaSeq X at CG Lund).
- Affiliation of 11 LU-based SciLifeLab group leaders.

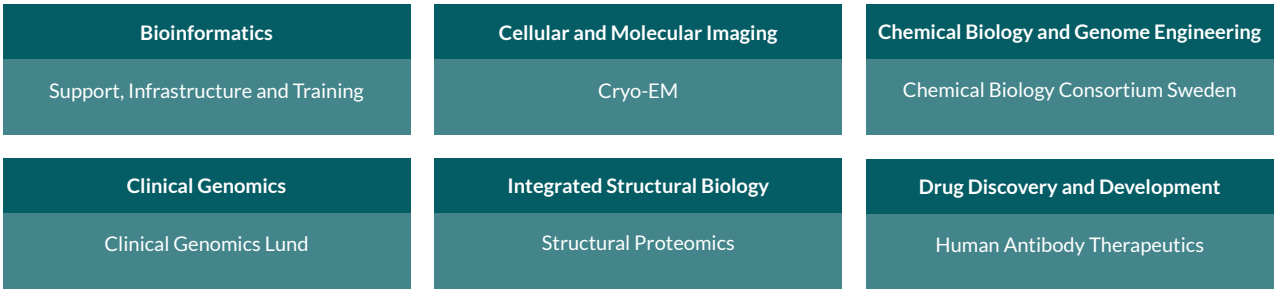


Figure 27. The platforms and units present at the SciLifeLab Lund site

Figure 28. SciLifeLab Day in Lund, September 28, 2023

7.3.3 Future Plans and Strategies

Future plans from 2024 and onwards will focus on:

- Establishment and execution of Lund-based data management plan (aligned with DC, DSNs and DDLS program needs).
- General and targeted outreach activities (e.g., WCMM and DDLS fellows, strategic research areas at LU, SLU Alnarp, and Malmö and Copenhagen universities) to reach new users and promote national and international collaborations.
- Promoting further interdisciplinary technology- and data-driven research.
- Affiliate additional GLs in strategically relevant areas.
- Establish a critical mass of personnel and work towards more sustainable organization and funding models for SciLifeLab Lund
- Promote further collaboration and harmonization between RIs, e.g., concerning data management, technology development, IT systems and infrastructure, automation, and KPI monitoring.
- Establishment of a site office, enabling improved visibility and interaction opportunities with users and key collaborators, including local InfraLife and the Training Hub representatives.

7.3.4 Challenges and Questions to the IAB

See section 7.1.4., where the main challenges for all new sites are summarized.

7.4 SciLifeLab Site Umeå

7.4.1 Introduction

At the Umeå Site, research infrastructure and research fellows bridge Umeå University, the Swedish Agricultural University (SLU) and the clinical research at Region Västerbotten. At the Site we share enthusiasm and world leading projects within infection medicine, plant science and arctic transdisciplinary research. Research infrastructure units, see *Figure* 29, have been nursed and developed together with the Umeå research centers: Molecular Infection Medicine Sweden (MIMS), Umeå Plant Science Centre (UPSC) and Wallenberg Centre for Molecular Medicine (WCMM). Today, the research fellow programs are heavily involved by determining the future infrastructure needs. And as a gratitude, the presence of SciLifeLab units, "state of the art" instruments and methods has been key to recruitment of internationally outstanding researchers to faculty positions. For example, Professor Oliver Billker; MIMS Director and DDLS steering group member, uses several SciLifeLab and site technologies, combining large scale DNA sequence analysis with 3D FIB-SEM volume imaging on malaria parasites. Newly recruited DDLS fellows also unite the infection medicine at the clinical side, forest genomics in a new network for data science.

The site is organized by a steering group, an infrastructure group, and an operations office that coordinates communication and information. The steering group includes faculty and university management across medicine and natural science disciplines at Umeå University, SLU, and Region Västerbotten. The infrastructure group includes infrastructure heads of units and local facility managers. The operations office is integrated in the KBC (Chemical Biological Centre) information office, facilitating activity coordination and research school courses.

7.4.2 Developments 2022–2023

Coordination of meetings and communication within and about life science has flourished with the common effort to develop the Umeå Site:

- Research school training, supported by KBC, has been embraced under the SciLifeLab site umbrella. This is a very fruitful organization for method specific workshops. To mention one example: Nordic EMBL partners, the Umeå units of CMI and our local imaging facilities hosted a workshop in Dec 2022 on "Correlative light and electron microscopy imaging of cells" including both cryo-EM correlation and 3D volume imaging.
- Start of a popular seminar series that covers recent developments and advances in techniques and infrastructure services ranging from imaging, molecular characterization to data analysis support.
- Contribution to local life science events: Organization of the annual KBC-Day, Umeå research infrastructure day and life science retreats during 2023. The site celebrated the launch of the site organization, with a SciLifeLab Day in September 2023, *Figure* 30.
- Common infrastructure functions were established by the Umeå site budget. We now offer visitor's access to wet/dry lab support, contacts to infrastructure and researchers and advice on travel, sample shipment, data transfer and data analysis support. Unique to infection medicine, associated infrastructures in Umeå are possibilities for "biosafety level 2" experiments.
- International visiting professors, in the fields of molecular infection biology and AI are attracted by the excellent research infrastructures, Cryo-EM and collaboration with MIMS, the Nordic EMBL partners to work in Umeå.

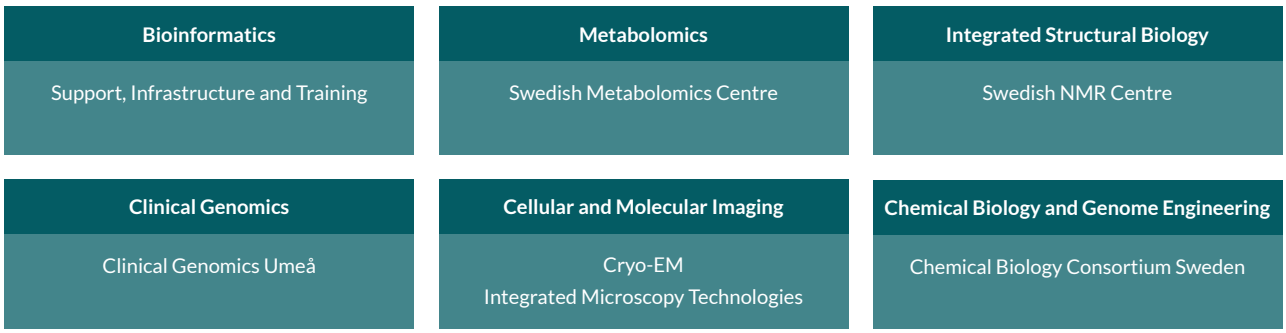


Figure 29. The platforms and units present at the SciLifeLab Umeå site

Figure 30. SciLifeLab Day in Umeå, September 11, 2023

7.4.3 Future Plans and Strategies

We will continue to strengthen and improve communication, and to create a good collaborative work environment within a shared SciLifeLab site and local DDLS organization.

Local bioinformatics support teams as well as integration of existing NBIS staff and the future DDLS data science node will together strengthen the organization. As part of this, we propose to include data management and bioinformatics in a common SciLifeLab and DDLS management organization, for example in steering group dialogues. The Umeå site office could be led by a management team representing both research infrastructure, data science and research directors. This will create a new inspiring office and work environment for a creative team including KBC information, meeting and course organization. An Umeå site office would further include shared support areas, social media and web-based information, training and data analysis support. The Umeå site operations office will in the future bridge expertise in communication to both researchers and the public with three specific aims:

- To work together with high schools in Norrland and around the Gulf of Bothnia to share our enthusiasm for life science.
- To develop the research school programs and post-doctoral training the Umeå Site operations office will include SciLifeLab Training Hub and research centers' PhD training coordinators.
- To extend international collaborations especially in the areas of research infrastructure quality control, management, and method development for research support.

7.4.4 Challenges and Questions to the IAB

See section 7.1.4., where the main challenges for all new sites are summarized.

7.5 SciLifeLab Site Stockholm

7.5.1 Introduction

The majority of SciLifeLab Site Stockholm activities reside at Campus Solna (CS). CS operates as a joint research facility uniting infrastructure and research groups affiliated with the Stockholm Trio University Alliance, i.e., Karolinska Institutet (KI), the Royal Institute of Technology (KTH) and Stockholm University (SU), see *Figure 31*. The infrastructure platforms and units of this site are found in *Figure 32*. Currently, there are over 100 research groups and more than 1,300 persons working in the Alfa and Gamma buildings at CS located on the northside of Stockholm adjacent to the KI campus, Karolinska Hospital (KS) and the Swedish Public Health Agency (Fohm). CS hosts a broad range of meetings and training activities, and is often used to showcase SciLifeLab for local, national, and international guests. The governing CS committee and CS leadership work closely with the SciLifeLab National leadership and the supporting Operations Office to coordinate the continued development of CS.

CS has two primary missions; i) to house the national SciLifeLab infrastructures operated by Stockholm Trio, and ii) to maintain and stimulate the dynamic research oriented community that seeks to better understand diverse life processes affecting human health and the environment at the molecular level. The two missions complement each other and are necessary to develop cutting edge technologies that have laid the foundation for the solid international reputation that SciLifeLab has earned. A distinguishing feature of CS is that by collaborating, the Stockholm Trio universities have created an advanced hub for innovation that brings researchers with basic biology and medical backgrounds together with researchers skilled in technique development and bioinformatics. This potent cross disciplinary mixture of expertise has spawned several novel technical developments, particularly impactful with respect to image analysis and biomarker identification. The experimental tools available at CS are useful for analyzing small molecules, purified proteins, single cells and tissues in healthy and diseased states and environmental samples.

The collective interest and competence in technology development at CS sets us apart from many well-renowned international research centers, and importantly is key to addressing biological questions in ways not previously possible. The unique environment of CS makes this site important in supporting the continued development of the DDLS era of SciLifeLab.

7.5.2 Developments 2022–2023

The years of 2022–2023 have been eventful. CS has continued to develop as a joint life science campus for the Stockholm Trio universities and as the major research and infrastructure site of SciLifeLab. Work has been guided towards meeting the goals of the Two-Year Campus Solna Action Plan, developed in 2021 to address comments raised in the 2019 IAB report. Perhaps most important, each of the Stockholm Trio universities have remained steadfast to the concept of maintaining a thriving research community closely linked to the National SciLifeLab infrastructures at CS. An illustrative example of the true value of the collaborative multidisciplinary research community at Campus Solna is the evolving Human Protein Atlas (HPA), which is now one of the world's largest digital platforms dedicated to the complete characterization of the cellular components underlying human life. HPA version 23 was launched in June 2023.

Clarification regarding the economic situation at CS, now judged to be excellent for the foreseeable future, represents major progress. The reasons underlying this positive development are primarily linked to two factors. First, governmental support, specifically directed to the founding universities, the SFO funding has remained steady. This has infused confidence, and the CS committee has responded by committing to supporting long-term initiatives, e.g., collectively recruiting and agreeing to locate eight SciLifeLab Fellows and twelve DDLS Fellows to CS, placing two highly successful senior scientists at CS, and supporting the development of new infrastructure initiatives, e.g., exposomics. Second, the financial status of SciLifeLab has been considerably strengthened during the past two years, i.e., support from the Swedish Government for Pandemic Laboratory Preparedness and from KAW for the DDLS initiatives. An impactful portion of these extra funds will eventually filter down to support activities at CS.

The Research Environment and Development (RED) grant program, now in its third year, was specifically initiated to support and maintain the high-value research capabilities at Campus Solna. Calls for early-stage proof of concept research RED projects, RED equipment grants, as well as a coordinated RED postdoctoral fellowship program involving the three Stockholm universities have been announced on a yearly basis. The ambition is to award RED grants in a manner that aligns with and emphasizes the core values of SciLifeLab research, i.e., research that develops and uses cutting edge analytic tools in life sciences, and that supports the highly successful SciLifeLab Fellows and DDLS Fellows.

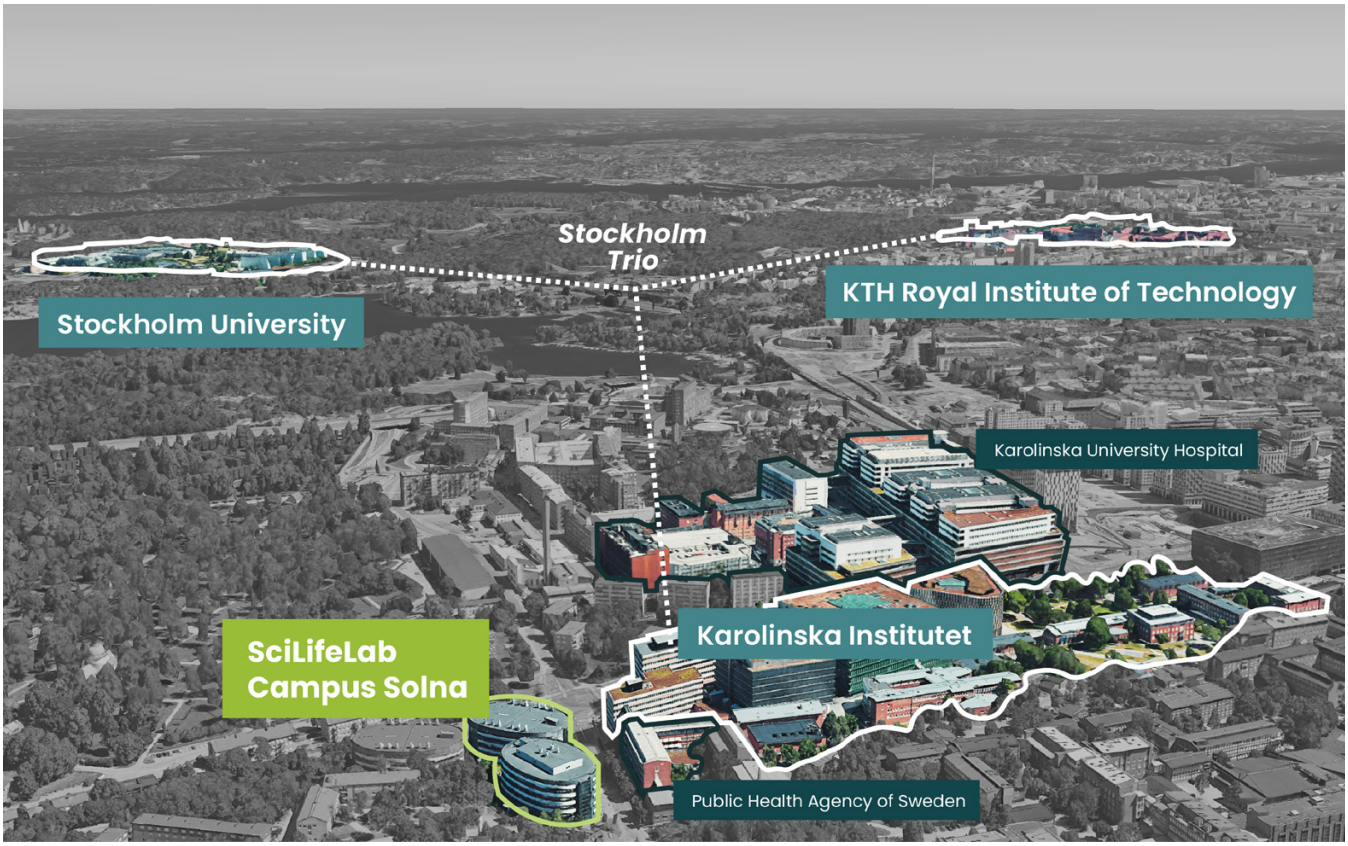


Figure 31. SciLifeLab site Stockholm and Campus Solna is a unique Stockholm Trio campus, co-localizing three universities and with a dual mission to host national infrastructures as well as research and technology development facilities. Campus Solna is a workplace for more than 1,300 people in 106 research groups (KI 32, KTH 47 and SU 27) on a current space of 16,372 m2.

Bioinformatics	Clinical Proteomics and Immunology	Cellular and Molecular Imaging
BioImage Informatics Support, Infrastructure and Training	Affinity Proteomics Autoimmunity and Serology Profiling Cellular Immunomonitoring Global Proteomics and Proteogenomics	Cryo-EM Integrated Microscopy Technologies
Genomics	**Metabolomics**	**Chemical Biology and Genome Engineering**
Ancient DNA National Genomics Infrastructure	Exposomics	Chemical Biology Consortium Sweden Chemical Proteomics CRISPR Functional Genomics
Clinical Genomics	**Spatial Biology**	**Drug Discovery and Development**
Clinical Genomics Stockholm	In Situ Sequencing Spatial Proteomics	Biochemical and Cellular Assay Human Antibody Therapeutics Medicinal Chemistry – Hit2Lead Protein Expression and Characterization Target Product Profiling and Drug Safety Assessment

Figure 32. The platforms and units present at the SciLifeLab Stockholm site

7.5.3 Future Plans and Strategies

Several strategic initiatives are being pursued. There is an acute space limitation at Campus Solna. Full occupancy of the Alfa and Gamma buildings is restricting the further development of research groups and national infrastructures, which is problematic in that it prevents Campus Solna from reaching its full potential. Additionally, there are also activity-dependent needs for space, such as an increased number of biosafety level 2 labs. The limiting space can be handled if transient, and if the possibility to expand is realized in the coming 2-year period. The solid financial status of SciLifeLab Campus Solna provides a strong impetus to acquire additional space. The best available option is the possibility to expand into the Beta building, which would add almost 50% more space. The rental contract for the current occupant, SOBI (Swedish Orphan Biovitrum), expires in March 2025. In August of 2023, KTH agreed, on behalf of Stockholm Trio, to investigate and plan the expansion of SciLifeLab, focusing on the Beta building.

The opportunity to expand should be leveraged to create an even stronger research environment that is also more representative of the true strengths of the Stockholm Trio universities and the national infrastructures. Strategic discussions at CS are ongoing to define how Stockholm Trio can optimally exploit this opportunity, for example, by promoting new infrastructure initiatives and thematic research areas. The guiding principles are to harness the power of our existing infrastructures, include the theoretical aspects associated with data-driven science and promote broad areas that will generate critical mass, thereby creating novel opportunities at CS that will make an international impact. Three areas are being considered for further discussion. First, a Biomarker Verification and Development (BVD) platform modeled similarly to the existing SciLifeLab Drug Discovery and Development (DDD) platform. The vision is that the BVD platform would provide a pipeline to validate biomarkers defined by real needs, i.e., input from the medical or environmental monitoring fields, and develop appropriate biomarkers for practical use. The ultimate goal is to make a tangible impact by creating tools applicable for high precision clinical diagnosis and environmental monitoring. Second, a Theoretical Computational Biology initiative. Here, we should work to fully support the 12 DDLS fellows coming to Campus Solna and build on our strengths. The collaborative agreements between Stockholm Trio universities, the Stockholm area has one of the highest densities of bioinformaticians and mathematical biologists in Europe. Third, the Human Biosphere, an area that is well-aligned with the recently launched Planetary Biology capability. The challenges confronting humankind that are directly linked to the increasing densities of populations accumulating in cities are not well understood. Here, we could create critical mass through coordinated recruitments to push our infrastructures to better understand the underlying molecular nature of the complex human biosphere. These ideas, although not fully vetted, are aligned with the IAB recommendations that CS should develop its capacity to train the next generation of interdisciplinary leaders needed to move Swedish life science to the forefront internationally. Expansion into the Beta Building will help meet this expectation.

7.5.4 Challenges and Questions to the IAB

- As pointed out, the major strategic challenge facing CS is the acute space limitation. Here, support and guidance by the IAB would be helpful to ensure that expansion is carried out in a timely manner, retains operational and scientific integrity, and underlines the importance of a healthy balance with respect to the presence of all three universities.
- Long term commitment to Campus Solna by the Stockholm universities. In making recommendations, the IAB should consider that CS is not a fully integrated research center with a single budget and omnipotent leadership, rather it functions as a joint biocentre, housing research groups and infrastructure from three different universities under one roof. The organizational structure places demands on the CS leadership, requiring extensive efforts to build consensus and to reach broad acceptance for implementing policy. Also, it is challenging that SFO funding, earmarked to support the research activities at SciLifeLab, is allocated in separate "pots" to each of the founding universities. With respect to CS, KI, KTH and SU, to individually control and allocate the use of their SFO funds. The creation of a truly integrated center, a suggestion by the IAB, would require pooling SFO funds across university boundaries. In addition to major administrative and legal obstacles, the universities are reluctant to relinquish control and are not positive about this possibility. Although the risk that the government will withdraw or greatly decrease current funding levels appears to have diminished, there remains a real concern that the SFO funds might be converted or transferred to the regular budgets at the respective universities. If this would happen, there is substantial risk that the funding would no longer be earmarked solely for CS, which could be very detrimental for SciLifeLab. Here, vigilance regarding this possibility and actively working to obtain long-term commitments is a priority of the CS leadership, and support by the IAB could be critical.
- Finally, the way that universities have set up their activities at SciLifeLab varies, which also presents a challenge to joint planning. Historically, before the new CS leadership was established, strategic decisions lacked coordination. As a consequence, there are significant differences regarding personnel administration and career development paths that complicate pressing strategic considerations. All

researchers affiliated with KI and SU are members of well-established departments primarily located on their main campuses, and consequently, the possibility exists to rotate personnel from CS to their home departments. In contrast, KTH has placed an entire department at CS, which has limited the possibility to rotate fellows and other personnel from CS. Now that space is limited, these differences present real practical challenges that affect decisions regarding space allocation and efforts to achieve a dynamic rotation of research groups. Aware of the inequities, the majority of SciLifeLab fellows and other PIs from KI have successfully argued to remain at CS. In contrast, the SU departments represented at CS have maintained tight contacts with their SciLifeLab fellows, and have remained committed to the expectation that fellows should rotate to their home departments when their fellowship terms expire. Based on this constructive engagement, several of the SU SciLifeLab fellows have rotated to their home departments.

- Clear and consistent strategies are needed to achieve the desired dynamic flow of research groups in and out of CS. These should take into account the need to fit into the current and future dimensions of the space available within the SciLifeLab building complex in Solna. Efforts are underway to map out and determine how well each of the over 100 research groups "fit" the core goals of SciLifeLab. This remains a complicated task and more work is required to fully utilize the information to formulate decisions to affect policy.

7.6 SciLifeLab Site Uppsala

7.6.1 Introduction

The Uppsala site is integrated into several locations within the Uppsala University (UU) campuses, including the university hospital, as well as being in close proximity to the Swedish Medical Product Agency and the Uppsala Innovation Center at the nearby Science Park, which also hosts numerous biotech and other companies dedicated to life science applications. The site is also near the Swedish Agricultural University (SLU) that hosts scientists involved in one of the Capabilities (see below). The site is centered around its hub, known as Navet, a separate building at the Biomedical Center UU, which hosts one half of the SciLifeLab operations office, part of the leadership of Drug Discovery and Development (DDD) and National Genomics Infrastructure (NGI) Uppsala, a large part of the SciLifeLab bioinformatics platform, the Data Centre and parts of the National Bioinformatics Infrastructure (NBIS). In addition, Navet offers a broad range of amenities serving physical and digital meetings and training activities, while being intimately surrounded by young biotech companies also hosted at the Biomedical Center. Navet is often used to showcase SciLifeLab for local, national, and international guests and frequently hosts national SciLifeLab community events, see *Figure* 34.

