



**Fourth Report of the International
Advisory Board (IAB)**

Chair: Dr. Jan Ellenberg

January 2022

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A. Members of the International Advisory Board 2021

1. Executive Summary

In its first ten years, SciLifeLab has succeeded to become the trusted entity to operate the national research infrastructure and enable life science that would otherwise not be possible in Sweden. SciLifeLab has proven its ability to switch to a “war time” mode during the SARS-CoV2 pandemic, enabling a well-coordinated rapid response by bundling all technology platforms into a single capability. In the last two years, SciLifeLab has started to pursue many of the strategic directions the IAB had outlined in 2019 in its ten-year forward looking report, whose intention was to help guide the second decade of SciLifeLab. Many of the 2019 recommendations remain valid, as they can only be achieved in the longer term.

SciLifeLab is now starting its second phase on a very strong basis. It has successfully aligned with the government research agenda and engaged strategically with the major private funder of Swedish science, the Knut and Alice Wallenberg Foundation. This has resulted in increased national infrastructure funding as well as a large new investment to promote data driven life science under the SciLifeLab umbrella. Hopefully the renewal and increase of the support for SciLifeLab’s core research by the founding universities will follow suit in the near future. Together, the resources coordinated by SciLifeLab will almost double.

This a major success and operational challenge, but most importantly provides an unprecedented strategic opportunity for Sweden. We recommend that SciLifeLab’s stakeholders seize the opportunity to deploy SciLifeLab’s new capabilities in order to substantially increase the quality of Swedish life science, which despite large investments is lagging behind leading European countries. We are convinced that bringing Sweden to the forefront of international excellence requires using the full added value that SciLifeLab has as a national organisation for the fragmented Swedish life science landscape. To support this, we make five major recommendations:

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.

2. Introduction

The 4th review of the Science for Life Laboratory (SciLifeLab) by the International Advisory Board (IAB) took place virtually, due to pandemic-imposed travel restrictions, on October 19-22, 2021. This review comes at an important moment, when SciLifeLab is starting to implement its new strategy and roadmap for the next 10 years. Important parts of the future strategy have taken the long-term recommendations the IAB provided in its ten-year forward look in 2019 on board, which almost all remain valid and will not be repeated in detail in this report. With its new strategy, SciLifeLab has successfully renewed the infrastructure commitment by the Swedish government and secured a major private investment by the Knut and Alice Wallenberg Foundation (KAW) into data driven life science. Given this context, our report focuses on major recommendations for the implementation of SciLifeLab's strategy for the next two years and provides advice on its future development.

The IAB welcomed back Aviv Regev (Genentech) and at the beginning of the review took note again of its role in SciLifeLab's governance (SciLifeLab rules of procedure Chapter 10, paragraph 1). The IAB is an independent, consultative body consisting of internationally leading experts from a broad range of fields of life sciences relevant for SciLifeLab's activities (for the current composition of the IAB, see Annex A). The mandate of the IAB is to advise the SciLifeLab Board on strategic questions regarding the future of SciLifeLab, especially from an international perspective.

To prepare the review, SciLifeLab management had provided the IAB with a comprehensive report as well as the material of the International Evaluation of the SciLifeLab Infrastructure that was carried out in 2020 with IAB members present as observers of the expert review panel. The SciLifeLab report outlined five key challenges on which IAB input was requested, Infrastructure, Research Profile, Data Driven Life Science, Training and Integration, particularly highlighting the Integration challenge. As many of these challenges were strategic in nature, the IAB chair had requested that similar to 2019, the virtual site visit again offered opportunities for the IAB to consult SciLifeLab stakeholders broadly, including meeting the SciLifeLab Board, the founding university rectors, the management group and campus Solna committee and new campus director, as well as the platform directors and representatives of new national Nodes in Umea, Lund and Gothenburg and last but certainly not least the SciLifeLab research fellows. The IAB is very grateful that all of these important stakeholders were available for discussions and shared their views on the current status and the future role of SciLifeLab.

In addition, we would like to thank SciLifeLab Management for compiling a clear, comprehensive and well-structured report. A special thanks goes to the Operations Office team around Erika and David for organising the IAB's visit with great professionalism, care and dedication.

3. Evaluation of the period 2019 to 2021

3.1. Response to IAB recommendations from 2019

The IAB appreciates the rapid response to its recommendations provided three months after its visit in March 2019, that have been updated and extended in chapter 5. of the 2021 SciLifeLab report. 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.