High impact benefit to society is the motivation of site Uppsala, realized via, i) innovation generated by collaborative schemes between SciLifeLab platforms and new technology units at UU; ii) academic excellence in recruitment, mentorship and promotion of young scientists (Fellows' program). The engagement of the leadership of site Uppsala contributes constructively to the demanding task of a cooperative and effectively steered organization. The national co-Director, the Integration Director and the Scientific Director that represent UU, facilitate continuous cross-fertilization of ideas through the national SciLifeLab management group. The Head of Operations, who is also the Director for the Office for SciLifeLab in Uppsala, and the Head of Data Centre are based at UU and add to connecting all national and local operations. Communications between the SciLifeLab site Uppsala committee, the Scientific Director, the consulting working group to the site Uppsala committee, members of the steering and reference groups of the DDLS program, and the scientific leads of the Capabilities have evolved into a truly cooperative network of management that catalyzes operations and collaborations. SciLifeLab site Uppsala also works on expanding the accessibility of SciLifeLab to humanities scientists that work with large data analyses. Building of a new SciLifeLab site Uppsala webpage aims at increasing visibility of the site in the future.

7.6.2 Developments 2022–2023

Research Environment dimension:

Academic excellence: continuous recruitment of SciLifeLab and DDLS fellows (see *Sections* 9.2.1 and 10.2.1); 2 fellows recruited in 2023 and 2 ongoing recruitments actively pursued. Mentorship and follow-up of fellows' progress has been effective so that 2 fellow alumni were promoted to tenured full professors, and 3 alumni and 4 active fellows were promoted to tenured associate professors during 2022–2+23. This is facilitated by the SciLifeLab site Uppsala committee which actively monitors how UU departments foster the fellows' development. The fellows frequently present their science to the committee and are simultaneously interviewed regarding their fostering by the respective department and their future plans. Investment into recruiting top senior scientists (4 professors during 2022–2023) by offering 1 MSEK start-up packages enhances research ties with the SciLifeLab infrastructures and opens opportunities for technological development.

Training activity support: organization of an active forum for scientific discussion, accomplished by continuing our The Svedberg seminar series and a PhD-postdoc webinar series initiated in 2022. Support to admit life science PhD students to a new IT-based eSSENCE PhD program at UU (4 students, 2021–2024) aims at enhancing the training of young scientists that can feed into the DDLS program (as future postdocs in DDLS projects).

Support for technology development projects beyond national support has continued. Prioritized areas over the past 2 years are: biodiversity and eukaryotic microbial pathogen analysis, biophysical screening and cryo-EM user support, customized microfluidics, single cell multi-omics, and in situ multiplex affinity proteomics.

Spreading of the SciLifeLab Uppsala model: SciLifeLab site Uppsala is integrated into departments at UU working in life sciences in a distributed model that has been optimized for more than 10 years. This model is now being used at the four new SciLifeLab sites in Lund, Gothenburg, Linköping and Umeå and the SciLifeLab site Uppsala leadership has been communicating with the leadership at the new sites to share experiences and help them in their establishment.

Leadership-level engagement into the Capabilities: SciLifeLab site Uppsala offers the Scientific Lead of the Pandemic Laboratory Preparedness (PLP) Capability, see *Section* 8.2. As a complementary activity to PLP, SciLifeLab site Uppsala supported additional COVID-19-related research projects during 2022–2023. Furthermore, UU and

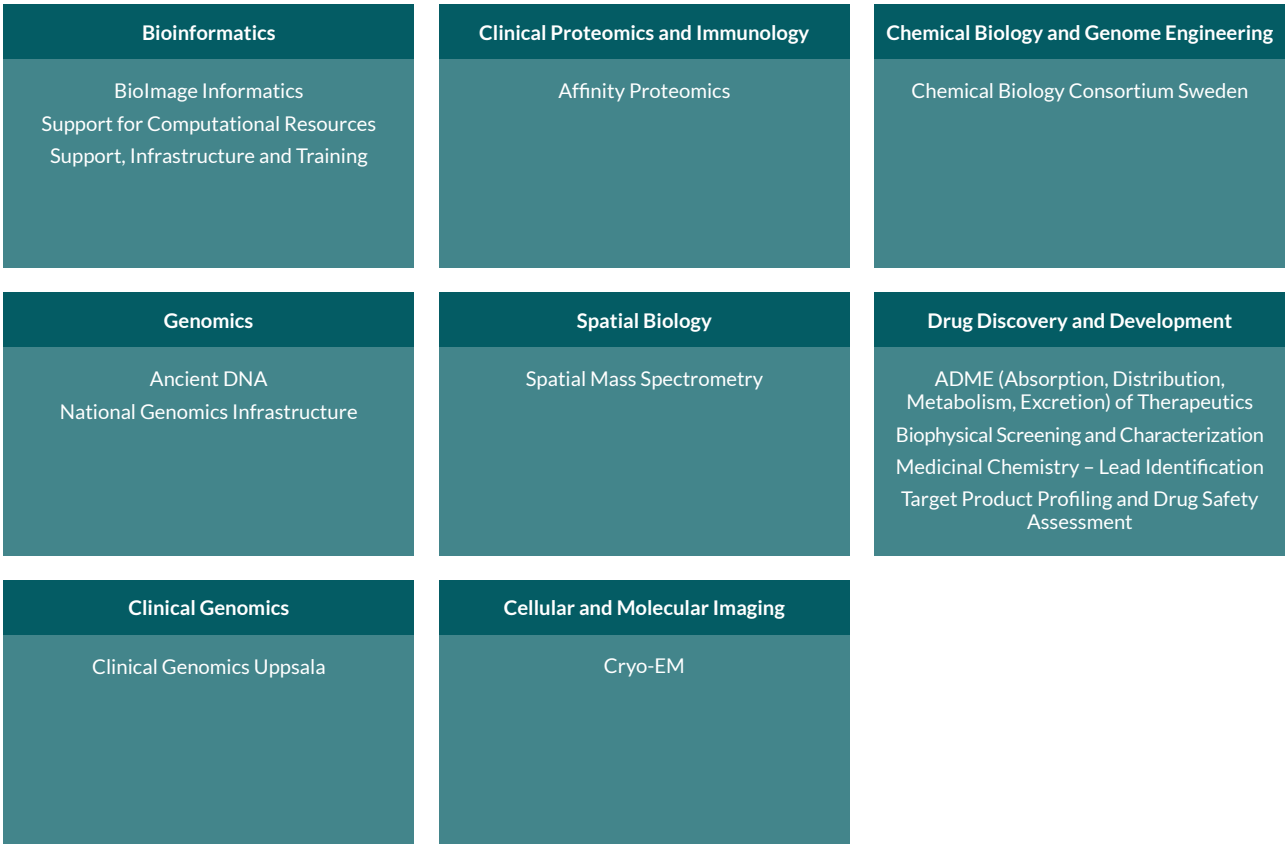


Figure 33. The platforms and units present at the SciLifeLab Uppsala site

SLU-Uppsala provide leadership to the Planetary Biology (PB) Capability, see *Section* 8.3. PLP and PB share research and technological approaches, and their interaction will contribute to sustainable success. The Precision Medicine (PM) Capability, see *Section* 8.1, is also represented at UU, which provides one of the three PM Scientific Leads. The technological and developmental demands of the capabilities are important areas for strategic development.

Infrastructure dimension:

SciLifeLab site Uppsala strengthens the nationally funded SciLifeLab infrastructures at UU with additional Strategic Research Funding (SFO) resources, as well as new technology units with national potential. The SciLifeLab platforms and units of the Uppsala site are found in *Figure* 33.

SciLifeLab site Uppsala hosts the SciLifeLab Data Centre that plays an important role in securing computer server space and organization at the national level. Despite recent changes in the steering of the national servers, SciLifeLab site Uppsala maintains a key position in governing and influencing the development of this important infrastructure. A major catalytic factor is the leadership of NBIS, stationed in Uppsala, and actively participating in the DDLS program.

Among the 8 platforms and 14 units of UU, SFO funds activities on Bioinformatics (including Bioimage Informatics), Genomics (including Ancient DNA, Microbial and Clinical Genomics), DDD, Cellular and Molecular Imaging (including the Cryo-EM screening node); previous pilot facilities on Spatial Mass Spectrometry (national infrastructure since 2021), Microfluidics, Preclinical Cancer Treatment (PCT), Positron Emission Tomography and Spectroscopy; 3D printing core facility U-print, UU NMR facility, Genome Engineering Zebrafish, and UU microscopy facility BioVis (the latter two, previously under SciLifeLab).

It is worth highlighting the importance of the DDD platform that generates a tight collaborative link with various innovation stakeholders in Sweden. UU scientists have led 12 DDD programs and, so far, 5 commercial exits. DDD has direct collaborations with competence centers at UU, e.g., ENABLE2 that supports the early stages of discovery and development of new antibiotics, and the PCT center that in collaboration with DDD provides service for in vivo PK and PKPD studies in cancer models.

DDLS dimension:

Important elements that couple SciLifeLab with DDLS actions have been described in examples above. Recent examples of developments are:

Figure 34. SciLifeLab Site Uppsala's meeting place Navet frequently hosts national SciLifeLab community events

- The Data Science Node of Evolution and Biodiversity, established at UU, effectively couples the research activities of several newly recruited SciLifeLab and DDLS fellows with the scientific excellence in this field that distinguishes UU globally.
- DDLS fellow recruitment in Data-driven Evolution and Biodiversity (one fellow) and in Data-driven Epidemiology and Biology of Infection (one fellow). The second phase of DDLS Fellow recruitment is ongoing: Data-driven Evolution and Biodiversity (one fellow) and Data-driven Precision Medicine and Diagnostics (one fellow).

7.6.3 Future Plans and Strategies

Key areas at SciLifeLab Site Uppsala include:

- Genomics with emphasis on precision medicine, infectious diseases, cancer and epidemiology, but also evolution and biodiversity, the latter covering planetary biology, organismal adaptation to climate change and adaptation to the increasing dominance of human society over the global habitat. Biodiversity and technological boosting of genomics demands major efforts into environmental (eDNA) sampling and preparation in monitoring biology of microorganisms and of larger organisms in a variety of geographical environments, including modern mega-city habitats. This cannot be only based on DNA (or RNA) analysis. Multi-omics technologies require interoperability in order to maximize monitoring of informative parameters reflecting different physiological and pathological states within populations in habitats, but also in all medically oriented applications.
- Precision medicine (PM) faces similar technological challenges and requires efforts for integration to clinical practice. The multi-omics approach is relevant also here as human physiology and pathology is not strictly defined by genomic or epigenomic analyses, but large-scale proteomic/metabolomic and biomarker analyses will take increasing weight in clinical practice. Coupling molecular omics data with structured health data from quality registries will provide new insights into disease development and new innovative therapeutic possibilities. The rich environment in biobanking at UU can contribute to implementation of PM in Sweden. Yet the challenge of full clinical implementation remains open.
- Molecular sciences and structural biology, ranging from metabolites to RNA biology, to spatial omics and digital pathology. Innovation in molecular and structural sciences is fostered by SciLifeLab fellows and two new professors that in combination develop novel spatial biological tools, better tools for epigenomic analysis, functional annotation of RNA structural domains, and RNA-based therapeutics, together with enhanced activity in NMR-based applications.
- The 3D printing and tissue engineering with incorporated microfluidics fields develop rapidly at UU and SciLifeLab can be the proper forum for their coordination and innovative development nationally.
- DDD is linked to modern Advanced Therapy Medicinal Product (ATMP) technology. Expanding the successful coupling of DDD with industrial-biotech companies is a challenge as one aims at maximization. The development of new ATMPs requires forefront research infrastructure and SciLifeLab site Uppsala has a pivotal role to play here, exemplified by the recruitment of a new SciLifeLab fellow on ATMP.
- Bioinformatics that covers bioimage analysis and multi-omics. Beyond managing the enormous needs of data storage and curation, including individualized sensitive data, the coupling of AI approaches to bioimage analysis and interfaces that can connect multi-omics data to biological phenotypes remain challenges where UU can offer leading avenues towards development.

7.6.4 Challenges and Questions to the IAB

- Coordinate activities between Capabilities. The synergy of the Capabilities demands higher level integration and imagination, including coordination at the training level and patient data collection. Can the Capabilities provide the source for infrastructure innovation? Generate a new Capability on DDD/ATMP?
- Expand and promote Technology Development Projects that can catalyze more synergy between the different SciLifeLab sites based on technological units of common orientation (e.g., clinical genomics, metabolomics, NMR, etc). Should every site offer the same portfolio of advanced equipment?
- How can SciLifeLab contribute to development of ATMP centers for accelerated translation of innovative therapies at a national level
- Although the SciLifeLab Fellows' program functions very well, should fellows become more engaged in new technology development and integrate more with the SciLifeLab infrastructure?
- How may DDLS fellows interact with experimental scientists to translate clinical, pharmaceutical and biodiversity insight into new innovative therapies and solutions for the global environment?

Photo: Mikael Wallerstedt

8. SciLifeLab Capabilities

During 2021 and 2022, SciLifeLab has launched three capabilities in Precision Medicine (PM), Pandemic Laboratory Preparedness (PLP), and Planetary Biology (PB). These capabilities constitute thematic focus areas whose purpose is to tie together and focus resources further to create increased opportunities when addressing complex and demanding societal challenges. The capabilities connect the infrastructure's broad range of technologies and expertise with the research community, sample handling resources and pipelines for data analysis, as well as coordinate these internally and with relevant external actors. The capabilities also reflect the research areas of the DDLS program with the aim of connecting with these; data-driven precision medicine and diagnostics, data-driven epidemiology and biology of infection, as well as data-driven evolution and biodiversity.

8.1 Precision Medicine Capability

8.1.1 Introduction

Sweden aspires to be a global leader in precision medicine, with SciLifeLab's Clinical Genomics platform playing a pivotal role in advancing genomics-based precision medicine in healthcare. To strengthen SciLifeLab's contribution using our full range of technology and data capabilities, the Precision Medicine (PM) Capability was established in June 2021.

8.1.2 Developments 2022–2023

An important mission has been to formulate a strategy for SciLifeLab's role in PM. SciLifeLab's Roadmap for Precision Medicine, *Appendix H*, which was approved by the SciLifeLab board in May 2023, outlines four strategic objectives, see *Figure* 35.

In addition, the PM capability has actively engaged with the SciLifeLab infrastructure and research community, conducting workshops, presentations and panel discussions at various retreats and scientific conferences. To increase societal awareness about the significance of cutting-edge research infrastructure for PM, SciLifeLab has arranged seminars in the political forum the "Almedalen Week" and engaged with Sweden's Ministry of Social Affairs in questions related to PM.

Securing external funding has been a major achievement, with 66.7 MSEK (2023–2027) obtained from the Swedish Research Council for improving SciLifeLab's ability to support clinical trials and from the European Digital program to co-develop a Testing and Experimenting Facility for Health[14]. This funding enables the formation of a cross-disciplinary operational team at SciLifeLab dedicated to PM.

Figure 35. Strategic objectives in SciLifeLab's Roadmap for Precision Medicine

[14] tefhealth.eu

Substantial effort has been invested in aligning SciLifeLab's initiatives with other key players within PM, including Genomic Medicine Sweden and national initiatives for medical imaging, biobanking and cell-based therapies. To further facilitate coordination across organizations and ensure broad expertise, we have established a strategic expert group.

8.1.3 Future Plans and Strategies

Our overall goal is to realize the strategic objectives outlined in the PM Roadmap. This includes establishing a national PM network that connects technology experts with preclinical, clinical and data-driven researchers. We plan to open a call for collaborative technology development projects driven by clinical needs. Events will include, for example, the highly appreciated seminar series "Clinical talks", an annual DDLS seminar and round-table discussions with clinicians and technology experts. We collaborate with the SciLifeLab Training Hub to map the need for training related to PM within our community.

Our external funding enables execution of pilot projects to establish cross-platform sample and data workflows, in collaboration with the SciLifeLab platforms, the Data Centre, DDLS, and the PLP capability. Actions to improve our support for clinical studies include supporting the national clinical drug-repurposing trial planned by the innovation milieu Test Bed Sweden for Precision Health in Cancer. Additional projects will be identified through a Letter-of-Interest announcement, to encourage engagement from our research community.

We will continue to engage in grant applications to enable development of additional PM services through large-scale projects. Several pending applications strive to promote SciLifeLab within the Swedish and European PM ecosystem. In addition to national and international partnerships, we engage with Precision Medicine Centers at the regional university hospitals.

8.1.4 Challenges and Questions to the IAB

- Harnessing genomics to clinical research required the establishment of the Clinical Genomics platform, to meet the needs of fast turnaround time, n = 1 analysis, and quality assured assays and data pipelines. While many other SciLifeLab platforms could also contribute to form a world leading precision medicine capability, they are not optimized for clinical research. Could the SciLifeLab infrastructure be reorganized to better accommodate the unmet needs within clinical research?

◆ 8.2 Pandemic Laboratory Preparedness Capability

8.2.1 Introduction

The Pandemic Laboratory Preparedness (PLP) Capability at SciLifeLab was established in 2021 in response to the COVID-19 pandemic. It is a 4-year program for national pandemic laboratory preparedness, financed by a special grant of 130 MSEK from the Swedish government. The main aim of the program is to provide SciLifeLab, in consultation with the Public Health Agency of Sweden[15] (Fohm), abilities to build laboratory capacities for pandemics to support health care, clinical laboratories as well as public and commercial sectors but not to replicate or create competing clinical testing capacity. The aim is achieved by strengthening technical facilities for molecular analyses, increasing the capacity to analyze large amounts of data and by supporting research required for increased understanding of infections that can cause pandemics. Relevant research fields include diagnosis, analysis of infection biology, disease pathogenesis, immunity and drug and vaccine resistance of viruses, bacteria and other disease-causing agents.

8.2.2 Developments 2022–2023

Since the start in 2021 the PLP network has expanded via open calls and consists today of 22 separate units spread throughout the country and different research environments, all focusing on different areas within pandemic laboratory preparedness, see *Figure* 36. The main focus areas are DNA/RNA sequencing and metagenomics, BSL3 operations, immunomonitoring, diagnosis and surveillance, environmental analyses, sample and data handling. The network has played a very important role during the COVID-19 pandemic. Most of the sequencing of SARS CoV2 virus variants in Sweden has been performed within the network, as were large scale serology, waste water analyses and sharing of research data via the COVID-19/Swedish Pathogens portal. Collaborations have been established with the seven major clinical microbiology labs at the university hospitals (mainly via the Clinical Genomics platform), governmental agencies (FoHM, SVA and FOI), international organizations

[15] folkhalsomyndigheten.se/the-public-health-agency-of-sweden/

(ECDC, CoVaRR-NET (Canada) and the vaccine institute IVI). In August 2023, the first PLP network meeting was held with participants from all units and collaborators and it showed that it is a strong and established national network. The PLP meeting initiated the writing of a road map for the PLP network 2025 to 2028.

8.2.3 Future Plans and Strategies

SciLifeLab and the PLP capability has shown a unique ability to strengthen basic and clinical research and technology development at universities, hospitals, authorities and companies during and between pandemics through the strong life-science infrastructure and research network established.

The PLP network is now focusing on five main areas.

1. Support and coordination of team-science efforts in the PLP network
2. Support of technique and technology development important for the study of pandemic pathogens and their pathobiology
3. National and international cooperation and collaboration with other research infrastructures and networks
4. Support of data management, sharing and open publication during and between pandemics via the Swedish Pathogens portal[16]
5. Integration of pandemic laboratory preparedness capabilities within SciLifeLab platforms, the Planetary Biology and Precision Medicine capabilities and the DDLS program in research area Epidemiology and Infection Biology

During 2024 the PLP program will continue to improve resources to be used in pandemics but with the added gain that these can also be used in other SciLifeLab activities, such as infrastructure support of infection research and precision medicine. Therefore, one aim is to make important PLP resources part of the SciLifeLab infrastructure portfolio from 2025 and to retain collaborations with the clinical microbiology laboratories to maintain and develop the capabilities needed for future pandemics.

8.2.4 Challenges and Questions to the IAB

- Integration of PLP activities into life-science infrastructure gives unique possibilities for sustainability but the main challenges will be to retain and develop the established PLP capabilities in the post-pandemic phase. It will also be important to secure funding when the current governmental grant ends in 2024 and to keep the PLP network active. Discussion on different solutions and experiences from the IAB would be most helpful.

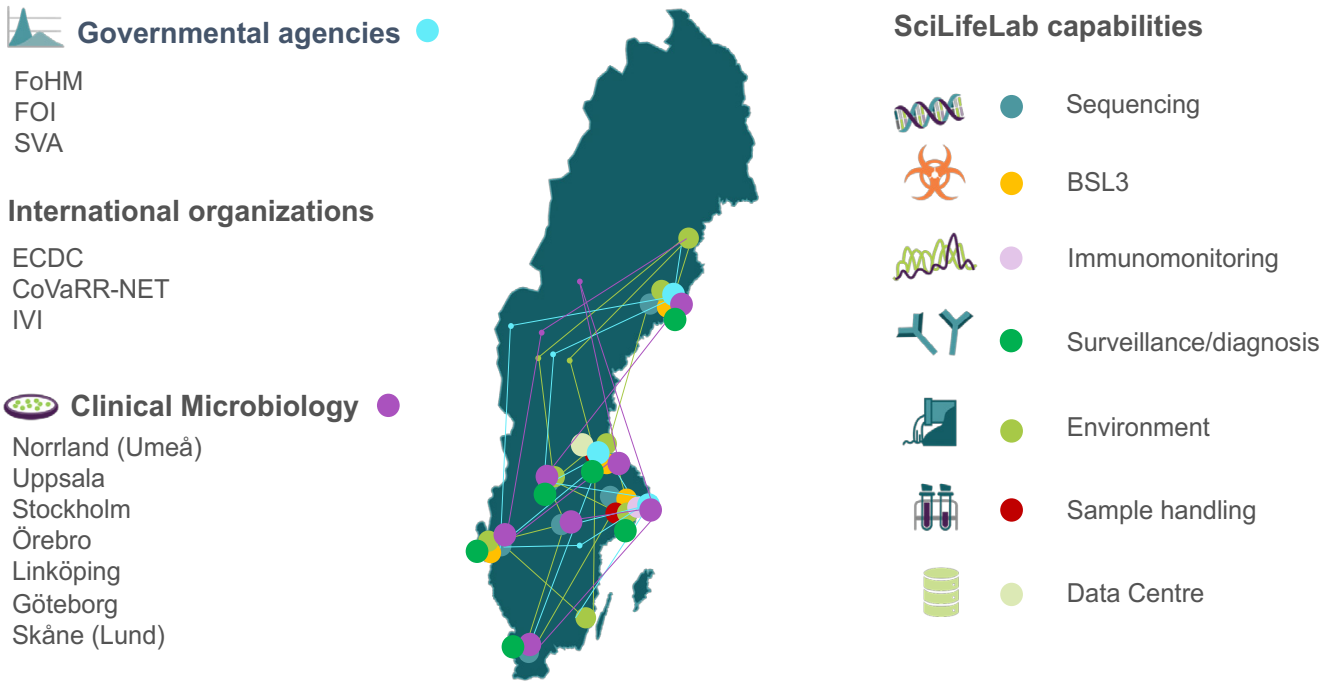


Figure 36. The PLP network with 22 separate units

[16] pathogens.se

8.3 Planetary Biology Capability

8.3.1 Introduction

The SciLifeLab Planetary Biology (PB) capability is motivated by a pressing need for coordinated trans-disciplinary efforts to comprehensively understand all different forms of life – the Earth's biodiversity – from single molecules and cells to individual species, interactive communities, ecosystems, and planetary impacts. PB aims to connect unique competencies of the SciLifeLab infrastructure platforms and DDLS with life science researchers to empower, promote, and accelerate ecosystem- to planetary-scale research, linking molecular-scale understanding to ecosystem function and biodiversity, see *Figure 37*. Prioritized PB objectives are to:

- Build a strong national Planetary Biology community.
- Increase SciLifeLab's accessibility and tailor services for the PB community.
- Promote knowledge transfer between the PB community, stakeholders, and SciLifeLab.
- Coordinate outreach and translational action to maximize research impacts and engage both the public and stakeholders.

8.3.2 Developments 2022–2023

- *Workshop Heidelberg May 2022.* PB was launched at a joint SciLifeLab / EMBL workshop with invited talks from leading experts on biodiversity genomics, ecology and evolution, biogeochemistry and ecosystems, and data-driven planetary biology. Capability leads participated and established important links with EMBL.
- *Engaging in the Biodiversity Genomics Europe (BGE) consortium.* PB participates in a newly formed international consortium that will carry out a large EU-funded project applying genomics to conservation biology and biodiversity research.
- *Partnering with the Aquatic Microbiome Research Initiative (AMRI) and engaging in TREC.* Building on the successful establishment of a strong and interactive research community in aquatic sciences, PB engaged in the yearly AMRI meeting (Nov 2022) and the EMBL-coordinated TREC expedition (TRaversing European Coastlines) during the summer 2023 with student volunteers and outreach activities.
- *PB capability kick-off meeting in Uppsala, March 2023.* A first national PB meeting was organized to prime the formation of multidisciplinary teams, evaluate synergies with existing projects and centers, and get broader inputs on priorities and scope for PBC. The event gathered 60 Swedish scientists representing 11 organizations including all major Swedish universities. A first version of a roadmap for the capability was discussed for release in fall 2023.
- *Outreach and visibility.* PB has participated in national outreach events (SciLifeLab Days) in Gothenburg, Umeå, Lund and Linköping and other relevant occasions such as the Umeå KBC days and DDLS symposia. Besides presenting the capability and soliciting inputs on the roadmap and priorities, local ambassadors have been appointed and the PB community has been expanded. PB has also engaged in several platform events (Facility forum, platform retreats) to forge links to SciLifeLab staff and leadership.
- *Stakeholder engagement at the "Almedalen week" 2023.* The PB capability organized a broadly announced and well-attended panel debate on the topic "New tools to secure biological diversity in a changing world - which path should Sweden choose?". A mixed panel of researchers and stakeholders (Parliament-Committee on Environment and Agriculture, Swedish Agency for Marine and Water Management, WWF, IVL, Blue Center Gotland) discussed the potential of molecular tools (such as those offered by SciLifeLab) for monitoring biodiversity and environmental change, see *Figure 38*.
- *PB Researcher Survey.* PB conducted an in-depth survey with the aim of identifying the technological priorities and gathering insights about special needs and challenges for our researchers to use existing SciLifeLab services. The responses from the survey suggest that SciLifeLab already offers many of the technologies required by the PB community and that the main limitation is that most applications are tailored to humans or certain model organisms. Services offered by Genomics, Bioinformatics, and Spatial Biology platforms were pointed out as particularly relevant.

8.3.3 Future Plans and Strategies

To strengthen the PB identity, gain visibility, and maintain and expand the emerging scientific network:

- Organize annual national PB conferences and co-organize and contribute to large, highly relevant international conferences.
- Forge links to e.g., the DDLS program, OneHealth Sweden, and the Precision Medicine and Pandemic Laboratory Preparedness capabilities.
- Finalize and publish the PB capability roadmap and develop our external website.

To support and empower the PB community:

- Establish a network/researcher program for early career researchers in planetary biology, forging links with the Training Hub to build a nationally distributed multidisciplinary research school in planetary biology.

- Engage and support our expanding network of local ambassadors.
- Provide recommendations for prioritized SciLifeLab technology/infrastructure and engage more SciLifeLab infrastructure units in the development and activities of the capability.

To increase the visibility of the PB capability and enhance interactions with stakeholders:

- Organize workshops on eDNA tools for biodiversity assessment targeting government agencies, the environmental management sector, and the private/industry sector.
- Establish an online forum for PB researchers and relevant stakeholders.

8.3.4 Challenges and Questions to the IAB

- With the increasing need to understand contemporary and anticipated environmental change and the impacts this will have on living systems (from cells to biomes), one of the main challenges of PB is to effectively engage with relevant stakeholders (e.g., governmental agencies, private sector). A discussion and advice on strategies and experiences from the IAB on effective ways to establish and strengthen such interactions would be very valuable. The capability would also benefit from a discussion on how to ensure proper/appropriate internal prioritization within SciLifeLab and its technology platforms in terms of specialized instrumentation, technology development, and services for environmental and non-model organism samples, all of which are needed for advancing planetary biology research.

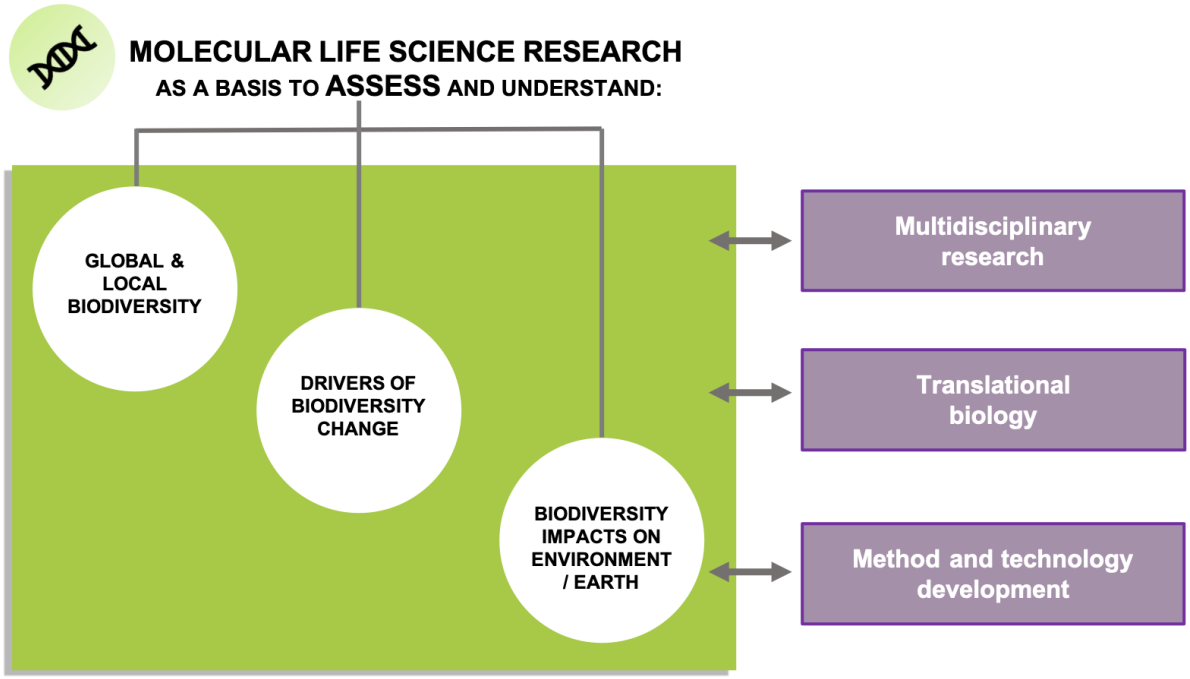
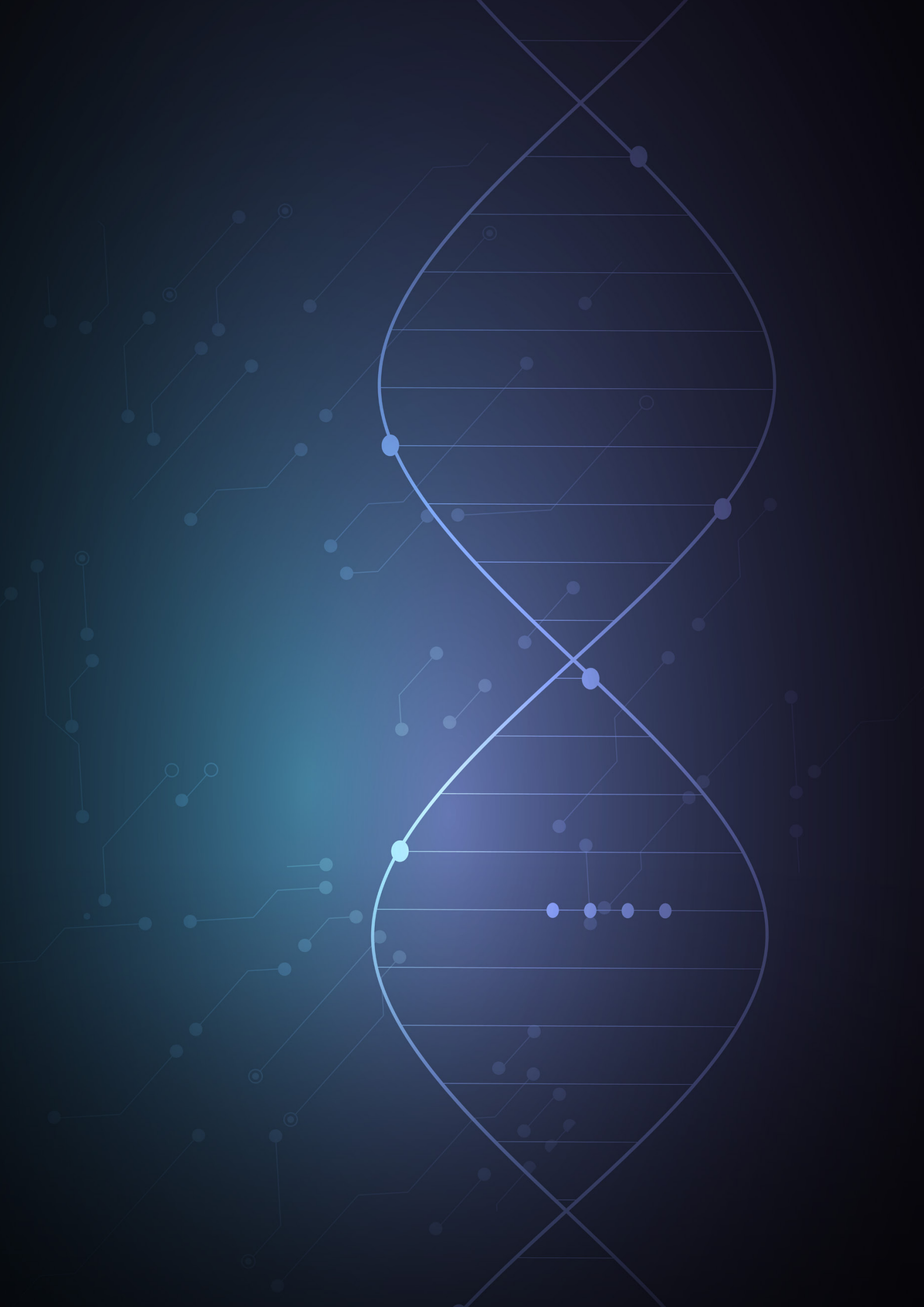


Figure 37. Planetary Biology Capability concept. Research in molecular life sciences allows us to understand the origin and functional adaptations of diversity, from genes to ecosystems. This approach gives rise to and feeds back into method and technology development, multidisciplinary work, and translational biology.

Figure 38. Planetary Biology capability at Almedalen week 2023. A mixed panel of researchers and stakeholders (SciLifeLab PB leads, Parliament-Committee on Environment and Agriculture, Swedish Agency for Marine and Water Management, WWF, IVL, Blue Center Gotland) discussed the potential of molecular tools (such as those offered by SciLifeLab) for monitoring biodiversity and environmental change[17].

[17] SciLifeLab (2023). *Är DNA-analyser av miljöprover vägen framåt? – SciLifeLab Planetary Biology i Almedalen.* Youtube. https://www.youtube.com/watch?v=WWZ8Nm1DVhk



9. SciLifeLab and Wallenberg National Program for Data-Driven Life Science (DDLS)

9.1 Introduction

In October 2020, the Knut and Alice Wallenberg Foundation (KAW) announced a 12-year funding initiative of 3.1 BSEK[18] to support data-driven life science in Sweden. SciLifeLab as a national research infrastructure within the technology- and data-driven life sciences was entrusted with the coordination of the initiative, a collaboration with 10 Swedish universities and the Swedish Museum of Natural History, *Figure* 39.

DDLS is integral to SciLifeLab's data-driven life science framework, and represents the organization's third pillar. The SciLifeLab Roadmap 2020–2030 emphasizes data-driven life science as a key strategic initiative critical for Sweden's ability to be a forefront life science nation, and this donation has accelerated the fulfillment of several of the strategic objectives.

Already in the first 2.5 years of the program 20 fellows within the field of data-driven life science have been recruited, 28 joint research projects with the Wallenberg Autonomous Systems and AI Program (WASP)[19] and 6 joint seed-money projects with WASP-humanities and society (WASP-HS)[20] have been funded, In addition, a national data platform with data services available for the whole Swedish research community been launched, four Data Science Nodes (DSNs) one for each of the four data-driven research areas been created, 24 staff scientists for these data services been recruited (system developers, data stewards, data engineers) and further recruitments are

Figure 39. The 11 partner organizations of DDLS: Chalmers University of Technology, University of Gothenburg, Karolinska Institutet, KTH Royal Institute of Technology, Linköping University, Lund University, Stockholm University, Swedish Museum of Natural History, Swedish University of Agricultural Sciences (Umeå and Uppsala), Uppsala University, and Umeå University.

[18] kaw.wallenberg.org/en/press/sek-37-billion-funding-life-science-knut-and-alice-wallenberg-foundation-launches-new
[19] wasp-sweden.org
[20] wasp-hs.org

ongoing. To facilitate networking and knowledge exchange 24 DDLS related events, workshops and seminars have been organized and plans for the upcoming DDLS research school and training program to start in 2024 are well underway. Program aims and developments are further described below. For specific milestones and program achievements see *Figure* 40 and *Appendix I. DDLS achievements, status June* 2023.

In June 2023, an external advisory committee, the DDLS Advisory Committee (DAC), consisting of global experts in data-driven life science, conducted a review of the DDLS program. DAC is closely linked to IAB as two of the three members are members of the IAB (Søren Brunak and Jan Ellenberg). This review aimed to assess the program's progress, offer insights for phase 2 and beyond, and advise on strategic aspects. A joint DAC report collected their recommendations and highlighted that the DAC members were truly impressed by the significant progress made since the start of the program, *Appendix J. Joint DDLS advisory committee (DAC) report* 2023. Recommendations from DAC have been analyzed and a response from the DDLS management is included in this report, *Appendix K. DDLS Response to the comments from the DDLS advisory committee.* Thus future plans for DDLS described in this IAB report builds on their recommendations and we ask from the IAB primarily to focus on the SciLifeLab overall aspects and general framework of hosting this 11 partner collaborative research and training program.

9.1.1 Funding and a 12-year Program Plan

In the donation letter for the time period 2021–2032, funding is distributed over five phases, *Table* 2, but also specifies the funding framework for the full 12-year period, see *Figure* 41. For each phase, an application has to be submitted to KAW, meaning that the program can be stopped, or the funding revised, after any of the phases.

The funding for each phase is allocated to several operative areas. All program components will not be activated until 2026 which is when the program is in full operation. Cost accumulation for an operative area may also roll over to forthcoming phases, partly due to the length of different operative areas, such as DDLS Fellows (5 years) and PhD project positions (4 years), *Figure* 42.

Table 2. KAW donation allocation over 5 phases of the program

Phase	Funding period	Grant (KSEK)
Phase 1	2021 jan–2024 mar	580,000
Phase 2	2024 apr–2026 mar	740,000
Phase 3	2026 apr–2028 mar	670,000
Phase 4	2028 apr–2030 mar	560,000
Phase 5	2030 apr–2032 dec	550,000
Total	*2021 jan–2032 dec*	*3,100,000*

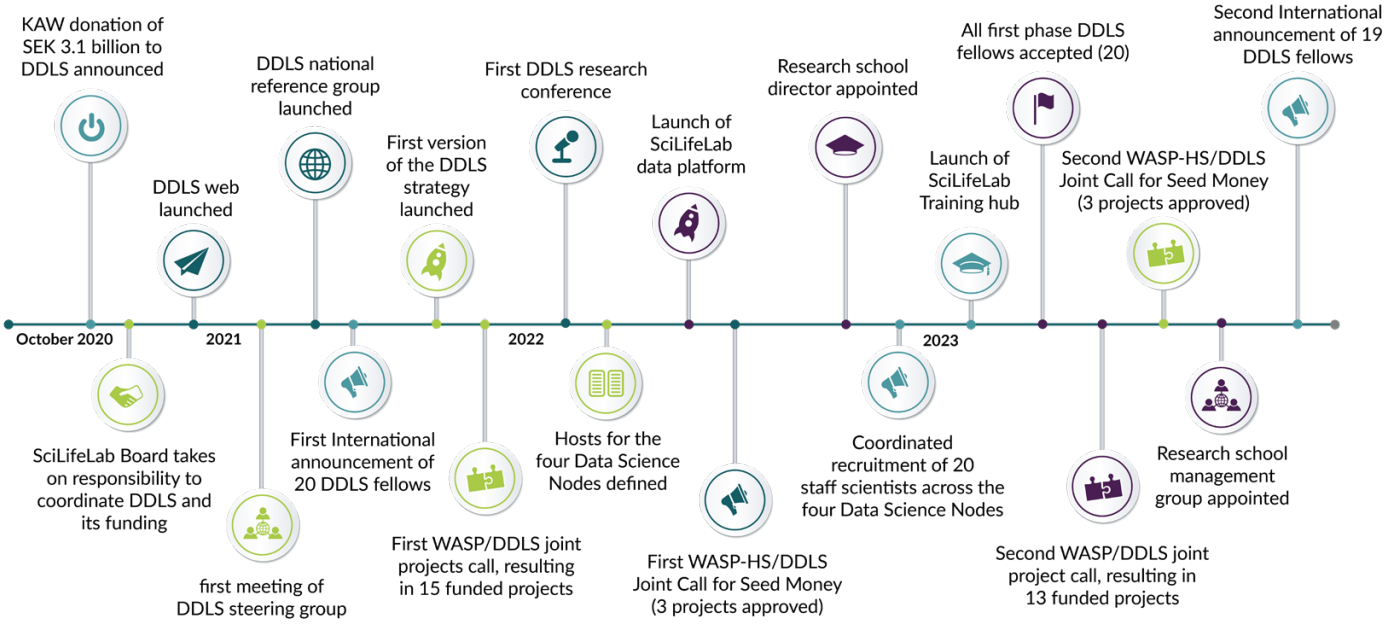


Figure 40. Timeline with milestones reached during Oct 2020–Aug 2023

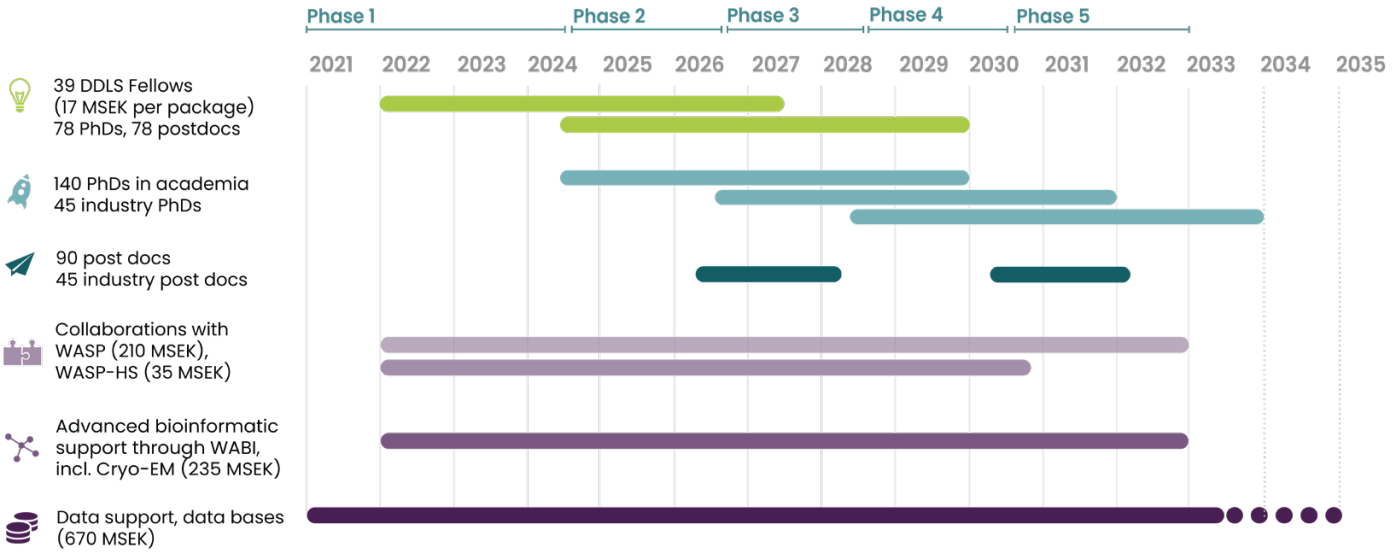


Figure 41. The overall 12-year plan for the DDLS program. Specifies active time period per operative area based on the overall plan provided in the KAW donation letter, and adjusted according to detailed plans set by the program management for the first funding phase (2021–2023). Listed items the 3.1 BSEK is expected to cover. Dotted line indicates depreciation time of assets. Wallenberg AI, Autonomous Systems and Software Program (WASP) and Wallenberg AI, Autonomous Systems and Software Program – Humanities and Society (WASP-HS), Wallenberg advanced bioinformatics infrastructure (WABI).