We will therefore not repeat chapter 5. of the 2021 SciLifeLab report here, but rather provide our general opinion on which recommendations have or are being addressed, which of them have not been and which in our opinion nevertheless remain important to consider in the future.

Overall, our major recommendations in 2019 pertained to the two core activities of SciLifeLab's founding mission, research and infrastructure, and gave advice for development of the future strategy in both areas and on renewing the funding commitments.

On the infrastructure side, big steps towards a more inclusively governed and better integrated national infrastructure have been made. This process is not completed, 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.

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. 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. 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.

Contrasting the absence of a decision to renew the funding for SciLifeLab's core research through the founding universities' SFO funds, the very successful model set by the SciLifeLab fellows program, has allowed SciLifeLab management to engage in a strategic dialogue with the KAW as a private funder and set up a close collaboration with a sister program, the Wallenberg Centre for Molecular Medicine fellows programme. Even more importantly, this good relationship and strategic planning has now resulted in launching a major new 12-year program of 300 Mio Euros that will invest in 40 new young investigators and almost ten times that number of junior research staff in the key area of data driven life science. This 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 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. That the new DDLS program will be run under the SciLifeLab umbrella speaks to the trust Swedish stakeholders now place into SciLifeLab as the national coordinator of life science research activities. It furthermore shows how much the joint research vision of SciLifeLab's founding universities has gained traction, much beyond their own investment. We sincerely hope the founding universities will be motivated by this success of what they have created to redouble their own support and consider taking new forward looking decisions for the next decade. This will allow them to continue to spearhead the development of SciLifeLab rather than risking a role where they passively follow the vision of private investors. 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.

3.2. Highlights 2019-2021

- renewed funding for research infrastructure (RI) and data driven life science (DDLS)
- pandemic response, blueprint for new capabilities
- very strong RI performance
- very strong performance of SciLifeLab fellows
- internationally leading technology developments in spatial omics

4. Strategic advice for the future development of SciLifeLab

4.1 SciLifeLab mission and overall governance

- Continue to develop the mission of a research organisation based on the strong national infrastructure platform.
- 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.
- Seize the integration and re-structuring opportunity DDLS provides, rather than creating two parallel structures.
- 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.

4.2 National infrastructure mission

- Further extend the governance to a truly national and inclusive system that represents all sites.
- 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
- 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.
- 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.
- 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.
- Collaborate more closely with the relevant European infrastructures beyond bioinformatics/ELIXIR, e.g. INSTRUCT, Euro-Biolmaging, 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.
- 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.

- 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.
- 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.

4.3 Research mission

General:

- Renew and increase the funding commitment (SFO) by the four host universities.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.

- The **SciLifeLab group leader** definition is a step forward, but seems to be very “soft” and have 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.
- 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.
- 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.

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.
- 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.
- Develop instruments for fellows to collaborate with each other, especially across host universities, for example a joint postdoc recruitment program, pre-funded for the first year and with a pool of 3-year fellowships for the best candidates.
- Increase transparency and remove inconsistencies between departments/ universities regarding the tenure system.
- Ensure that SciLifeLab fellows are not at a disadvantage compared to their university peers to apply for international funding through their host universities.
- 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.

4.4. Capabilities

- 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.
- Define better for which grand challenges, e.g. major diseases, in Sweden, these capabilities will likely deliver impact in “peace” times.

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

4.5. Data Driven Life Science

- 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.
- 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).
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.

- 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.
- 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.
- 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 Center/DDLS data support team early on.
- 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.

4.6. Training, Innovation and Career Development

- 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 commercialisation of new technologies and applications and could easily fund this activity from a small part of the proceeds of successful initiatives.
- 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.
- 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 fulfill 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.

It is critical that **career development** for 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.
- Regarding **training**, the plans are very promising. We advise to integrate the DDLS related training activities into the overall SciLifeLab training programme.
- 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.

4.7. Continuing to shape the second decade of SciLifeLab

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 groundbreaking 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.

In the view of the IAB, the main strategic recommendations to achieve this are five-fold and we repeat them here:

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 programme** 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.

5. Closing remarks

We very much look forward to SciLifeLab's continued success. We would appreciate to receive a formal response of the SciLifeLab Board to our recommendations within three months after the Board meeting where they are presented.

Annexes to SciLifeLab's International Advisory Board report 2021

Annex A – Members of the International Advisory Board

Jan Ellenberg (Chair)
Søren Brunak
Jo Bury
Yoshihide Hayashizaki
Sirpa Jalkanen
Janet Jansson
Jonathan Knowles
Svante Pääbo
Aviv Regev
Sarah Teichmann