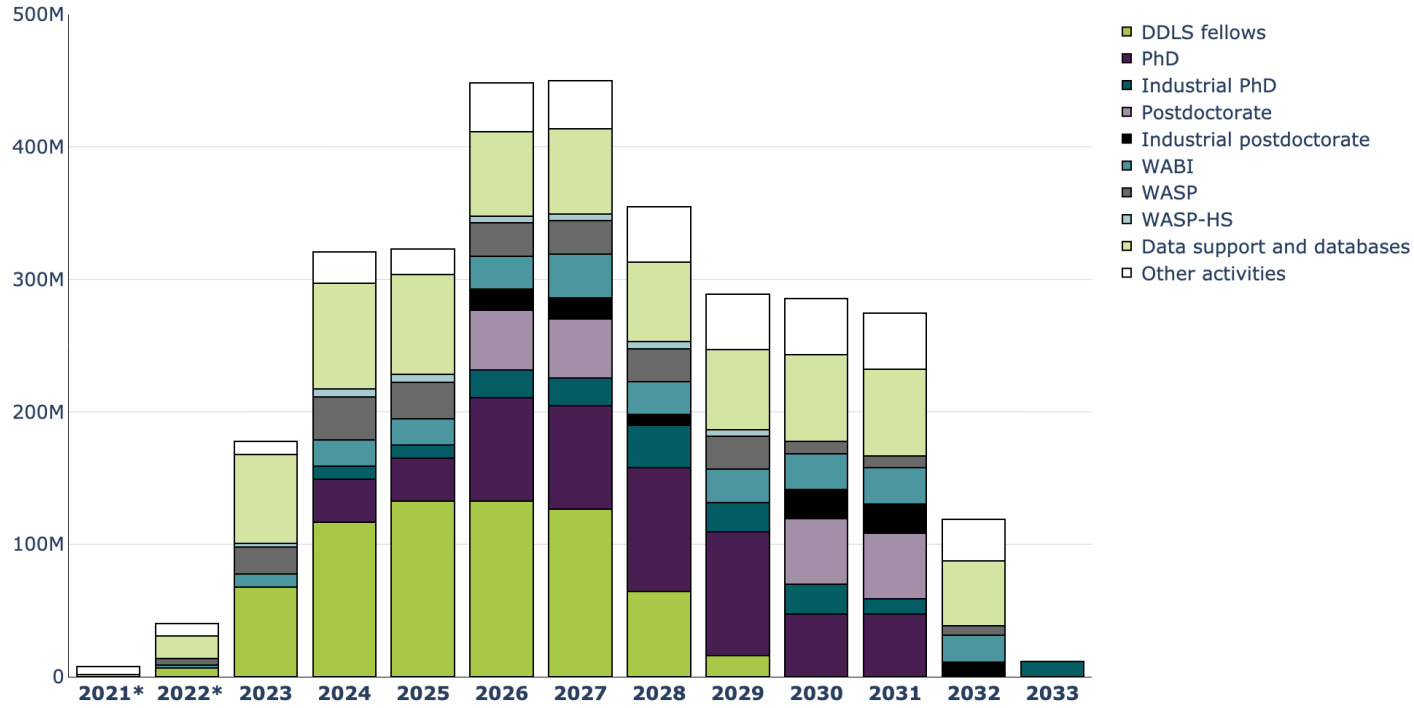


Figure 42. Distribution of actual and estimated costs per operative area per year (MSEK). The funding for each operational area, outlined in the donation letter, is allocated based on the annual detailed plans established by the program management for the period 2023–2033. The asterisk (*) denotes the years 2021–2022, during which actual costs were aligned with KAW funding conditions for ongoing activities. *Note: i) DDLS Fellow packages includes costs for PhD and postdocs (typically 2 + 2 per fellow) and running costs, ii) Other activities include program coordination and management, networking initiatives, a research school, a training hub, and unplanned activities that, while not specifically categorized in the donation letter, fall within the program's budgetary framework.*

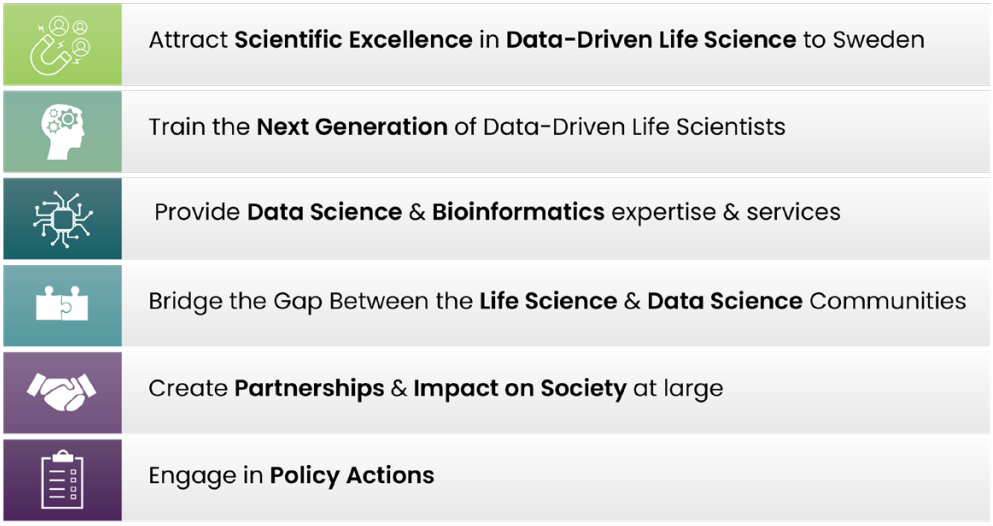


Figure 43. The six DDLS strategic objectives, as defined in the second version of the DDLS strategy published in March 2023, see *Appendix L*

9.2 Developments 2022–2023

Directions and what DDLS wants to achieve in the coming years are realized through six strategic objectives, *Figure* 43, and the four strategic areas for data-driven research, *Figure* 44. As described in the second version of the DDLS strategy released in March 2023, see *Appendix L. The future of life science is data-driven – Strategy for The SciLifeLab & Wallenberg National Program for Data-Driven Life Science (DDLS) v2.*

9.2.1 Attract Scientific Excellence in Data-Driven Life Science to Sweden

The foundation of the program is the recruitment of 39 research group leaders, DDLS fellows, to eleven partner organizations. Each DDLS fellow receives a five-year 17 MSEK career package to support their own salary, PhD students and postdoctoral fellows (typically 2+2 per fellow).

The DDLS fellows are recruited in two rounds through simultaneously announced positions; internationally in Science careers, and nationally at partners' local networks and on the SciLifeLab website. During the first phase (2021–2023) the first round was completed and 20 young researchers were recruited, see *Figure* 45 and *Table* 3. More than 700 applications were received and the recruited researchers were selected in a broad international competition with a multitude of research backgrounds and geographical distribution. Fellows are currently starting up their research groups and activities they need for community building and network activities are in focus, both within the DDLS fellow group and in joint fellows' networks such as the Program for Academic Leaders (PALS), see *Section* 10.2.4.

The second recruitment round where an additional 19 DDLS fellows will be recruited has been initiated. All positions were announced before the summer of 2023, and the evaluation process was initiated during autumn. The first DDLS fellows recruited in the second phase are planned to start in April 2024.

Further, activities within each research area are planned, coordinated and governed through four research area-specific expert groups, which also serve as national scientific advisors for the program addressing area-specific research questions. DDLS fellows, PhD students

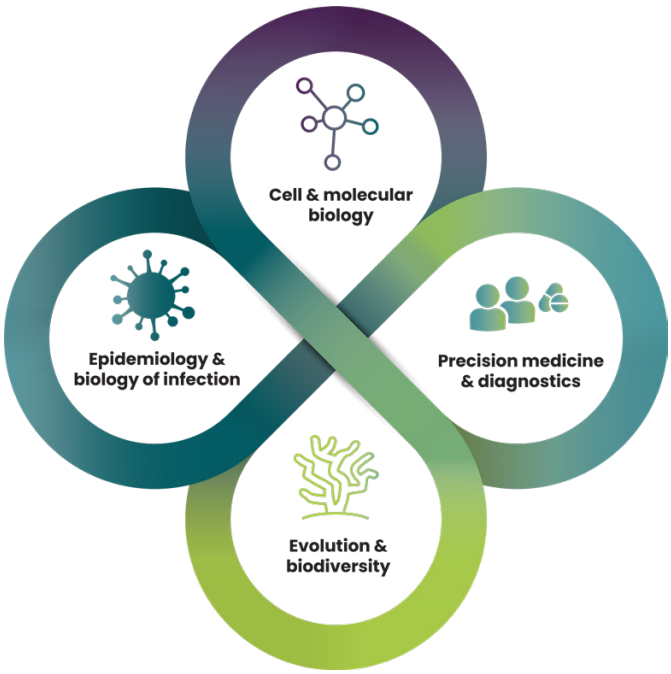


Figure 44. The four strategic research areas within the DDLS program

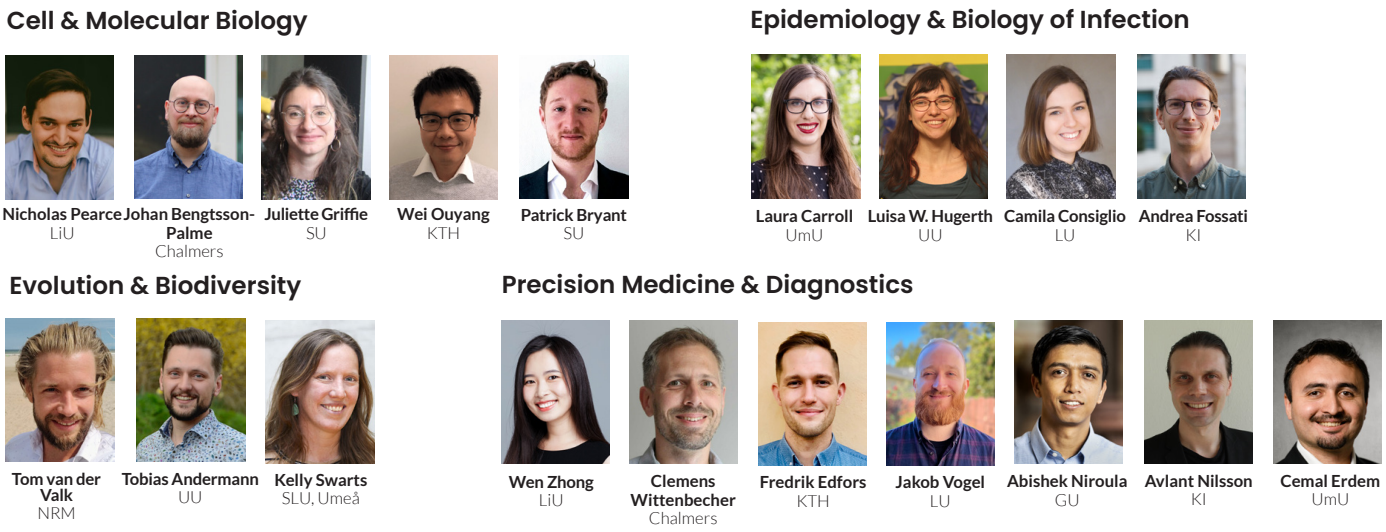


Figure 45. First round of DDLS Fellows recruited to their respective DDLS research area and partner organization

Table 3. DDLS fellows' research focus within their respective DDLS research area

Fellows recruited 2022–2023	Scientific field/DDLS research area	Affiliation
Clemens Wittenbecher	Biomarker-driven precision nutrition approaches for cardiometabolic disease prevention	Chalmers
Johan Bengsson-Palme	Creation of an interactive map predicting the presence of antibiotic resistance in the environment globally	Chalmers
Abhishek Niroula	Markers for early diagnosis of blood cancer through analysis of genomic data from large biobanks and generation of multi-omics data	GU
Andrea Fossati	Discover of bacterial defense systems, understand their composition and viral triggers as well as identifying phage mechanisms to evade them.	KI
Avlant Nilsson	Macrophage ligand combinatorics with model validation and analysis	KI
Fredrik Edfors	Blood-based protein profiling and data-driven integration of comprehensive data resources to develop improved prediction models.	KTH
Wei Ouyang	Building of Data-Driven AI-powered Human Cell Simulator, generative AI for Cell Biology	KTH
Nicholas Pearce	New ways of analyzing and presenting macromolecular structural data developing novel multi-dataset approaches for modelling structural data	LiU
Wen Zhong	Development of AI models for risk stratification and disease management platforms to improve the standard-of-care in the prevention and management of human diseases.	LiU
Camila Consiglio	Deciphering sex differences in human immunity using systems immunology	LU
Jakob Vogel	Data-driven statistical learning approaches to human neuroimaging and multi-omic data to understand the genesis and progression of neurodegenerative diseases	LU
Tom van der Valk	Environmental DNA in the genomic decade, developing k-mer based DNA classification tools	NRM
Kelly Swarts	Quantitative, computational and population genetic approaches to understand the biological basis of climate adaptation in conifers.	SLU
Juliette Griffie	Development of computational tools to extract useful information from super resolution microscopy images.	SU
Patrick Bryant	Structure prediction of alternative protein conformations with multiple sequence alignment and AI	SU
Cemal Erdem	Integrate multi-omics datasets, machine learning, and large-scale mechanistic models to build clinically predictive computational models	UmU
Laura Carroll	How the interplay between humans, animals, and the environment contribute to the spread of bacterial pathogens	UmU
Luisa W. Hugerth	Analyses of the human microbiome as a modifiable risk factor	UU
Tobias Andermann	Measuring biodiversity with genomic methods and predictive AI biodiversity models	UU

and postdoctoral fellows to be recruited to the program will belong to one of these four areas. In addition, data services and advanced bioinformatics support will also be constructed to meet the area-specific needs within the field of data-driven life science and will be available for Swedish researchers in general. During the first phase, the focus has been on establishing the components of the program including directions of the four specific research areas for DDLS and developing the research networks, through arranging research area specific symposia (four symposia organized by June 2023).

9.2.2 Train the Next Generation of Data-Driven Life Scientists

The DDLS program aims to train and foster the next generation of life scientists in technology- and data-driven life sciences. SciLifeLab, as a quickly evolving national research infrastructure, possesses state-of-the-art knowledge and is in a unique position to facilitate lifelong learning. Providing advanced and state-of-the-art training complements the formal education provided by the universities and is necessary in order to produce excellent research. Therefore, to plan and organize education and training on a national level for the Swedish life science community to be upskilled in the data-driven topics has been one key focus area. It has included planning and organization of the DDLS Research School (RS) to be started in 2024, and launch of the SciLifeLab Training Hub, aiming to enhance the technology and data-driven skills on a national level. Benchmarking against national and international research schools has been vital to understand the context in which the DDLS RS will be operating and for getting insights into management of research schools, as well as identifying the best model to attract and recruit the best talent to Sweden. Also dialogues with all 11 partner organizations and interested industrial partners have been held. The RS will, together with the SciLifeLab Training Hub ensure that the doctoral students and postdocs in the RS will be well equipped with key knowledge, skills and people connections for the future. The RS will have an annual intake and in total 40 academic and 15 industrial PhD students will be recruited in phase two, where 20 academic and 7 industrial PhD students will be recruited during 2024 and additional 20 academic and 8 industrial students during 2025.

In addition, the DDLS program and SciLifeLab aim to enhance the technological and data-driven skills of the wider life science community in lifelong learning. The SciLifeLab Training Hub has been launched to support the professional growth of individuals at all career stages, including PhD students, researchers, established PIs, professors, staff scientists, technology experts, and data stewards, see *Section* 12.3.

9.2.3 Provide Data Science and Bioinformatics Expertise and Services

Of the DDLS funding SEK 670 million is earmarked for providing data support and databases, ensuring data-driven life science research in Sweden is conducted at the highest international scientific- and technical level. The SciLifeLab Data Centre is responsible for establishing and operating a national data platform in collaboration with the partner organizations. The platform[21] was launched in 2022 and provides a technical environment for data-driven research, with resources for compute and storage, software development, data management and analysis tools. It also provides hosting and data infrastructure for data services, scientific software, as well as access to databases and web services and computational applications developed by Swedish researchers. The platform supports FAIR data sharing (emphasizing on searchability, accessibility, interoperability, and reusability of research data), and connects both the SciLifeLab infrastructure and research with DDLS, as well as with other large e-infrastructures both in Sweden and internationally. This model of integrating research data services with robust IT operations while still prioritizing scientific excellence has received international recognition. Available services from the Data Centre, including those developed and operated through the DDLS program are listed in *Table* 8 in *Section* 12.2.

The model of integrating research data services with robust IT operations while prioritizing scientific excellence has received international recognition, see further in *Section* 12.2.

Bioinformatics support, including Cryo-EM data, within the program strives to enable excellent and data-driven life science by ensuring that peer-reviewed research projects have access to advanced bioinformatics and data science competence, and by providing knowledge transfer and cutting-edge community training. The bioinformatics support strongly promotes and applies reproducible research, open science and FAIR data handling, and is an expansion of the previously successful and internationally unique initiative Wallenberg Advanced Bioinformatics Infrastructure (WABI), and operates as an integrated part of SciLifeLab's bioinformatics platform (NBIS). In 2022 the national bioinformatics support at SciLifeLab went through a major reorganization to ensure effective services are well aligned with the DDLS program, and the SciLifeLab technology platforms, to best provide both technology-driven and data-driven research projects with the best advanced bioinformatic analyses.

Based on open expressions of interest and an international review, the SciLifeLab Board has decided to establish four Data Science Nodes (DSNs), a national network for developing data services and conducting bioinformatics support, hosted by the following main partner organizations:

[21] data.scilifelab.se (web interface to the technical platform)

- Uppsala University, Evolution and Biodiversity (in collaboration with the Swedish Museum of Natural History)
- Umeå University, Epidemiology and Biology of Infection
- Chalmers University of Technology, Cell and Molecular Biology (in collaboration with the University of Gothenburg)
- Karolinska Institutet, Precision Medicine and Diagnostics

The establishment of the DSNs is under way and co-localizes resources and expertise from the SciLifeLab Data Centre and NBIS at the nodes' four host organizations, creating unique synergies and a critical mass for the four strategic areas of DDLS. Through these DSNs, the partner organizations are involved in the work on bioinformatics, data services, e-infrastructure, and FAIR, and connect central functions at SciLifeLab closer to the research environments at the universities. The establishment of DSNs, together with the development of the new research groups within DDLS, will be a prerequisite for accelerating the paradigm shift underway in data-driven life sciences in Sweden.

9.2.4 Bridge the Gap between the Life Science and Data Science Communities

DDLS has earmarked funding for collaborating with another major KAW funded initiative, Wallenberg AI, Autonomous Systems and Software Program (WASP) which has powerful research methodologies focusing on e.g., mathematics, machine learning, or autonomous systems and software. Connecting these two programs enables life scientists to link up with the pre-eminent data scientists, and provides access to world leading AI-optimized high-performance computing capabilities, thus providing a majorly attractive dimension for the DDLS program. Additionally, the WASP community is introduced to life science challenges.

During the first phase, DDLS and WASP has had two joint calls for collaborative research projects, where a researcher from one of the four DDLS research areas paired up with one from the WASP areas and applied for a joint project (28 such projects have been funded, find a list of projects in *Appendix I. DDLS achievements, status June 2023*). These project PIs form the basis of the new joint research community and researchers from the first call in 2021 met at a kick-off event in the fall of 2022. In addition, a call for research visits aiming to establish new, or deepening already existing, collaborations between WASP and DDLS areas has also been launched, with two approved applications.

As AI is becoming increasingly important, and applications is a common denominator of both programs, this is a field where continued joint efforts will be of high importance and beneficial for life scientists as well as future research infrastructure.

9.2.5 Create Partnerships and Impact on Society at Large

Since the DDLS program was launched, major industries in Sweden, including small and medium-sized enterprises, healthcare, trade associations and other stakeholders, have shown an interest in the program. Collaborating with academic researchers in the DDLS research areas is valued as such collaborations can lead to new research results and innovations within healthcare and the Swedish life sciences in general. ERO at SciLifeLab operations office has met with several organizations and collected feedback and suggestions on different ways to engage and collaborate within the program, e.g., AstraZeneca, SwedenBIO and Business Sweden.

In November 2022, companies with activities related to data-driven life science were invited to a digital stakeholders' dialogue to discuss the role of the industry in both the DDLS RS and the DDLS program as a whole in a digital stakeholders' dialogue, see *Table 4*. For the future directions, a dialogue with the industry will continue, and the DDLS RS will have a close connection with industry through the industrial PhD students and postdoc projects. One of the DDLS RS's goals is to facilitate the exchange of knowledge between academia and industry.

DDLS facilitates access to international training programs for the Swedish research community which can lead to promoting global connections and opportunities. Robust international networking is the foundation of the success of DDLS. Collaborative programs with global leading institutions that specialize in data-driven research are being established. Notable examples include EU programs (for instance, through several funded projects in the European Health Data Space) and Nordic collaborations. Using already existing collaborations with organizations such as EMBL, we are committed to developing and promoting international standards and practices in data management. In addition, DDLS is actively involved in engaging with other national communities in diverse research areas such as biodiversity, environment, agriculture and forestry.

Table 4. List of participants from industry and academia at the DDLS Industry PhD Collaboration event in November 2022

ANYO Labs	Lif	Pixelgen Technologies AB
AstraZeneca	Navari Surgical AB	Stratipath AB
Chiesi	Navinci Diagnostics AB	SwedenBIO
Fluicell	Novartis	Symcel AB
IQVIA Inc.	Organisation PHI	Testa Center - Cytiva
Chalmers University of Technology	Karolinska Institutet	Stockholm University
Department of Experimental Medical Science	KTH	Swedish Museum of Natural History
EECS, KTHELIXIR	Linköping University	Umeå University
Gothenburg University	Luleå University of Technology	Uppsala University
	SciLifeLab	

9.2.6 Engage in Policy Actions

Effective and responsible data-driven research requires clear policies and attention to ethical, legal and social implications/aspects (ELSI) of research. DDLS engages in these matters as issues arise, often in collaboration with other stakeholders. These issues may involve access to healthcare data, secondary use of healthcare data, privacy issues, the challenges and ethical issues in using AI etc. On many occasions, practical implementation of data-driven research is dependent on solving such society issues and will require new policies and legislations. To assist SciLifeLab and DDLS with this, an ELSI advisor was appointed to identify operational areas and to propose an action plan for issues that may become obstacles in the transition to a digital, data-driven future in life science research.

In addition to the central work of mapping stakeholders and identifying the main ELSI aspects and issues covered by stakeholders' work, the mission has also included advice on more specific ethical issues, organizational ethics, as well as ELSI education and capacity building.

The Wallenberg Foundations have a long-term commitment, which aims to stimulate collaborative research and to bridge the gap between the data-driven life sciences, the social sciences, and the humanities. This true interdisciplinary effort, driven by the DDLS and WASP-HS (Wallenberg AI, Autonomous Systems and Software Program – Humanities and Society) programs, aim to create new scientific communities. This collaboration primarily focuses on the four DDLS research areas, as well as AI and autonomous systems, data, and the ethical, legal, social, economic, cultural, and policy aspects related to their applications. During the first phase, DDLS and WASP-HS has had two joint calls for collaborative projects, where a researcher from DDLS paired up with one from the WASP-HS and applied for seed-money (six such projects have been funded, find a list of projects in *Appendix I*). A joint working group is currently creating a plan for the next phase to present to the SciLifeLab board, which might include collaboration with the research schools, community building, research ecology, funding, larger grants, expert panel, internationalization, and collaboration with other KAW programs. WASP-HS will additionally seek funding from KAW for this collaboration, which today is financed only via the DDLS funds.

9.3 Future Plans and Strategies

The world is right now in the middle of an AI revolution, and this applies to life science as well. The applications, methods, regulatory frameworks and dynamic effects in neighboring fields are developing so extremely rapidly that it is difficult to predict the state of the field, or the necessary actions, even one or two years ahead highlighting the importance of DDLS and all its own and collaborative efforts. In this context, it is even more important for DDLS to be flexible in order to develop a culture and toolkit for quick changes and adaptations rather than create specific and rigid long-term plans. We plan to achieve this in various ways, as will be described in the application for Phase 2 of the program to KAW, due November 17, 2023.

In summary, the DDLS program aims to continue on activities started during the first phase of the program such as facilitating formation of a data-driven life science community through the internationally recruited DDLS fellows, and via research area activities and events that enable active national collaborative communities to reach international level of scientific excellence. By continuing the DDLS collaborations with other Wallenberg funded initiatives (i.e., WCMM, WASP and WASP- HS) encouraging research activities between fields and across universities. Through forming synergistic national networks, we expect to see collaborations within each DDLS research area, including data support and computational capabilities, but also cross-disciplinary collaborations across the four research areas. In this way, ground-breaking research can develop bottom-up from within the data-driven life science community. In addition, a next phase of funding will allow expanding the program further by recruitment of PhD students in academia and industry and the start of a new DDLS RS.

Many recommendations by DAC are already in our plans for Phase 2 and beyond, however some new ideas emerging from their recommendations are starting to form. DAC highlighted the importance of providing up to date training and education for both senior and junior researchers to keep up and empower the community in this quickly evolving field. This is well aligned with the launch of the SciLifeLab Training Hub and DDLS RS which will include both PhD students and postdocs. We have also launched a joint call for fellows within the PALS network to promote interactions between different fellow networks. Collaborating closely with WASP presents the opportunity for new strategic initiatives to be in the forefront of AI development. For example, addressing societal grand challenges through strategic projects where leading scientists from life sciences, computational and data sciences, and research infrastructure join forces to address these challenges collaboratively through funded projects, will allow for ground breaking discoveries, methodologies and applications for the benefit of society at large.

9.4 Challenges and Questions to the IAB

Recommendations from DAC have been analyzed and a response from the DDLS management is included in this report, see *Appendix K. Response to the comments from the DDLS advisory committee.*

IAB could build their suggestions based on our responses to the DDLS advisory comment report. In addition, we would like advice on:

- Synergies with the SciLifeLab infrastructure
- How to best synergies with SciLifeLab training and other training initiatives
- How to best build a community and critical mass around the program
- How to get engagement bottom-up
- How to stay at the cutting edge of AI technology revolution
- Are there any gaps that the IAB can identify that will enable the DDLS program to reach even higher and broader?

Photo: Mattias Pettersson

10. Research Community

10.1 Introduction

Maintaining a strong reciprocal connection between SciLifeLab´s three pillars; infrastructure, research and data is essential to ensure long-term success of SciLifeLab, where all feeds into the other, e.g., the SciLifeLab infrastructure serves researchers, and the infrastructure is developed in collaboration with the research community. Thus, SciLifeLab puts major emphasis on supporting and promoting its research community, encompassing SciLifeLab and DDLS fellows, SciLifeLab group leaders, users of infrastructure ("SciLifeLab infrastructure enabled community"), the wider national research community at all SciLifeLab sites, to enable life science research in Sweden that is beyond what is possible for an individual researcher, an individual university or an individual research discipline.

Key are e.g.,

- Recruitment of SciLifeLab and DDLS fellows (see section below, and *Section* 9).
- Distinct funding to make the interaction between infrastructure, research and data even closer (e.g., through Research Community Programs, the national SciLifeLab & KAW COVID-19 program, infrastructure Technology Development Projects, Campus Solna RED grants, Uppsala's senior scientists start-up packages to enhance research ties with the SciLifeLab infrastructures, DDLS calls etc.).
- An extensive offer of scientific networking and training events, organized centrally, or self-organized by entities within SciLifeLab with support from the Operations office and Sites (e.g., The Svedberg seminar series, Clinical talks, Campus Solna seminar series, Science Summit, Prize, SciLifeLab Site Days), all offered free of charge to the community and widely announced at scilifelab.se, and other channels

SciLifeLab particularly supports and promotes its junior researchers, e.g., through PhD council's activities, seminar series with focus on junior researchers, special opportunities for training and career development and Prize week activities, and of course various opportunities to interact with experts from SciLifeLab's infrastructure, to learn about its technology and service offers. Through bottom-up initiatives and development of a SciLifeLab Code of Conduct [22], SciLifeLab aims to propagate diversity-equity-inclusion and ELSI aspects in science.

10.2 Developments 2022–2023

Key events for the research community in 2022–2023 have been:

- Nomination of SciLifeLab Group Leaders at all SciLifeLab's sites, see *Figure* 46 and *Table* 5.
- Continuous recruitment of SciLifeLab Fellows through founding universities' SFO funding, see *Sections* 7.5 and 7.6, and several fellows have completed the program and are now successfully continuing their scientific journey as senior academic group leaders.
- Directed efforts through which SciLifeLab extends into, and promotes, the wider national research community including: i) the DDLS program, ii) Capabilities in Precision Medicine, Pandemic Laboratory Preparedness and Planetary Biology, iii) the national Program for Academic Leaders (PALS), following the successful NMMP program and co-funded by KAW.
- An active fruitful collaboration with EMBL, with two major events with focus on Planetary Biology and Data Science, and exchange of infrastructure and research talent (see *Section* 12.4).
- Impactful Scientific Output resulting from infrastructure-supported research and SciLifeLab associated researchers, see *Sections* 11.2 and 11.3.
- Various well-received scientific events, e.g., SciLifeLab Group Leader retreat in 2022, Science summit in 2023 on Genomics of Biodiversity and Evolution and exciting 'bottom-up initiatives' such as in 2023 the Scientific research through an artist's lens program, connecting art and science communities in Stockholm through artists at the Royal Institute of Art (KKH) and scientists at SciLifeLab Campus Solna.
- Launch of SciLifeLab Code of Conduct.
- An advanced ERC grant awarded to a SciLifeLab fellow, a community that now in total has been awarded 18 ERC grants (10 Starting, 5 Consolidator, 2 Proof of Concept, 1 Advanced).

[22] scilifelab.se/code-of-conduct/

Figure 46. Affiliations of SciLifeLab Group Leaders.

SciLifeLab Site	Host university	Number of SciLifeLab Group leaders
Stockholm	KI	45
	SU	32
	KTH	51
	NRM	1
Uppsala	UU	110
	SLU	1
Gothenburg	GU	21
	Chalmers	8
Lund	LU	11
Linköping	LiU	9
Umeå	UmU	18
	SLU	1
	ÖrU	*1*
Total		**309**

Table 5. Distribution of SciLifeLab Group Leaders, October 2023

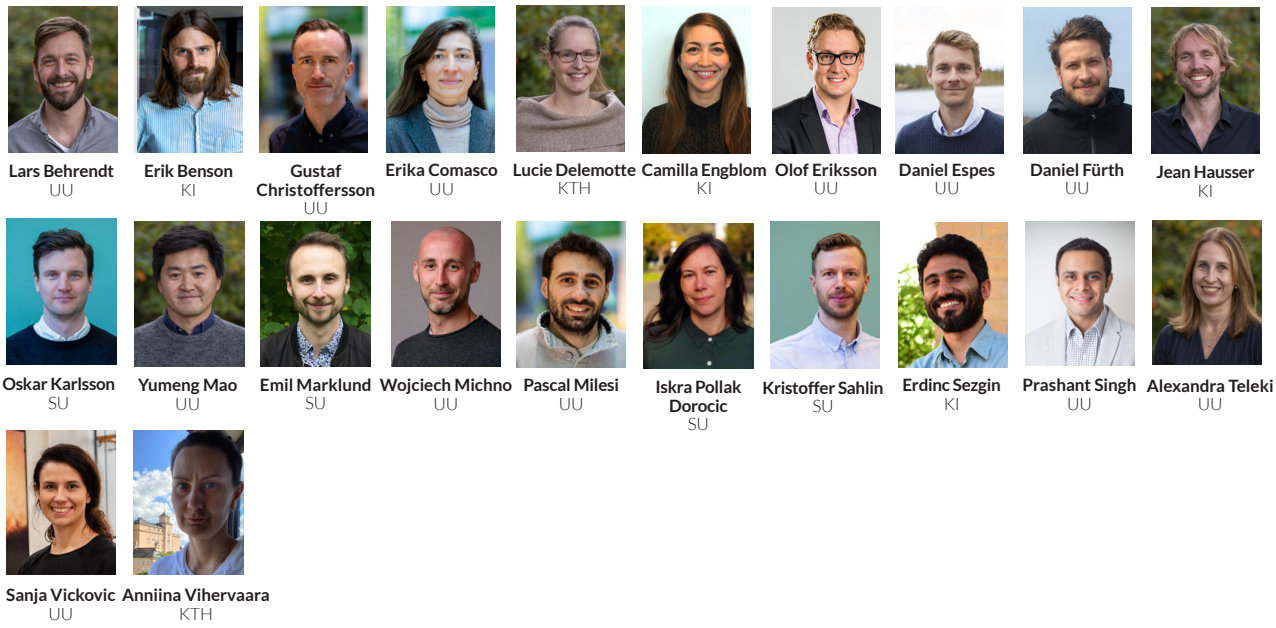
10.2.1 SciLifeLab Fellows Program

The SciLifeLab Fellows program is a career program aiming at strengthening Swedish research in molecular biosciences, on a long-term perspective leading to societal impact for Sweden. The host universities KI, KTH, SU and UU provide an advantageous economic starting package and together with SciLifeLab a strong interdisciplinary research environment in close proximity to a cutting-edge research infrastructure. The recruitment of excellent researchers in international competition provides an influx of new and fresh knowledge and ideas to drive the development of the SciLifeLab research environment, see all fellows in *Figure* 47 and new recruitments 2022–2023 in *Table* 6, and the success of the program is clear with 16 fellows having been promoted to senior academic positions at their host universities, and the impressive amount of external grants awarded totally to the fellow group (>1.2 BSEK 2014-2022, incl. 18 ERC grants).

To maintain the SciLifeLab Fellows program as highly attractive for young researchers internationally, ensuring continuous recruitment of excellent junior researchers in molecular life science to Sweden is high priority, and so is ensuring that these researchers develop into scientific leaders that are well-established and integrated in the Swedish research community. SciLifeLab thus supports fellows' career development, where the introduction and integration are key (introduction meeting in conjunction and ideally prior to starting date, follow-up meetings 1-2 years into the program, and 15 months prior to the planned end date of the program). This dialogue is done with the respective SciLifeLab scientific director and CS Director, departmental head or other senior group leaders/faculty working closely with the fellow, to assure that fellow's research and career development is progressing according to plan, or if any changes need to be done. For upskilling in life-long learning, leadership training opportunities are offered regularly to fellows together with group leaders from the infrastructure, that in effect also offers a great opportunity for networking and establishing new connections between the research and infrastructure partners.

SciLifeLab is actively working to connect the SciLifeLab Fellows program with the SciLifeLab & Wallenberg National Program for Data-Driven Life Science (DDLS) to create maximum synergies, and more networking opportunities was also requested in the SciLifeLab fellow program survey (from 2021). In line with this, several networking activities have indeed been offered: annual fellows retreats (from 2023 also including DDLS fellows), annual NMMP (changing name to PALS from 2024, see below) networking meeting for SciLifeLab, DDLS and WCMM fellows as well as representatives from SciLifeLab's infrastructure, complemented by local and self-organized activities within the fellow's own research. PALS will offer funding opportunities for also self-organized networking activities/exchange within the community, and as for all members of SciLifeLab's community, fellows can apply for funding of events through the national SciLifeLab event call.

Active Fellows



Lars Behrendt UU
Erik Benson KI
Gustaf Christoffersson UU
Erika Comasco UU
Lucie Delemotte KTH
Camilla Engblom KI
Olof Eriksson UU
Daniel Espes UU
Daniel Fürth UU
Jean Hausser KI
Oskar Karlsson SU
Yumeng Mao UU
Emil Marklund SU
Wojciech Michno UU
Pascal Milesi UU
Iskra Pollak Dorocic SU
Kristoffer Sahlin SU
Erdinc Sezgin KI
Prashant Singh UU
Alexandra Teleki UU
Sanja Vickovic UU
Anniina Vihervaara KTH

Fellows Alumni

Alexey Amunts SU
Jonas Barandun UmU
Magda Bienko KI
Fabien Burki UU
Jens Carlsson UU
Sebastian Deindl UU
Simon Elsässer KI
Marc Friedländer SU
Sarahi Garcia SU
Daniel Globisch UU
Paul Hudson KTH
Kristina Jonas SU
Claudia Kutter KI
Adil Mardinoglu KTH
Vicent Pelechano KI
Sari Peura SLU
Mikael Sellin UU
Saeed Shoaie KTH
Tanja Slotte SU
Ilaria Testa KTH
Aleksej Zelezniak Chalmers

Previous affiliations e.g.

- Harvard University
- Stanford University
- ETH Zürich
- MIT
- EMBL Heidelberg
- Max Planck Institute for Biophysical Chemistry
- Francis Crick Institute
- University of Oxford
- University of Cambridge
- Astra Zeneca
- Antaros Medical

Figure 45. SciLifeLab fellows active in the program and fellow alumni. The program was started in 2014 and has since then, and so far, resulted in recruitment of 44 fellows.

Table 6. New SciLifeLab fellow recruitments 2022–2023

Fellows recruited 2022–2023	Scientific field/focus	Affiliation
Sanja Vickovic	High-throughput spatial multi-omics as "digital pathology" tools	UU
Wojciech Michno	Metabolic contribution to single cell phenotypes in neurodevelopment and neurodegeneration	UU
Erik Benson	Combination of DNA nanotechnology, selection and high throughput sequencing to solve biomedical problems	KI
Camilla Engblom	Cancer immunology with focus on B and T cell receptor mapping	KI
Reid Alderson	Structural biology of protein homeostasis and degradation	UU
Emil Marklund	Structure, function and interaction of biological macromolecules	SU

10.2.2 SciLifeLab Group Leaders

In response to IAB's recommendation to "*set up a system for obtaining and renewing the status of SciLifeLab group leader and building in an external evaluation by default*", to ensure excellence, and also a transparent, quality-ensured process, SciLifeLab's leadership have looked over the Group Leader criteria and process in 2023. The Group leader concept aims to strengthen infrastructure technology development, empower the community, and increase SciLifeLab presence nationally. It is key to more clearly define group leaders benefits (to attract the best), responsibilities and criteria, where the motivation to become a group leaders must be anchored in clear, objective key contributions to SciLifeLab's strategic objectives within infrastructure, research, capabilities, translation & innovation, data/DDLS, and training/community. A new process is being discussed, see *Appendix M. SciLifeLab national Group leader definition, criteria and process*, where i) all group leaders reapply (nomination open 2 times per year, re-evaluation every 4 years), ii) nominations are evaluated individually, iii) approved nominations are published. Preliminary, the process will be carried out in the spring, 2024.

10.2.3 Major SciLifeLab Scientific Events 2022–2023

- Annual event call: SciLifeLab aims to support events within the scope of our fields of research, and the call is open to participants from all over Sweden. We aim to encourage collaboration among and between SciLifeLab infrastructure and researchers, as well as with external organizations, and increase awareness of SciLifeLab to the broader research community in Sweden and abroad.
- Science Summit 2023: Genomics of Biodiversity and Evolution. Event concept with the aim to highlight SciLifeLab´s research areas and researchers, as well as highlight and promote collaborations and interactions between different research fields and technologies.
- Publishing workshops for junior researchers with Science editors (successful event organized annually 2021–2023).
- Leadership courses for group leaders, with special focus on SciLifeLab and DDLS fellows and Heads of unit (organized annually 2021–2023).
- Group Leader two-day retreat 2022, with aim to spur new collaborations leading to exciting scientific progress.
- Annual Celebration for the winners of *Science* & SciLifeLab Prize for Young Scientists. The *Science* & SciLifeLab Prize for Young Scientists was established in 2013. This global prize is aimed at rewarding scientists at an early stage of their careers, to recognize excellence amongst young researchers from around the world. The four winners are invited to Sweden and SciLifeLab for a full week 'celebration of science' program in December each year.
- Various seminar series, national and local level, e.g., The Svedberg, Clinical talks, and Campus Solna seminar series with focus on junior researchers.
- Campus Solna Science talks
- NMMP/PALS annual meetings

10.2.4 Program for Academic Leaders in Life Science (PALS)

Following the recommendation from the IAB in 2021 to "*Integrate the different fellows into a Swedish young investigator program with international recruitment based on excellence and competitive mid-career support*", the KAW-funded network program Program for Academic leaders in Life Science, PALS, has been established (20 MSEK, 2024–2028)[23]. PALS is a collaboration between SciLifeLab, the DDLS program and the four WCMM Molecular Medicine Centers at Umeå, Linköping, Lund and Gothenburg, and follows the success and track record of the previous WCMM and SciLifeLab collaboration NMMP (National Molecular Medicine Fellows Program). With PALS, the scope of the collaboration is expanded from molecular medicine to also include the diverse areas of life science that the SciLifeLab and DDLS communities represent, including 10 universities and the Museum of Natural History, and more than 150 fellows. The PALS will be an opportunity for experimental and computational scientists to meet in order to establish multi-disciplinary collaborations with each other. It will enable these future leaders of Swedish life science to establish strong national networks that could last for years to come and that will broadly enrich opportunities for excellence in life science.

The PALS has the following main objectives/activities to further strengthen the research network and to foster the next generation of young research group leaders:

- Annual meetings that will feature joint general sessions of interest to all fellows, but also specific parallel sessions tailored to the diverse interest areas of specific fellow communities
- Promote additional scientific interactions between the fellows to initiate new, innovative, and cross-disciplinary research collaborations and technology/knowledge/data transfer in the context of e.g., joint

[23] palsnetwork.se

research projects or training/workshop events, organized jointly by the fellows with seed funding from the program.

- Promote collaborations between curiosity-driven researchers, technology-driven and data-driven researchers, as well as translational and clinical scientists.
- Help new fellows with information about SciLifeLab and other Swedish research infrastructures, computational infrastructures and data, also promoted through specific funding for such initiatives.

10.3 Future Plans and Strategies

The SciLifeLab and DDLS programs are among the most important SciLifeLab investments (enabled through host university SFO and the DDLS program) for the future of molecular, data-driven life science in Sweden, and as such will continue to be a main focus for SciLifeLab research community activities. Now, with the fourth generation SciLifeLab fellows starting the program, the many Fellow alumni are a highly valuable 'resource', and will be connected with both new SciLifeLab and DDLS fellows as mentors. The ambition is to keep fellow alumni associated with the 'active' fellows in the program, both through internal networking activities and PALS as mentors.

10.3.1 Postdoc Program PULSE

In 2022, a SciLifeLab working group was formed to establish a SciLifeLab postdoc training program, Program for future leaders in life science, SciLifeLab PULSE, see *Figure* 48. An application for funding through the Marie Skłodowska-Curie Actions MSCA-COFUND was submitted in February 2023, which received high marks (89.2%) but was not granted funding in the high competition. SciLifeLab intends to submit a revised proposal in the next 2024 call, possibly with a new name of the program to more clearly describe its vision and content.

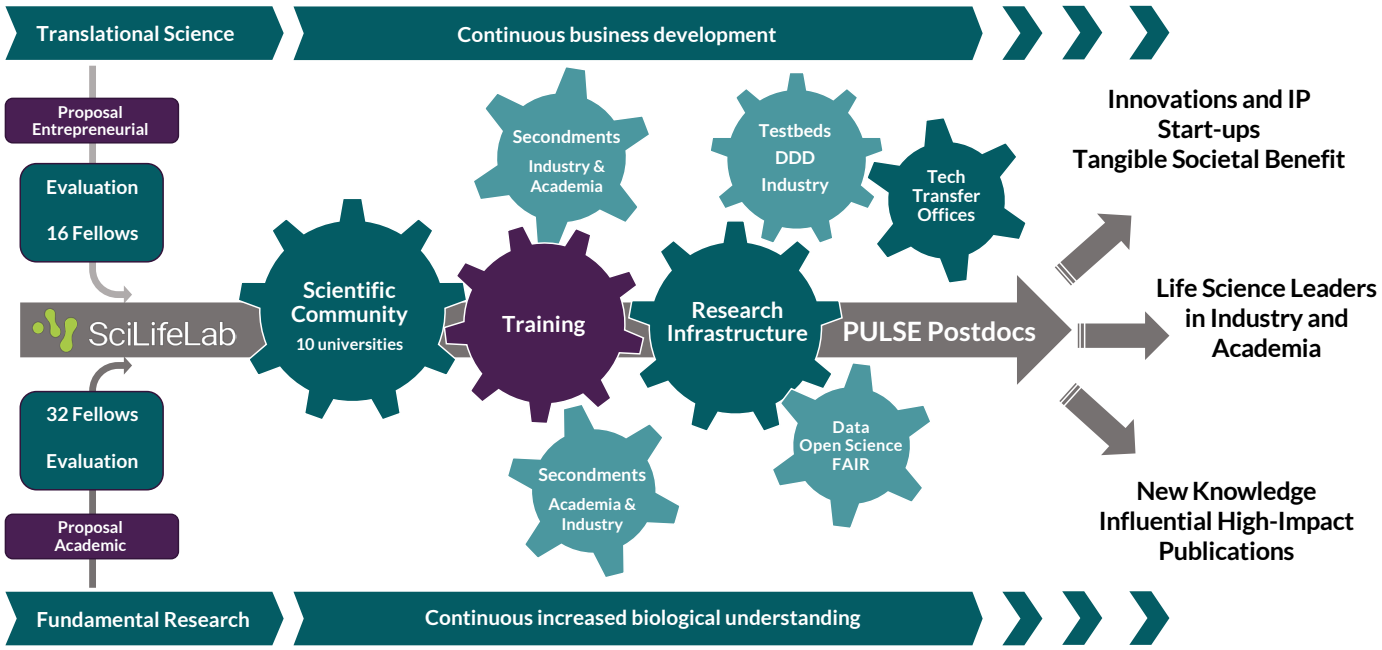


Figure 48. The goal of SciLifeLab PULSE is to establish a holistic postdoctoral training program with international, intersectoral and interdisciplinary components to train 48 future academic and industrial leaders in Life Sciences with a 3-year postdoctoral fellowship. Postdocs will break new ground in fundamental, innovative and translational research as they pursue careers in academia or industry. PULSE is focused on long-term career sustainability, creating resilience by taking mental health and supportive environments into account.

Photo: Mikael Wallerstedt

11. Scientific Output and Impact 2020–2022

11.1 Publication Tracking at SciLifeLab

SciLifeLab tracks publications from the following categories:

1. **Infrastructure** units report publications contingent upon their service projects to external users and internal technology development. Publications are labeled *service projects* (infrastructure services mentioned in acknowledgement), collaborative (infrastructure staff as co-author), or *technology development* (resulting from the development of services or technologies). Publications may be labeled by more than one infrastructure unit and with more than one subcategory, but only counted once when calculating impact. These publications can be found in the SciLifeLab Infrastructure Publication Database.[24]
2. **Affiliated researchers,** identified through reporting SciLifeLab as their address or affiliation in the publication record in Web of Science.
3. **SciLifeLab Fellows,** which is a subset of the affiliated researchers. Publications co-authored by Fellows are automatically added to the database, then curated and labeled by the Fellows themselves, who can also add or remove records. The information is stored in the same database instance as affiliated researchers[25] but can be identified by the labels curated by the fellows.

SciLifeLab also maintains other publication databases for specific purposes. For example, the COVID-19 research program collects reports about publications from the participating researchers in the program. Publications can appear in multiple databases, e.g., publications from affiliated researchers using infrastructure services. The Data Centre maintains and develops the publication databases and supports the reporting process. The data reported to these databases or obtained using searches may be incomplete, for example, because an affiliation to SciLifeLab was not specified. However, we have issued guidance to try to minimize this issue.

Only publications identified or reported with a publication date before 31 December 2022, were included in this report. Impact calculations based on citations are in general reported for the years 2017–2020, allowing for institution-level impact comparisons with public data available at the KTH library. In this report, we use PP(top 10%), the fraction of publications found among the top 10% most cited papers in the same field and for the same period. Commonly, at least two years are required before citation data is considered stable and comparable for citation-based impact scores.

Since the previous IAB report, work has progressed to improve the granularity by which publications can be tracked and analyzed. SciLifeLab is compiling lists of established group leaders which will enable future analyses on the co-author level. SciLifeLab will require that affiliated researchers use ORCID in publications to facilitate publication tracking, and the Data Centre has developed the database system to handle author-level identification and association with publications through ORCID. The Data Centre has also established a collaboration with the KTH library that includes access to raw bibliometric data, curated records, and support from staff bibliometricians. Therefore, the analyses in this report have been produced entirely within SciLifeLab, and we now have a stronger capability to assess bibliometric output dynamically. We have used Altmetric Explorer to access altmetric, which collects attention-type impact (such as news, social media, etc.) for recent publications for which no robust citation data yet exists.

[24] publications.scilifelab.se
[25] publications-affiliated.scilifelab.se

11.2 Scientific Output from Infrastructure Units and their Users

For the years 2021–2022, the infrastructure units reported a total of 1,668 publications resulting from their work. There has been a slight increase in the average number of publications compared to previous years, which corresponds to the timing of the COVID-19 pandemic, see *Figure* 9. The PP(top 10%) for 2017–2020 is 21%. Please refer to the infrastructure section for more information about the Leiden Ranking and how the SciLifeLab PP(Top 10%) compares, see *Section* 6.2.2.

The analysis and figures for publications from infrastructure units and their users are reported in *Section* 6.2.2 and in *Section* 11.5, where we only consider infrastructure publications when compared to other types of SciLifeLab publications.

11.3 Scientific Output from Affiliated Researchers

SciLifeLab-affiliated researchers are identified by their reported affiliation or address, and publications are harvested from the Web of Science. SciLifeLab fellows, who are a subset of affiliated researchers, instead report their publications into a dedicated database. More information about the output and impact of fellows' publications can be found further down in this section.

In 2021–2022, affiliated researchers published 1,928 papers, many in high-impact journals, *Figure* 49. Similar to the infrastructure publications reported in *Section* 6.2.2, the number of publications has remained relatively consistent since 2016, with a slight increase during the COVID-19 pandemic. The number of citations received in recent years has increased sharply, see *Figure* 50, indicating that recent papers are gaining relatively more citations.

The impact of the publications from affiliated researchers is also high, with 21.0% of the 3,343 papers published in 2017–2020 belonging to the top 10% most cited. In comparison, the Leiden Ranking of over 1,400 universities only has six going above 21%.

To study the impact of publications across the main fields where SciLifeLab operates, we categorized publications in scientific fields and assessed field-normalized impact scores for those. Six categories dominate the publication landscape of both infrastructure and affiliated researchers: biochemistry and molecular biology, cell biology, genetics and heredity, biochemical research methods, biotechnology and applied microbiology, and oncology. We estimate the impact scores of these subcategories only, as the larger quantity of publications makes these data more reliable, see *Figure* 51.

Of course, SciLifeLab-affiliated researchers only produced a relatively small fraction of the papers published by all Swedish researchers in 2017–2020, even in the six fields where SciLifeLab publishes most frequently. For example, affiliated researchers produced 11.7% of biochemistry and molecular biology publications from all Swedish organizations. However, papers from SciLifeLab-affiliated scientists outperform the average impact of Swedish universities, as measured by the percentage of papers in the top 10% most cited (PP(top 10%)), see *Figure* 51.

In 2021–2022, SciLifeLab fellows published 330 papers, of which 109 were in journals with an impact factor (JIF) over 9, see *Figure* 52 *a*). PP(top 10%) impact score for fellows' publications in 2017–2020 was 23.4%, at the same high level as the overall group of affiliated researchers, see *Figure* 52 *b*).

COVID-19 was rampant during the 2021–2022 period. As the Data Centre also collects and curates publications with Swedish co-authors as part of their work with the national COVID-19 data portal, we do see a very strong output because of the pandemic.[26]

[26] These publications can be found in a dedicated database pathogens.se/publications/, which holds 3,073 papers as of 30 August 2023. This database collects all papers on COVID-19 involving a researcher affiliated with a Swedish organization, not just those emanating from SciLifeLab-affiliated scientists or users of SciLifeLab infrastructure.

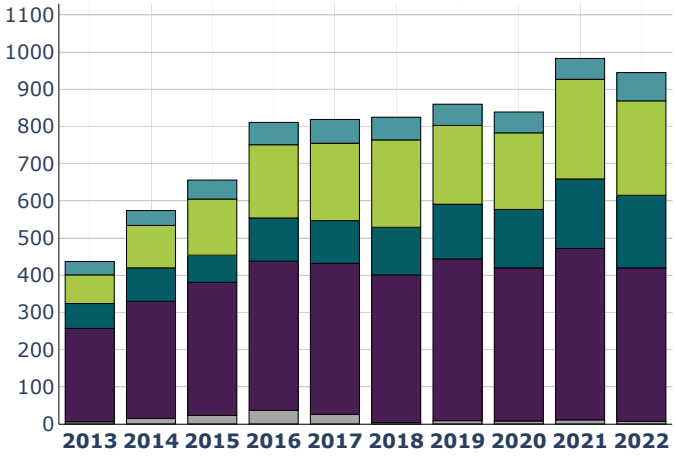


Figure 49. The number of publications produced by affiliated researchers annually, with Journal Impact Factor (JIF) distribution: JIF > 25 (blue), JIF 9–25 (light green), JIF 6–9 (dark green), JIF < 6 (purple), JIF unknown (gray)

Figure 50. Number of citations received each year for publications by affiliated researchers

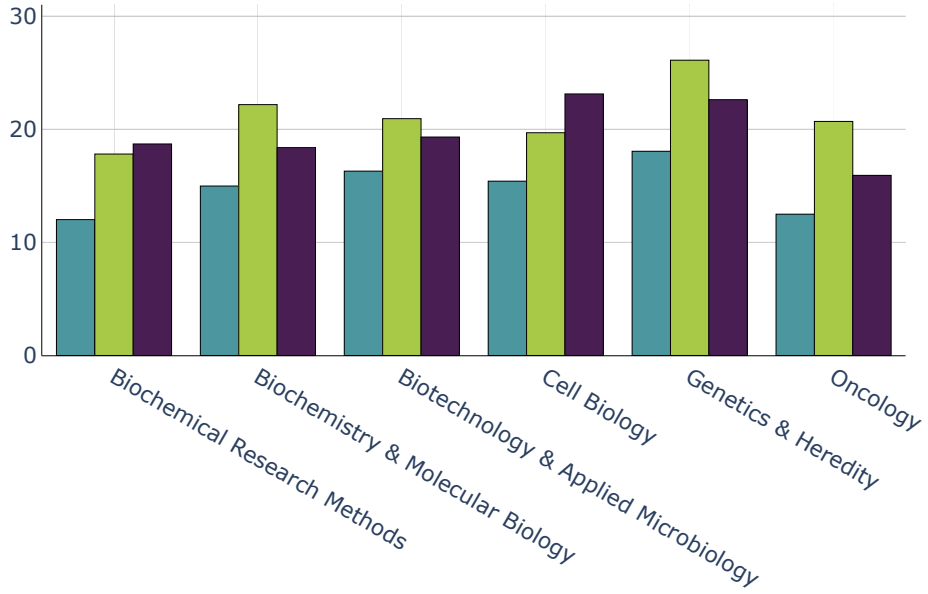


Figure 51. Percentage of papers in the top 10% of most highly cited publications (PP(top 10%) score) for all Swedish research institutes (blue), affiliated researchers (green) and infrastructure users (purple), and in the six subject categories in which SciLifeLab publishes most frequently. All scores are for papers published in the years 2017–2020.

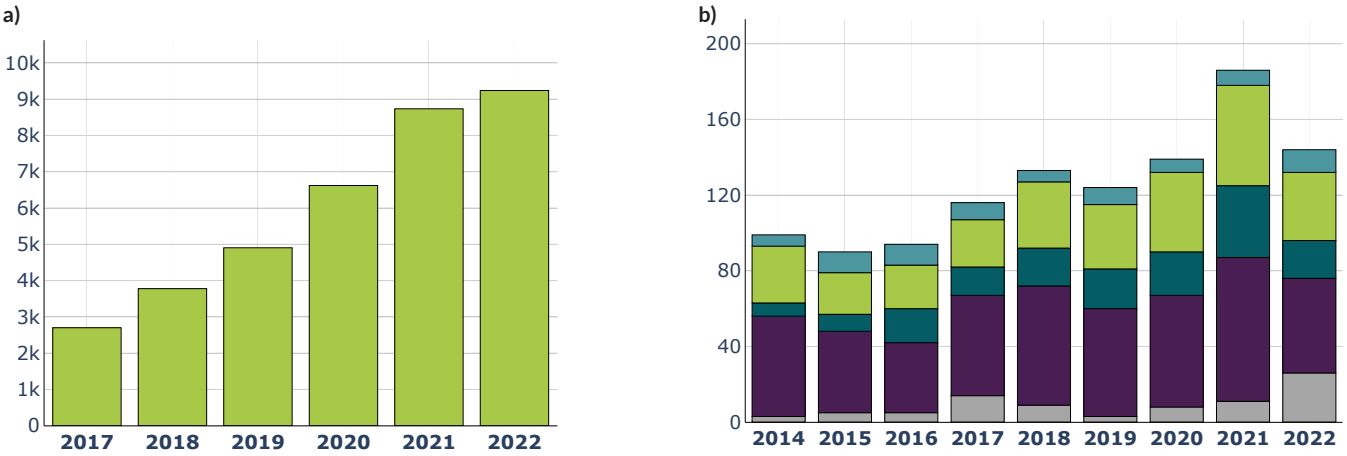


Figure 52. a) Number of citations received each year for publications by fellows. **b) The number of publications** produced by fellows annually, with Journal Impact Factor (JIF) distribution: JIF > 25 (blue), JIF 9–25 (light green), JIF 6–9 (dark green), JIF < 6 (purple), JIF unknown (gray)

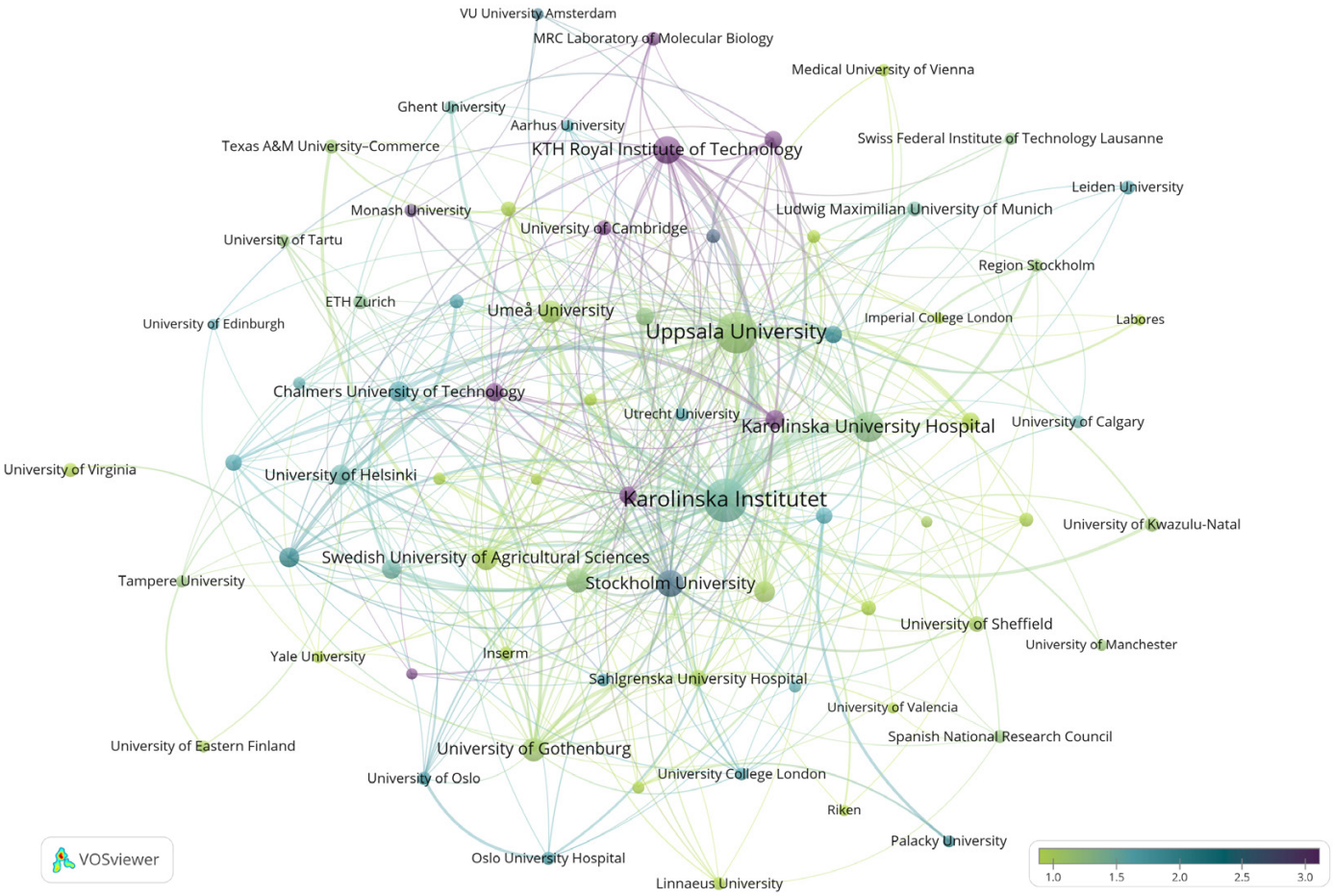


Figure 53. Co-publication plot of publications (2017–2020) by SciLifeLab affiliated researchers involving both international and national collaborators. The size of the 'bubble' for an institute indicates the number of co-publications, with larger bubbles indicating more co-publications. Institutes are colored by mean normalized citation (MNCS) score, as defined in the legend.

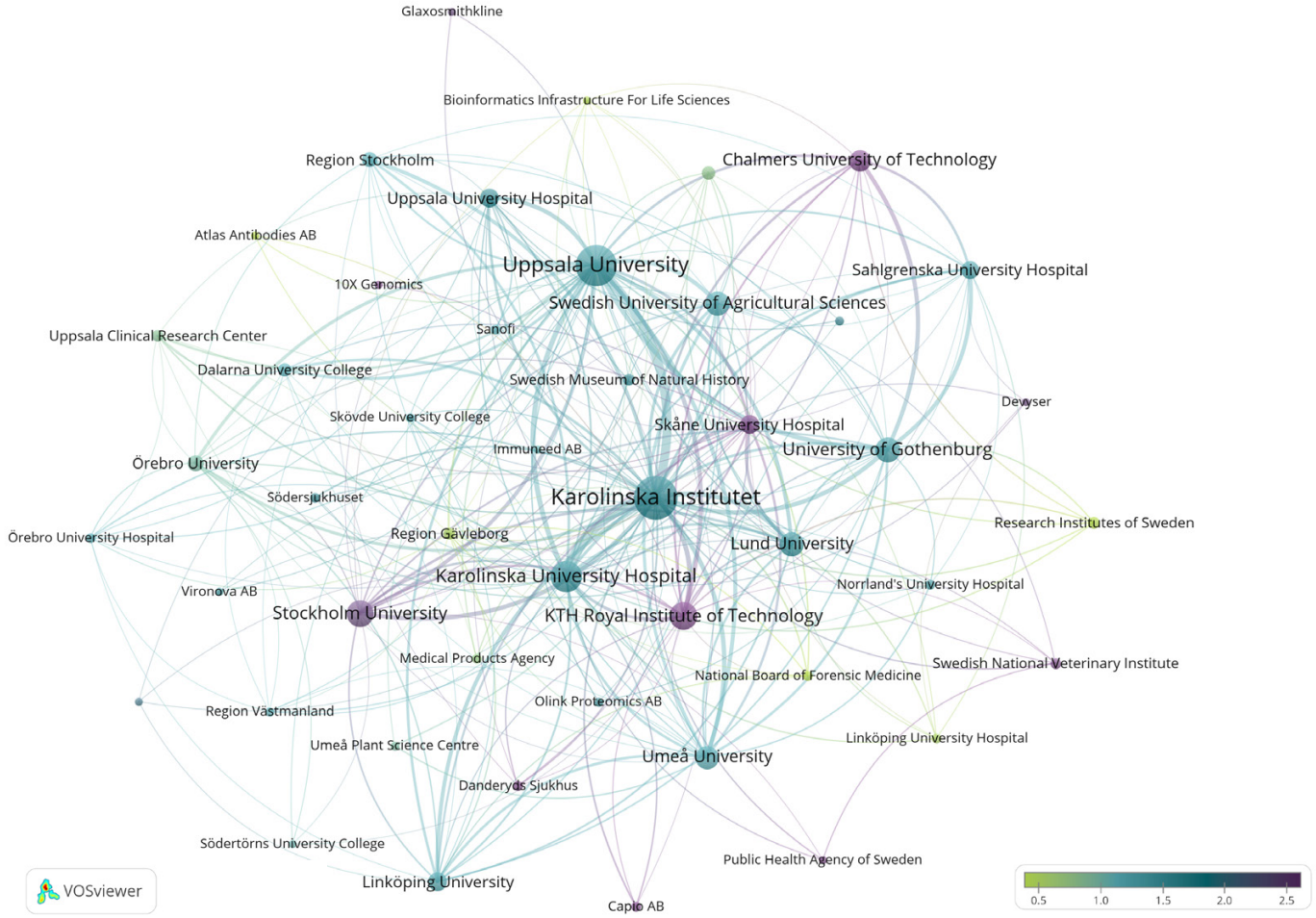


Figure 54. Co-publication plot of publications (2017–2020) by SciLifeLab affiliated researchers involving only national collaborators. The size of the 'bubble' for an institute indicates the number of co-publications, with larger bubbles indicating more co-publications. Institutes are colored by mean normalized citation (MNCS) score, as defined in the legend.

11.4 National and International Collaborations of Affiliated Researchers

Affiliations of co-authors of publications with SciLifeLab-affiliated researchers indicate a wide network of national and international collaboration, see *Figure* 53. Strong interactions with the SciLifeLab founding universities are particularly evident, as are high-impact links with other national (e.g., Lund University and Umeå University) and international (e.g., Harvard, Stanford, and MIT) parties, see *Figure* 54.

11.5 Interaction Between Infrastructure and Research

In total, 541 (17.7%) papers published between 2021–2022 included contributions from both infrastructure units and affiliated researchers, *Figure* 55. This is a slight reduction from the numbers in 2019–2020 (19.4%).

The three sets in the Venn diagram in *Figure* 55 present different observations and conclusions. Firstly, the 1,127 papers from infrastructure not involving co-authors affiliated with SciLifeLab are mainly service projects with users elsewhere in Sweden. This group represents 67.6% of all papers reported by infrastructure units. This is indicative of the fact that a sizable fraction of the work done at infrastructure units is related to the life science community at large. In 2017–2020, the PP(top 10%) for this group was 18.3%, indicating that papers produced by users outside of SciLifeLab affiliated researchers are very impactful. Taken together with the information provided in the benchmarking plot, *Figure* 51, we can infer that the utility of SciLifeLab infrastructure units enables the research community to create more impactful research than might otherwise be possible. Secondly, the 1,387 papers from SciLifeLab-affiliated researchers not served by the infrastructure is also quite a sizable amount. In fact, two thirds of SciLifeLab associated researchers' papers do not depend on SciLifeLab infrastructure. This indicates that, whilst SciLifeLab does facilitate access for our own research community, they are not avid infrastructure users in all of their research efforts. This is in line with the aims of SciLifeLab, as we strive to serve the research community at large. The PP(top 10%) for papers by affiliated researchers 2017–2020 was 19%; indicating that these papers are also highly impactful. Lastly, the 541 papers in the intersection, involving researchers and infrastructure units, are also labeled as service projects, collaborative, or technology development, see *Section* 7.4. The PP(top10%) for this group is 24.1%, which is the highest score of the three sections, meaning that the most impactful papers overall are those produced when SciLifeLab researchers make use of the infrastructure units. 27.9% of these 541 publications involve more than one infrastructure unit in different roles, and approximately half of them, 45.7%, are service projects. 43 publications are labeled only as technology development (7.9%), and a further 9 technology development projects also have other infrastructure units involved in other roles (included in category 'Multiple', *Figure* 56). This intersection also includes service projects to SciLifeLab-affiliated researchers at host universities.

In 2017–2020, the impact of this group was PP(top 10%) = 24.1%, and corresponding numbers for the three sub-categories were for service projects 27%, collaborative projects 22% and technology development 25%. We observe an increase in impact for collaborative projects involving SciLifeLab community and technology development.

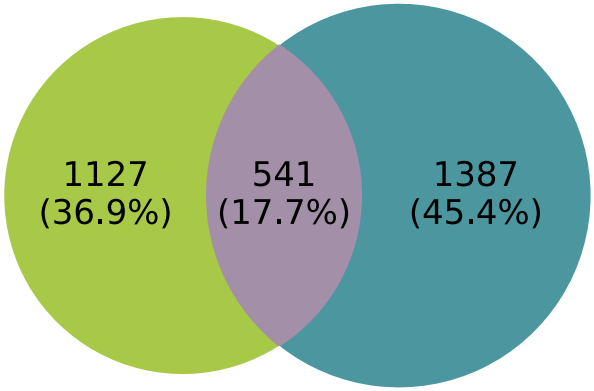


Figure 55. Venn diagram of publications by infrastructure users and affiliated researchers published 2021–2022. Papers from infrastructure users only (green), affiliated researchers only (blue), and papers reported by infrastructure units with SciLifeLab affiliated co-authors in the intersection (purple). The PP(top10%) in 2017–2020 of these three groups were: Infrastructure users only (18.3%), affiliated users only (19.5%), and intersection (24.1%)

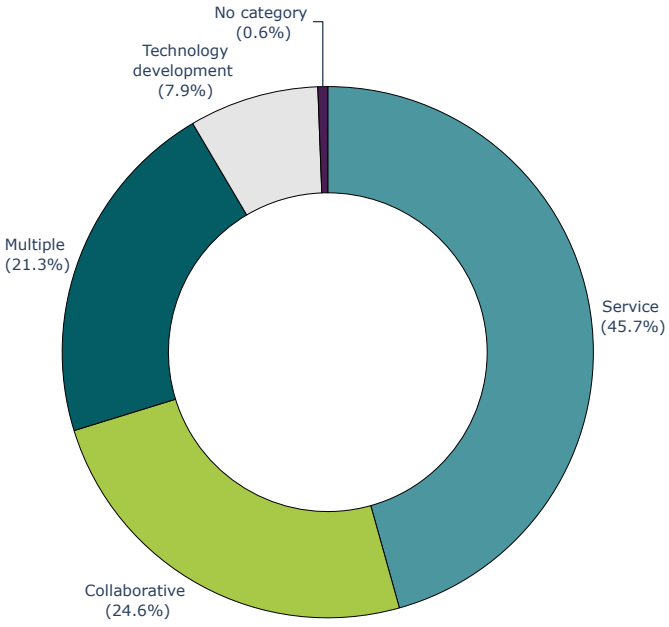


Figure 56. Out of the 541 publications with SciLifeLab-affiliated co-authors reported by infrastructure units, half have been labeled as service projects only, and nearly a quarter have been reported by multiple infrastructure units in different roles.

11.6 Highlights and Summary

In *Table* 7, we highlight a few selected publications by affiliated researchers (including Fellows) or resulting from projects funded by SciLifeLab and infrastructure users 2020–2022. These papers cover a range of topics and are published in a wide variety of high-impact journals.

In summary, our analysis indicates that SciLifeLab continues to produce very high-impact publications. That is evident both for publications produced by affiliated researchers and those involving infrastructure units; we can see, for example, a steeply increasing trend in the number of citations received each year. SciLifeLab covers diverse topics within life science but shows particular strength in the fields of biochemistry, biotechnology, genetics, cell biology and cancer research, *Figure* 51. In those fields, the impact of papers involving affiliated researchers and infrastructure units is significantly higher than that of publications from Sweden institutions on average. The volume of publications represents approximately 10–18% of all Swedish publications in these fields. Thus, we conclude that SciLifeLab contributes to a relatively small but impactful fraction of the Swedish research outcome each year. The intersection between affiliated researchers supported by infrastructure platforms shows a slight increase in impact for service- and collaborative projects. It should also be noted that citation statistics lag behind the raw output statistics and are highly sensitive to annotation, such as the group leader affiliation and the proper annotation of infrastructure users' publications.

SciLifeLab Data Centre is expanding its work on research assessment as part of its new Open Science operational area. This is a rapidly evolving international field, where recent international initiatives are forming that aim to address, for example, the biases towards for-profit publishing. Instead, research assessment based on quality over quantity, and using impact measures arising from the adherence to Open Science principles. We aim to join international community initiatives in this area and add new approaches to assessing impact accordingly in the future.

Table 7. Selected high-level SciLifeLab publications 2021–2022 with a high altmetrics score[27]. R: Publication from SciLifeLab-affiliated researcher, F: Publication from SciLifeLab Fellow, I: Publication where SciLifeLab infrastructure services have been used.

SciLifeLab Contribution	*SciLifeLab publication*
I/R	Symptoms and Functional Impairment Assessed 8 Months After Mild COVID-19 Among Health Care Workers Havervall S, Rosell A, **Phillipson M, Mangsbo SM, Nilsson P, Hober S,** and Thålin C. *This study showed that a considerable portion of individuals with mild COVID-19 reported a diversity of long-term symptoms, and that these symptoms disrupted work, social, and home life.* Altmetrics score: 1322. JAMA. 2021 Apr; 325: 2015-2016.
I/F	A combined approach for single-cell mRNA and intracellular protein expression analysis **Reimegård J, Tarbier M, Danielsson M,** Schuster J, Baskaran S, Panagiotou S, Dahl N, **Friedländer MR,** and Gallant CJ. *Study presents SPARC, an approach that combines single-cell RNA-sequencing with proximity extension essays to simultaneously measure global mRNA and intracellular proteins in individual cells. SPARC overcomes current limitations in throughput and protein localization, including removing the need for cell fixation. Altmetrics score: 24.* Communications Biology. 2021 May; 4; 624.
I/R	The structure of neurofibromin isoform 2 reveals different functional states **Naschberger A, Baradaran R,** Rupp B, and **Carroni M.** *The widespread disease neurofibromatosis type 1 is caused by mutations in the NF1 tumour suppressor gene, leading to dysfunction in the protein neurofibromin (Nf1). This study determined the structure of human Nf1 dimer, and will aid in deciphering the complex molecular mechanism behind e.g., neurofibromatosis syndrome. Altmetrics score: 77.* Nature. 2021 Oct; 599: 315-319.
I/R	Proteogenomics of non-small cell lung cancer reveals molecular subtypes associated with specific therapeutic targets and immune-evasion mechanisms **Lehtiö J, Arslan T, Siavelis I, Pan Y, Socciarelli F, Berkovska O, Umer HM, Mermelekas G, Pirmoradian M,** Jönsson M, Brunnström H, Brustugun OT, Purohit KPP, Cunningham R, Asl HF, Isaksson S, Arbajian E, Aine M, Karlsson A, Kotevska M, Hansen CG, Haakensen VD, Helland Å, **Tamborero D, Johansson HJ, Branca RM,** Planck M, Staaf J, and **Orre LM.** *In-depth mass-spectrometry-based proteogenomic analysis carried out in study to deepen understanding of molecular phenotypes of lung cancer, to identify specific cancer dependencies and immune-evasion mechanisms. Altmetrics score: 165.* Nature Cancer. 2021 Nov; 2, 1224-1242.
I/R/F	Sequence specificity in DNA binding is mainly governed by association **Marklund E, Mao G, Yuan J, Zikrin S, Abdurakhmanov E, Deindl S,** and **Elf J.** *Study derived a model that predicts an anticorrelation between the macroscopic association and dissociation rates of DNA binding proteins. Following tests using the lac operon, authors found that sequence specificity is mainly governed by the efficiency with which the protein recognizes different targets. Altmetrics score: 154.* Science. 2022 Jan; 375; 6579: 442-445.

[27] altmetric.com. *Extraction was done in June 2023.*

I/R	Integrative multi-omics and drug response profiling of childhood acute lymphoblastic leukemia cell lines **Leo IR, Aswad L, Stahl M, Kunold E, Post F, Erkers T, Struyf N, Mermelekas G, Joshi RN, Gracia-Villacampa E, Östling P, Kallioniemi OP,** Tamm KP, **Siavelis I, Lehtiö J, Vesterlund M,** and **Jafari R.** *Acute lymphoblastic leukemia (ALL) is the most common childhood cancer, where some patients respond poorly to treatment. Authors perform comprehensive multi-omic analyses of 49 childhood ALL cell lines, using proteomics, transcriptomics, and pharmacoproteomic characterization, and connect molecular phenotypes with drug responses to >500 oncology drugs. Data is the foundation of the interactive online Functional Omics Resource of ALL (FORALL) at https://proteomics.se/forall. Altmetrics score: 29.* Nature Communications. 2022 March;13; 1691.
I/R	Immune responses after omicron infection in triple-vaccinated health-care workers with and without previous SARS-CoV-2 infection Blom K, Marking U, Havervall S, Greilert Norin N, Gordon M, García M, Tecleab T, W Christ, Forsell M, **Phillipson M, Nilsson P, Mangsbo S, Hober S, Åberg M,** Klingström J, Thålin C. *Findings in this study suggest that previous SARS-CoV-2 infection, as well as high pre-infection antibody titres impact omicron-induced spike-specific serological responses in triple-vaccinated individuals. Close monitoring of immune responses following repeated antigenic exposures through infection or booster doses is advised. Altmetrics score: 294.* The Lancet Infectious diseases. 2022 July; 7: 943-945.
I/R	Spatially resolved clonal copy number alterations in benign and malignant tissue Erickson A, **He M, Berglund E, Marklund M, Mirzazadeh R, Schultz N, Kvastad L, Andersson A, Bergenstråhle L, Bergenstråhle J, Larsson L, Galicia LA,** Shamikh A, Basmaci A, Ståhl TDD, Rajakumar T, Doultsinos D, **Thrane K,** Ji AL, Khavari PA, **Tarish F,** Tanoglidi A, **Maaskola J,** Colling R, Mirtti T, Hamdy FC, Woodcock DJ, **Helleday T,** Mills IG, Lamb AD, and **Lundeberg J.** *Study uses a systematic approach to study spatial genome integrity in situ and describe previously unidentified clonal relationships in cancer, by spatially resolved transcriptomics focused on copy number variations in >120,000 regions across multiple organs, in benign and malignant tissue. Altmetrics score: 237.* Nature. 2022 Aug; 608: 360-367.
I/F	Global patterns and rates of habitat transitions across the eukaryotic tree of life Jamy M, Biwer C, Vaulot D, Obiol A, Jing H, **Peura S,** Massana R, and **Burki F.** *Study investigates habitat evolution across the tree of eukaryotes using a unique set of taxon-rich phylogenies inferred from a combination of long-read and short-read environmental metabarcoding data spanning the ribosomal DNA operon. Findings indicate that the salt barrier has played an important role during eukaryote evolution and provide a global perspective on habitat transitions in this domain of life. Altmetrics score: 184.* Nature Ecology & Evolution. 2022 Aug; 6: 1458-1470.
I/R/F	The exon-junction complex helicase eIF4A3 controls cell fate via coordinated regulation of ribosome biogenesis and translational output **Kanellis DC, Espinoza JA, Zisi A, Sakkas E, Bartkova J, Katsori A-M, Boström J,** Dyrskjøt L, Broholm H, **Altun M, Elsässer SJ, Lindström MS,** and **Bartek J.** *Eukaryotic initiation factor 4A-III (eIF4A3) is essential for splicing, mRNA trafficking, and nonsense-mediated decay processes emerging as targets in cancer therapy. Study unravels eIF4A3's tumor-promoting function by demonstrating its role in ribosome biogenesis (RiBi) and p53 (de)regulation, with implications for cancer pathogenesis and treatment. Altmetrics score: 70.* Science Advances. 2021 Aug; 7; 32.
F	Extending fluorescence anisotropy to large complexes using reversibly switchable proteins **Volpato A, Ollech D, Alvelid J, Damenti M,** Müller B, York AG, Ingaramo M, and **Testa I.** *Study describes selective time-resolved anisotropy with reversibly switchable states (STARSS), which overcomes limitations of time-resolved fluorescence anisotropy to only analyze relatively small molecules (~0.1–30 kDa), and extends the observable mass range by more than three orders of magnitude. The Authors show through probing several molecular complexes in cells, including chromatin, that STARSS is applicable to the entire human proteome. Altmetrics score: 114.* Nature Biotechnology. 2022 Oct; 41: 552-559.
I/R	Spatial genomics maps the structure, nature and evolution of cancer clones Lomakin A, **Svedlund J, Strell C,** Gataric M, Shmatko A, Rukhovich C, Park JS, Ju YS, Dentro S, Kleshchevnikov V, Vaskivskyi V, Li T, Bayraktar OA, Pinder S, Richardson AL, Santagata S, Campbell PJ, Russnes H, Gerstung M, **Nilsson M,** and Yates LR. *Development of the slide-DNA-seq for capturing spatially resolved DNA sequences from intact tissue sections, applied in the study of local tumor architecture. Through integration with spatial transcriptomics, this multi-modal spatial genomics approach provides a versatile platform for quantifying how cell-intrinsic and cell-extrinsic factors contribute to gene expression, protein abundance and other cellular phenotypes. Altmetrics score: 500.* Nature. 2022 Nov;611: 594-602.

11.7 Challenges & Questions to the IAB

What considerations does the IAB advise SciLifeLab to take regarding assessment of research and infrastructure impact and quality?

12. SciLifeLab Support Functions

12.1 Operations Office

12.1.1 Introduction

SciLifeLab Operations Office (OO) is jointly run by the Head of Operations (HOP) and vice Head of Operations (vHOP). When the updated steering documents were finally approved in December 2022, see *Appendices* P-R, these assignments were finalized long-term. Since 2021 the number of FTEs have increased slightly to better support the broadened scope of assignments given to SciLifeLab, but given the extent of new initiatives, while also administering all current operations in a multi-university environment, the group remains quite slim.

The personnel working at OO, currently 28 FTEs in total, are all highly skilled professionals and are specialists of their respective area. Over 75% hold a PhD degree and have a research background. Many initiatives and projects run at SciLifeLab have been initiated by OO, and the close working relation with the SciLifeLab management, which has increased and improved over the past few years, are key to the success for SciLifeLab.

The OO personnel are employed either at KI, KTH or UU and are physically located at either Campus Solna or Navet in Uppsala. OO supports the organization in eight operational support areas as well as the sites at Solna and Uppsala, see *Figure* 57. Each of the support areas have an assigned coordinator and a major task for the area coordinators is to assist the OO management with making the yearly operational plan and budget and to handle the day-to-day operational work of their respective teams. The main responsibility of the different support areas is divided equally between HOP and vHOP based on expertise and preference but all strategic planning for the overall operations and activities is done jointly.

The OO personnel are grouped according to the support area they mainly work within, but some individuals work in several of the support areas, and the OO personnel are gathered in inter-university teams based on the needs of assignments and projects. This structure has enabled the OO management to spend more time on overarching strategic and overall operational issues, but most importantly increased the quality and efficiency and enabled easier prioritization and allocation of resources.

Figure 57. Operations Office (OO) support areas and responsibilities

12.1.2 Developments 2022–2023

During 2021–2023 Operations Office has grown from 22 to 28 FTEs to support the expansion and development of SciLifeLab. Besides planning and maintaining everyday operations, OO has been instrumental in for example supporting the launch of sites and capabilities, revision of SciLifeLab steering documents, acquiring external funding (i.e., from VR to support InfraLife, Vinnova for national coordination of EU DIGITAL projects), managing strategic partnerships (e.g., SciLifeLab-EMBL partnership, InfraLife project with MAXIV and ESS), organizing events and hosting a vast number of visitors (the post-pandemic interest by international and national delegations to visit SciLifeLab has been enormous), coordinating the DDLS program including processes for fellows recruitments and planning for the DDLS Research School (RS). In summary, OO is instrumental in supporting the management in developing and executing the SciLifeLab strategy at all levels.

With the launch of capabilities (PLP, PM, PB and sites, besides Stockholm and Uppsala now also Gothenburg, Lund, Linköping, and Umeå), OO closely interacts with both the capability and site coordinators and directors. Besides internal coordination and support for the different parts of SciLifeLab, Operations Office also pro-actively seeks out and manages contacts to external stakeholders (government offices, funders, strategic collaboration partners etc).

SciLifeLab's status as a national player for Swedish life science has developed during recent years, which has also resulted in an expectation from the government, KAW and other stakeholders, that SciLifeLab can act as a party for Sweden in different initiatives. This applies for example for large EU programs, for coordination at a national level, as well new initiatives within life science innovation. Indeed, SciLifeLab is well positioned to take on these types of tasks, many of which are handled by the Operations Office, but it remains important to specify the core aims of SciLifeLab to focus resources and define priorities.

12.1.3 Future Plans and Strategies

Reflecting on the fast paced development of SciLifeLab as a whole and its widened collaborations, it will be central for the Operations Office during the coming years to have a clear strategy and prioritized aims to define key activities and direct resources accordingly. Supporting the infrastructure will remain at the heart, including supporting cross-platform initiatives and thematic team science efforts (such as the capabilities), as well as accessibility to infrastructure for users from different sectors (including legal hurdles). An increased focus will be on training as the Training Hub is being developed, with the launch of the DDLS RS, and with re-submission of the application to MSCA COFUND for the national SciLifeLab PULSE postdoc program. Innovation will receive more attention with new initiatives such as the annual KAW Proof of Concept call launched in June 2023. DDLS will naturally remain a central program coordinated by the Operations Office, as well as other joint efforts together with the Data Centre such as participation in and national coordination of the EU-DIGITAL projects, see *Section* 12.4.

Revising and expanding the composition and expertise of the management group, as well as assigning responsible members for different areas and working groups, would likely benefit operations, support development and focused actions towards fulfilling the strategic goals set for SciLifeLab, see the updated Roadmap, *Section* 4 and *Appendix* A. The current composition of the management group reflects earlier SciLifeLab days with members from the four founding universities primarily selected as university representatives, whereas appointment based on expertise towards realizing and developing SciLifeLab should be at the core for the future.

12.1.4 Challenges and Questions to the IAB

- How much should we expand SciLifeLab undertakings in general and Operations Office support in relation? As an agile, central, neutral, and broad national player, SciLifeLab with its Operations Office with highly skilled professionals, is well positioned to coordinate and support many relevant initiatives for life science in Sweden, but a challenge is not diluting operations too much.
- How should SciLifeLab prioritize efforts and its resources balancing expansion nationally, internationally, as well as within different focus areas and sectors? I.e., where do we draw the line of what we support, coordinate, and take an active role in, and which activities do we leave to others to run but are informed about?
- How do we remain the bridge between actors without taking on the operational and administrative responsibility of a plethora of large projects and collaborations long term?

12.1.5 New Communication Strategy

A communication strategy for SciLifeLab is under development. The aim is to have a useful guiding document for effective and sustainable communication about SciLifeLab's operations. To be relevant the strategy shall describe how communication can be used as a tool to contribute to the realization of SciLifeLab's strategic goals, which are under current revision. The overall aims of the communication strategy are to contribute to increased awareness, well-founded perceptions, and attitudes and behaviors that benefit SciLifeLab's strategic goals.

The communication should therefore contribute to:

- Direct current and potential users to SciLifeLab's research infrastructure.

- Clarify SciLifeLab's strategic role as a unique and impactful life science infrastructure to stakeholders such as decision-makers, financers, and the life science sector in a wide sense.
- Increase the knowledge of how SciLifeLab's services and research efforts contribute to strengthening life science and contributing to meeting societal challenges.
- Attract talent.
- Increase collaborative and innovative efforts.

A challenge identified for the new communication strategy that we would like to discuss with the IAB is how to use communication as a tool to maximize engagement and awareness with the goal of leveraging the potential of SciLifeLab's updated five strategic objectives, see *Section 4*.

12.2 Data Centre

SciLifeLab Data Centre (DC) is a central support function at SciLifeLab responsible for services, resources, and support for IT and data-related issues. It serves the infrastructure platforms but also supports operations and management, research programmes, strategic initiatives, and represents SciLifeLab in national and international collaborations on issues regarding data and IT. As data-driven research has become pivotal to SciLifeLab's future, including the launch of the DDLS research programme, DC has now established itself as a core part of SciLifeLab.

12.2.1 Infrastructure

SciLifeLab Data Centre aims to bourgeon the scientific impact of the infrastructure technology platforms and the research supported by SciLifeLab by providing robust joint services and enabling Open Science and FAIR data. Openness and transparency are paramount to DC operations, and the software developed by the team is always available as open source.

DC supports the infrastructure through close interaction with the service platforms, providing IT solutions and software services, advice on data flow design, and assistance in preparing operational plans or grant proposals. New services developed or procured by DC often originate in platform requirements, followed by collaboration projects piloting and evaluating prospective services. There is particularly close collaboration between DC and the Bioinformatics platform, NBIS, regarding data management and FAIR. For example, DC and NBIS develop brokering submissions of data produced by SciLifeLab platforms to the appropriate repositories at EMBL–EBI[28] (*European Molecular Biology Laboratory–European Bioinformatics Institute*) through interactions with the platform, researchers in the project, and EMBL-EBI curators.

A central service to platforms is a system developed in-house for data delivery, already deployed in production with over 1,000 projects delivered and more than 400 TB transferred to users. It is built around a cloud-based storage system and on-the-fly encryption, enabling the transfer and storage of sensitive data. The philosophy of DC is to make data sharing an integral part of the research process, linking data-producing platforms and research projects rather than being used passively for data publishing at the end of the research project.

The role of the Data Centre is not solely to provide services upon request or to fill gaps in the IT ecosystem but should also be forward-looking and advance the state-of-the-art. Thus, the DC can be expected to engage in projects for technology development in health data and AI, for example, or other challenging areas.

12.2.2 Research and Cooperation

Although DC is a part of the central SciLifeLab organization and not a platform, the unit also supports external research projects in several cases. DC actively engages with individual projects from their adaptation to support good data practices and Open Science. DC also engages directly with external research projects to strengthen strategic development central to SciLifeLab, such as AI, health data, scientific software engineering, collaborations with biobanks and sample collections, and image data applications.

The model of integrating research data services with robust IT operations while prioritizing scientific excellence has received international recognition. It has resulted in collaborative efforts and joint events with other organizations such as VIB (Belgium), EMBL and EMBL-EBI (Germany and UK), San Diego Supercomputer Centre (USA), CERN (Switzerland), Global Alliance for Genomics and Health, and CSC (Finland). SciLifeLab Data Centre was highlighted by the steering board of the European Open Science Cloud (EOSC) in their first catalog of best practices in 2022. Strong international collaboration has formed and resulted in, for example, a data science workshop in partnership with EMBL and EBI in May 2023 and a workshop on Open Science together with the American Geophysical Union in 2022.

The Data Centre has active international collaborations, primarily in Europe and North America. One example is data sharing for infectious diseases, where it operates the Swedish Pathogens data portal[29], the first national data portal of the Pathogens platform operated by the EMBL-EBI. The software and design of the national Swedish data portal have been used by several of the national data portals that have followed.

[28] ebi.ac.uk
[29] pathogens.se

12.2.3 DDLS

At the start of the DDLS program, DC was assigned to lead the operational work for the DDLS program data services and resources as the hub of a national network for life science data across the participating universities. That includes strengthening the compute- and storage capacity required to operate the data platform, often through coordination with other e-infrastructure centers across Sweden, e.g., UPPMAX in Uppsala and NSC (National Supercomputer Centre) in Linköping. The strategy is to complement e-infrastructure services provided by other national providers or the universities, and the focus areas are services hosting platforms with Kubernetes, an open-source system for automating deployment, scaling, and management of containerised applications, and data sharing services equipped with considerable capacity for data storage. A close collaboration has been established with NSC, hosting the KAW-funded resource Berzelius and also appointed to host the new EuroHPC system Arrhenius. The Data Centre effort for increased e-infrastructure capacity is implemented via closer collaboration with KTH IT and between Campus Solna IT activities and the national infrastructure.

12.2.4 Organizational Support

The Data Centre also has an integral role in SciLifeLab operations, closely interacting with the management for infrastructure, the DDLS program, and the Operations Office. DC operates systems developed in-house for data collection from the infrastructure, for reporting and surveying, a publications database, and a system called Anubis to handle proposal submissions and the accompanying review process.

DC provides collaborative tools and team science software to facilitate work across the national organization of SciLifeLab. For example, this includes commonly used software platforms such as Confluence, Jira, Nextcloud and Slack. That has proven to be very important for community building. At the time of writing (Aug 2023), the SciLifeLab Slack workspace has over 1,800 members and transfers approximately 4,000 messages daily.

12.2.5 Data Centre Staffing

Currently, the Data Centre employs about 40 FTE: system developers, data engineers, data stewards, and project managers. Of these, about 6 FTE are covered by national infrastructure funding, 6 by external grants or pandemic preparedness funding, and the remaining by DDLS. Recruitments are still ongoing, in particular for the DDLS Data Science Nodes. DC is led by a management team covering four main operational areas: development; services and support; infrastructure and operations; Open Science. The staff is placed all over Sweden, including DDLS Data Science Node employees, but concentrated in Uppsala and Solna. *Table 8* presents an overview of the Data Centre services.

12.2.6 Future Plans and Strategies

Data Centre's assignments cover large and rapidly evolving technical domains. That requires DC to be both visionary and ambitious in its role to lead, while also being very concrete and driven by community needs in its supporting role. With the recent rapid expansion because of DDLS, it is now also important for the Data Centre to settle organisationally and build the competence of the team and the external relations needed. Therefore, immediate plans primarily concern fulfilling the existing commitments and building a stable organization, work environment and management structure. Those commitments include adapting to new challenges, for example:

- Facilitating using new AI/ML technology both in research projects and infrastructure operations, and making tools and services for AI widely accessible. This includes supporting technical staff and researchers at SciLifeLab working with ML operations in software engineering, and hosting, annotating and serving AI models through SciLifeLab Serve. As we develop trusted environments for sensitive data, we will in particular look at federated learning and AI-driven methods for data anonymization and synthetic data.
- Compute- and storage infrastructure for sensitive data needs to be secured to facilitate work on for example precision medicine, infectious disease research and health data. The major resources will primarily be provided by other national e-infrastructures, and SciLifeLab's role is to complement and facilitate access to these, and to be an active and knowledgeable domain-specific partner to those e-infrastructures.
- Open Science as a field is becoming stronger and more technology-intensive, and is highly prioritized in international funding programmes. DC will develop its Open Science activities with stronger technology competence, community building, and engagement in international initiatives.
- Research software engineering is another field close to the heart of DC, where we will support technical staff and researchers with tools, frameworks and training to raise Sweden's ability to participate in top international communities with research software engineering activities.
- As the model of the national Pathogens Portal has turned out to be highly successful, both in Sweden and internationally, we will strive to apply this approach to support the communities also for other areas of the DDLS program, for example precision medicine and biodiversity/planetary biology. We will strive to engage with the DDLS/SciLifeLab fellows and upcoming PhD/postdoc programs to support community building and providing platforms for national data services and resources.

Table 8. SciLifeLab Data Centre Services. These services are available for infrastructures, operations/management, and SciLifeLab-affiliated research programs. A few broad services are open to all Swedish life-science researchers. DC also operates a data and IT service desk at datacentre@scilifelab.se.

Service	Description
SciLifeLab Data Repository	General data repository powered by Figshare. A service to publish data and other information with a persistent Digital Object Identifier (DOI). Available to all SciLifeLab-affiliated platforms and research projects.
Swedish Pathogens Portal	National data portal, aggregating data, services, information and guidelines regarding infectious diseases. Part of the EMBL-EBI led Pathogens platform. Publicly available.
SciLifeLab Data Platform	A technical environment offering data-centric tools and databases as well as an overarching website to support and accelerate data-driven life science research in Sweden.
SciLifeLab Serve	A platform developed in-house to host and share compute applications (e.g., Shiny and Dash apps), computational notebooks (Jupyter), and trained machine learning models (PyTorch, Tensorflow).
Hosting services	DC hosts storage and services for the units and select research groups. DC manages the compute and storage resources and a Kubernetes-based container management system.
Data Delivery System	Cloud-based system facilitating data delivery and storage for units. It can also provide some other services, including feedback forms. DDS is developed in close collaboration with the infrastructure units and is in production for non-sensitive data. Delivery of sensitive data is enabled by design, and will be rolled out as data processing agreements are finalized.
Order Portal	A web-based management system that, amongst other things, enables infrastructure units to communicate with their users. It is currently used at multiple units and allows for the configuration of platform-specific instances.
Anubis	System for call-proposal submissions and handling of the review process.
Confluence	A system provided by Atlassian for wiki-style collaborative workspaces.
NextCloud	File management system à la Dropbox, with DC-managed storage provided via SUNET, enabling file sharing and editing for platforms and operations.
Slack	Cloud-based communication system for rapid work communication.
Publication database	System developed in-house to store publication data, providing a search and browse interface and an Application Programming Interface to find publications produced by researchers affiliated with SciLifeLab (including Fellows) or based on infrastructure services. The system is also a reporting tool for the platforms.
Data Stewardship Wizard	A web-based tool for storing and maintaining structured Data Management Plans (DMPs), facilitating their use by SciLifeLab researchers and infrastructure users. The system supports DMP formats as required by the SciLifeLab research programmes and the Swedish Research Council. SciLifeLab participates in the national coordination of DMPs.
ProjectPlace	Project management system.

- Community driven science and technology development is becoming so central for the field that the empowerment of communities through provisioning of tools and services is rapidly becoming the most important direction for DC. But hand in hand with that is the empowerment of communities through knowledge: life-long learning, knowledge transfer, upskilling of technical staff and platforms for training. Therefore, forming a close interaction with the new Training Hub is imperative for DC, and we regard the strong support for training as key to SciLifeLab's ability to operate in an environment where competition for technically skilled staff is so high.

12.2.7 Challenges and Questions to the IAB

- DC has grown thanks to the DDLS assignment, which often leads to unrealistic expectations on infrastructure-specific services, for example bespoke software- or service development projects benefiting single units or platforms. A model where infrastructure platforms have earmarked funding and a responsibility to have some IT/data capability ("the last mile") of their own has been discussed, enabling them to work with DC for interoperability with SciLifeLab-wide services and technologies towards adaptation for platform specific needs. The IAB's advice on such a model would be much appreciated.
- In its role to lead and drive new technology development for data services, interactions with industry are becoming very important. Currently, DC has collaborations with some industry partners around technology implementation in services, but it may be interesting to also open data services for industry users. In particular, data services supporting collaboration projects between academic and industry could have an important impact on Swedish life science innovation. Should DC expand its activities with an industry programme, and if so what should be the focus?
- What should the focus be for the Data Centre regarding sensitive data services, including for precision medicine and more general health data management?

12.3 Training and Professional Development

12.3.1 Introduction

Continuous learning and development is required to create a cutting edge, sustainable life science workforce. SciLifeLab is a recognized and trusted learning provider, with all platforms at SciLifeLab and the DDLS program engaged in national and international training events as short-form courses (lifelong learning) and/or part of university formal education. Training is recognized as an important part of each platform's service portfolio, and SciLifeLab was during 2022 involved in >120 educational events for individuals from academia, industry and health-care. Following the recommendation of the 2021 IAB visit to establish a dedicated training platform, SciLifeLab launched its Training Hub in January 2023 to consolidate and increase access to training.

Training Hub

SciLifeLab Training Hub is establishing itself as a central support function responsible for training support, resources and tools available to the SciLifeLab ecosystem. Once fully operational, it will serve the infrastructure platforms with training support and resources, in addition to supporting the SciLifeLab research environment and its strategic initiatives. Already today the Training Hub is representing SciLifeLab in national and international collaborations on issues regarding lifelong learning and training in technology- and data-driven life science topics and we foresee this to continue to grow as lifelong learning is high on both the national and the European Commission agenda. Of particular highlight is the involvement with ELIXIR, where the Head of Training via NBIS (the SciLifeLab Bioinformatics Platform) is one of the Executive Committee members for its Training Platform in addition to the Training Hub's collaborations with EMBL, EMBL-EBI, VIB and SIB. These collaborative projects revolve around building the technical infrastructure to implement the AI and cloud based resources and tools with regards to training, in addition to collaboratively designing and delivering courses of demand for the European life science community.

12.3.2 Developments 2022–2023

The mission of the Training Hub is i) to coordinate and support the training creation and delivery at the SciLifeLab Infrastructure and DDLS program, ii) to connect the Swedish life science community with the cutting-edge knowledge and skills required to be leaders in data- and technology-driven life science, and iii) to ensure that SciLifeLab and DDLS training is captured and delivered in accordance with FAIR and Open education. To meet this mission, the Training Hub is engaged in i) supporting individual SciLifeLab entities in capturing training and knowledge, ii) building a platform for connecting scientists with relevant training opportunities, resources, and networks, and iii) ensuring that lifelong learning from SciLifeLab Infrastructure and DDLS program is achieved nationally.

The Training Hub has received a 4-year grant (~11 MSEK, 2023–2026) from the Swedish Research Council, using Training to reach and educate the research community in order to increase stakeholder accessibility to the various SciLifeLab Infrastructures. The Training Hub has a core team located in proximity to SciLifeLab at Umeå, Lund, and Solna sites (4.5 FTEs).

The main targets for the Training Hub in 2023 have been to:

- Launch phase I of the Training Hub Portal, a technical platform to host tools, opportunities, and resources for capturing and delivering knowledge at SciLifeLab.
- Deliver Train-the-Trainer courses (co-created with ELIXIR) to build a community of trainers who can ensure SciLifeLab training is sustainable, quality-assured, Open, and FAIR.
- Provide agnostic training coordination and support to SciLifeLab Infrastructure and DDLS program, and the community at large.
- Provide 1-to-1 training support and coordination to three SciLifeLab Infrastructure platforms (NBIS, NGI, Clinical Genomics) and two Capabilities (Precision Medicine, Planetary Biology) in creating and delivering training. The aim is also to make use of the support given to specific groups and convert into agnostic training support and service.

12.3.3 Future Plans and Strategies

The SciLifeLab Training Hub aims to grow into a rich platform for active knowledge transfer that connects life scientists with SciLifeLab training resources relevant for their individual career trajectories. In parallel, the Training Hub will continuously capture new skills and technologies in co-created training materials to develop the SciLifeLab Infrastructure staff-scientists and technology experts in addition to the Sweden-based researchers.

In addition to the ongoing projects, Training Hub will during 2024:

- Launch phase II of the Training Hub portal with a library of training hosted on the Training e-Support Service architecture and a structure for connecting individuals to tailored professional and scientific development paths.

- Co-create SciLifeLab training in broadly valuable "soft" topics such as Open Science, project management, and leadership.
- Stimulate development of cutting-edge training through connecting fellows across SciLifeLab and DDLS to help analyze knowledge gaps in the next generation of scientists and encourage co-creation of new training materials.

Completing these plans will result in a diverse library of current training resources that keep the life science community updated in advanced technology- and data-driven life science as well as complementary skills.

For the Training Hub Roadmap and 5-year work program detail the upcoming work, see *Appendix N. SciLifeLab Training Hub Roadmap 2023–2030* and *Appendix O. SciLifeLab Training 5-year Work program 2023–2028.*

12.3.4 Challenges and Questions to the IAB

- How can SciLifeLab as a national infrastructure, centrally via the Training Hub, ensure commitment from the SciLifeLab Infrastructure/platforms, SciLifeLab Sites, Capabilities and DDLS expert communities to ensure training is happening on a national level from a bottom-up perspective?
- Do IAB have recommendations on additional KPIs that SciLifeLab Infra training and the Training Hub should collect from the SciLifeLab ecosystem and the DDLS program in order to showcase the impact such training has to enable research and innovation? I.e., beyond the number of courses (delivered and supported), the number of participants etc. Recommendations on impact pathway analysis performance.
- How can the Training Hub ensure that SciLifeLab infrastructure training is to be made use of, and implemented into, the DDLS program?

12.4 SciLifeLab External Relations

12.4.1 Introduction

SciLifeLab external relations aim to communicate all different aspects of SciLifeLab to potential stakeholders to maximize the benefit of SciLifeLab infrastructure and research for the society. These interactions occur at different levels, as the management, operations office, research infrastructure staff and the research group members create relations with external partners in different constellations. Collaboration is the core of SciLifeLab where continuous dialogue and exchange with international and national universities, companies of different size, industry organizations, research- and innovation funding bodies, hospitals and other healthcare stakeholders, as well as governmental funding authorities, are key for innovation and fruitful research impact, *Figure 58*. Examples of national and international collaborations where SciLifeLab are involved can be found on the SciLifeLab website[30].

12.4.2 Developments 2022–2023

As a representative of a national Life Science research community, SciLifeLab are in dialogue with central stakeholders, such as the Government offices, the Swedish Research Council and the Swedish Innovation agency Vinnova, to secure a strong voice in the Swedish life science ecosystem and to ensure SciLifeLab's contribution towards Swedish participation in both national and international consortia and funding initiatives. As a result, SciLifeLab has a facilitating role in several national and international initiatives with the aim to strengthen Swedish life science.

For example, SciLifeLab is now involved in three out of four large EU-DIGITAL[31]-funded projects related to health data and coordinates a cross-project initiative funded by Vinnova to ensure a joint view and synergies on issues related to, for example, ethical, legal, social and Technical Infrastructure and Semantic Interoperability. As a partner in the largest EU-DIGITAL project, TEF Health (Testing and Experimentation Facility for Health AI and Robotics), a five-year project, SciLifeLab aims to support SMEs accessibility to experimentation facilities as well as data within this area.

Collaborations also ensure stable and continuous relations with other national and international research infrastructures. An MoU between SciLifeLab and the European Molecular Biology Laboratory (EMBL) was signed in May 2021. Since then, multiple joint activities have taken place. These include; Planetary Biology workshop in Heidelberg, Germany 2022 and SciLifeLab-EMBL Data Science workshop 2023 in Uppsala, Sweden. In addition, SciLifeLab has launched repeated calls to promote exchange visits to EMBL for SciLifeLab associated researchers or infrastructure personnel.

[30] scilifelab.se/external-relations#example-collaboration
[31] digital-strategy.ec.europa.eu/en/activities/digital-programme

Another example is the InfraLife project[32], a collaborative initiative between the three large-scale research infrastructures in Sweden: MAX IV, ESS and SciLifeLab. The initiative aims to increase knowledge and accessibility to the infrastructures for academia, industry, and health care. It provides a format for sharing experience in managing national infrastructures as well as forming a strong research infrastructure-collaborative voice in e.g., national policy, legal-, regulation- and funding matters. In addition, InfraLife partners jointly participate in the largest industry partnering conference in the Nordics, Nordic Life Science Days, to jointly promote the infrastructure offerings.

12.4.3 Future Plans and Strategies

External relations focus towards the SciLifeLab strategic objective *Innovation and bridge-building for the benefit of society.* Collaborations across sectors and borders enable translational science and promote research to become innovations and in the long term benefit for the society.

With more than 100 different companies utilizing SciLifeLab infrastructure yearly, *Figure* 59, one strategy to highlight the impact is to communicate "industry user cases", *Figure* 60, illustrating the variety of possibilities available. An additional effort investigated is to join the European infrastructure consortium EATRIS (European infrastructure for translational medicine) to increase visibility in Europe to both academic and industrial stakeholders.

The *SciLifeLab Innovation Coaching* initiative includes academic innovation support nationwide promoting further development of findings and ideas for commercialization within Life Science. In addition, the collaboration within drug discovery which started as a Vinnova-funded project, is now established as SciLifeLab Innovations – initiative Pharma & Biotech which is coordinated by the Drug discovery and Development Platform. The latest initiative to promote innovation is the KAW/WALP and SciLifeLab Proof of Concept call launched in 2023.

SciLifeLab has in 2022 and 2023 participated in and organized panel discussions during the yearly Swedish political democratic meeting place, the "Almedalen week", to strengthen SciLifeLab interactions with key decision makers and stakeholders as well as to showcase the SciLifeLab Capabilities, infrastructure and other initiatives and services. This has proven fruitful in engaging with important stakeholders and will be a continued activity.

12.4.4 Challenges and Questions to the IAB

- Do you have suggestions on international organizations that SciLifeLab would benefit from having a strategic partnership or collaboration with, and, in your experience, what is the most fruitful content/actions for these types of collaborations and why?
- What kind of KPIs are effective to evaluate the value of strategic partnership and collaborations?

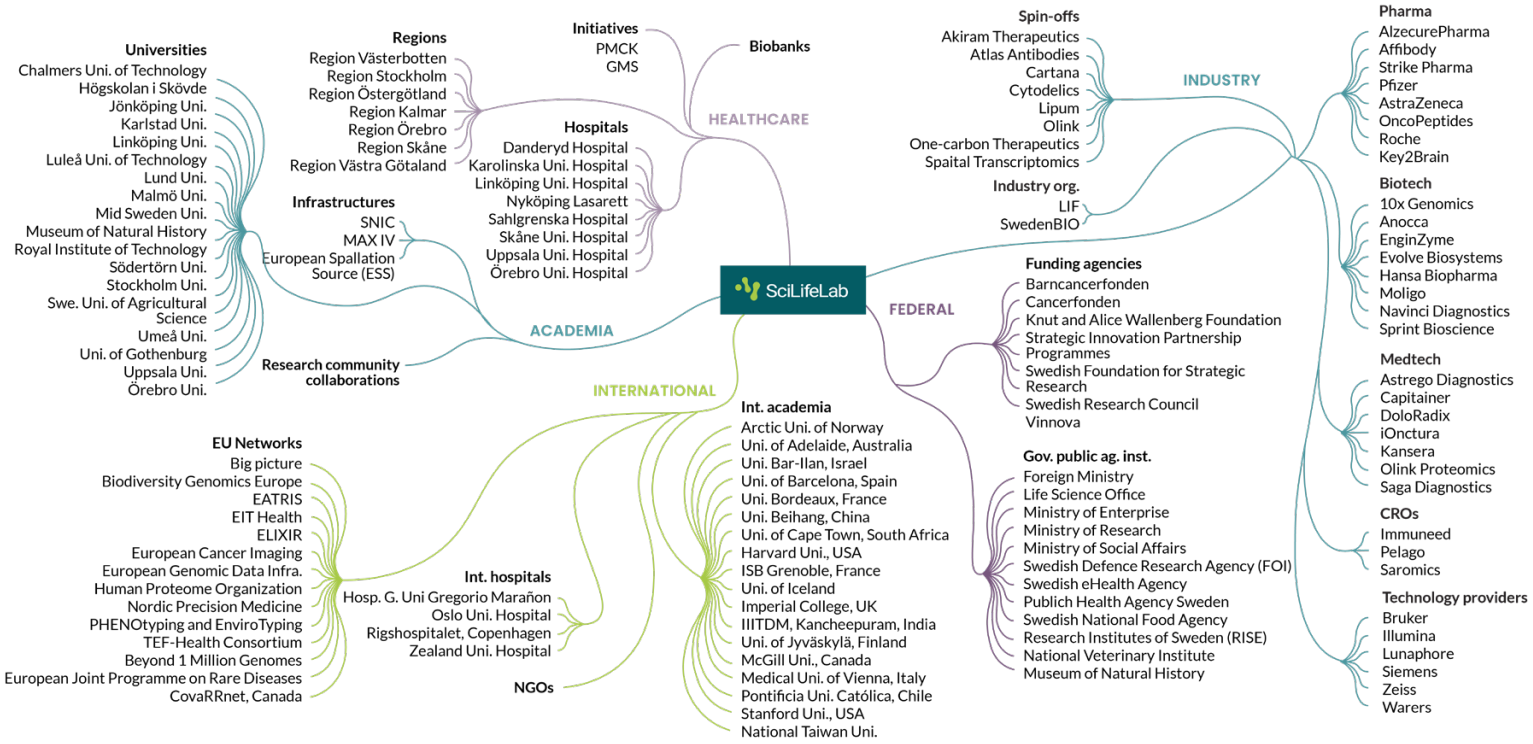


Figure 58. SciLifeLab infrastructure users and external research collaborations span national and international organizations

[32] infralife.se

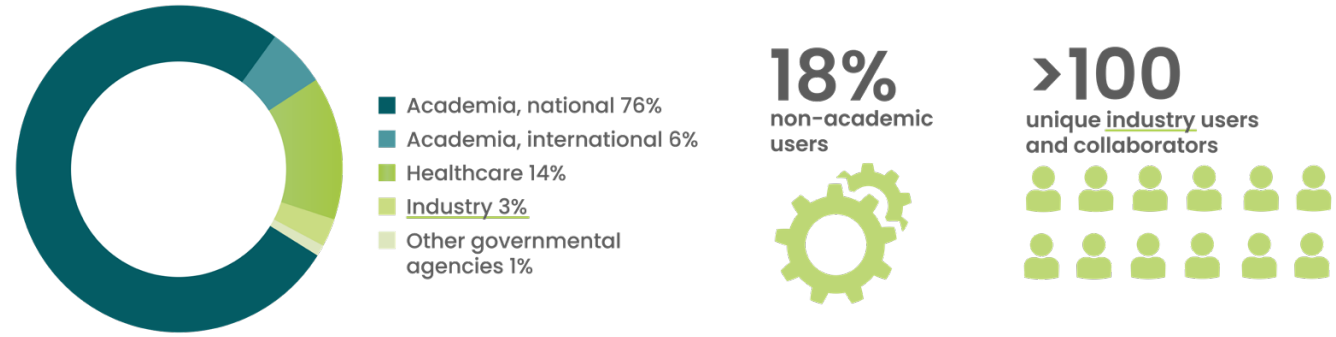


Figure 59. Infrastructure user base distribution showing a total of 18 percent of external non-academic users

Figure 60. Industry user case flyer exemplifying a company using SciLifeLab infrastructure

Notes


SciLifeLab