SciLifeLab National COVID-19 Research Program

During the spring of 2020, SciLifeLab launched four main efforts addressing critical needs in the COVID-19 pandemic, through setting up testing, promoting national collaborations, team science and sharing data openly.

This document is a summary of SciLifeLab's efforts to fight the Covid-19 pandemic, with an emphasis on the national research program, which was funded by a 50 MSEK donation from the Knut and Alice Wallenberg foundation (KAW). We summarize the steps to launch the program, its content, aims and a list of participants and projects. The present summary document is the first version as of Oct 7, to be updated later on, including e.g. summary of the major results that will be obtained.

Introduction - SciLifeLab efforts addressing the COVID-19 pandemic

Funding by Knut and Alice Wallenberg foundation (KAW) and early formation of a coordinating COVID-19 action group enabled fast and synchronized actions, including stakeholder meetings (healthcare regions, Public Health agency, Biobank Sweden and others), funding decisions and coordination of the program. The COVID-19 action group includes members from the SciLifeLab management, Data Center, Infrastructure platforms (e.g. Genomics, Diagnostics Development, Proteomics and Metabolomics), Genome Medicine Sweden and Operations Office.

1. SciLifeLab infrastructure facilities prioritize COVID-19 projects

Since mid-March 2020, SciLifeLab infrastructure facilities have been encouraged to prioritize COVID-19 projects, and make the available advanced technologies and expertise available to support researchers working on COVID-19. This prioritization remains in effect, until further notice

2. SciLifeLab/KAW Program for SARS-CoV-2 testing

Funded by Knut and Alice Wallenberg Foundation (KAW), these initiatives were launched to contribute to SARS-Cov-2 testing by sequencing, development of serology testing, and biobanking required to study the development of COVID-19 disease:

- Rapid testing of SARS-Cov-2 in national coordination with health care, Lars Engstrand, *Karolinska Institutet, CTMR/SciLifeLab/GMS Microbiology, Swedish health care regions*
- Development of high-throughput serology testing capability, Peter Nilsson and Sophia Hober, *KTH*
- Sampling of COVID-19 patients for analysis of disease pathogenesis, Hans-Gustaf Ljunggren, *Karolinska Institutet, Karolinska University Hospital*

By October 7, 2020, 253,055 samples have been processed for virus testing in a health care setting of which 11,910 have been positive. At the same time, almost 80,000 serology tests have been carried out (https://covid19dataportal.se).

3. SciLifeLab National COVID-19 Research Program

This program is composed of 67 projects, funded by the 50 MSEK donation from the Knut and Alice Wallenberg Foundation, and divided into nine research areas. Also, SciLifeLab national funding has been allocated to program coordination and data management support, to promote collaboration and data sharing within the program, as well as to support research infrastructure and facilitate the formation of new capabilities to further strengthen the effects of the effort.

4. National COVID-19 Data Portal, coordinated by SciLifeLab

The Swedish COVID-19 Data Portal[1] is coordinated by SciLifeLab and provides information, guidelines, tools and services to support researchers to utilize Swedish and European infrastructures for data sharing, in particular the European COVID-19 Data Portal[2] .

SciLifeLab Data Centre and partners operate the Swedish COVID-19 Data Portal and the Swedish Research Council (VR) is responsible for coordination with the European initiative.

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[1] https://covid19dataportal.se
[2] https://covid19dataportal.org

About this document

This document focuses on describing the objective for starting a national COVID-19 research program at SciLifeLab (effort no. 3, above). It also sets the framework on how the research program operates, connects to SciLifeLab infrastructure as well as the data management, communication, and other support provided by the SciLifeLab Operations Office and SciLifeLab Data Centre, respectively. The document has been written by the program coordinators and reviewed by the SciLifeLab Board, SciLifeLab management group, head of Data Centre, members of the Operations Office as well as research area coordinators and scientific leads of the program and further approved by the program Directors.

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Attachments:

A Conditions for KAW funding, act no. VC2020-0015
B Conditions for national funding, act no VC2020-0026
C Requisition template for KAW funding

1. Background and start of a research program

In March 2020, as part of its COVID-19 action plan, SciLifeLab launched a national call for researchers nationwide, to create a comprehensive program to combat the coronavirus pandemic by studying SARS-Cov2 virus and COVID-19 disease at the molecular, cellular, patient, population and environmental level. A total of 285 proposals were received from applicants affiliated with most Swedish universities, several hospitals, and other organizations in Sweden and abroad (Act no. VC-2020-0011, V-2020-0250).

The SciLifeLab management group reviewed the proposals and consulted external experts when required. In addition to scientific impact, the evaluation criteria considered were relevance and impact on tackling the COVID-19 pandemic, opportunities created by the SciLifeLab community, possibility to form synergies with and collaborations between each other. Commitment and contribution to open data and real-time updates of progress was expected from all funded projects. Support was given only to research areas that linked to molecular virology, environment and medicine, and not e.g. to biomaterials, clinical trials or social sciences. 67 proposals, within nine research areas, were approved by the SciLifeLab board and funded a total of 50 MSEK from the Knut and Alice Wallenberg Foundation (KAW) on May 4, 2020. The nine research areas are presented in table 2. These will be evaluated and current RAs may be fused and new RAs created when the research progresses.

Furthermore, the SciLifeLab board decided to allocated 12 MSEK of national SciLifeLab funding for coordination and collaboration with the KAW funded research projects in order to create national COVID-19 research capabilities[3]. This was the start of the SciLifeLab national COVID-19 research program, tightly interconnected with the SciLifeLab infrastructure and the COVID- 19 data portal, to enable synergies and further strengthen the effects of the effort, steps taken in the formation of the research program are listed in table 1.

Objectives

The purpose of the national COVID-19 research program is to set up capabilities to analyze the current Covid-19 pandemic, future waves of this pandemic and any future viral pandemics. To improve prevention, diagnostics and treatment of the disease, provide a clearer real-time overview of the pandemic, integrate data across technologies and research domains, and create better predictive models.

This will be achieved by creating a unique multidisciplinary COVID-19 research program, with analysis and integration of data from molecules to viruses, host cells, patients, populations

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[3] The funding decisions was made at the SciLifeLab board meeting no 43, 4 May 2020.

and the environment.

i. Fund the best COVID-19 research projects
ii. Create and coordinate the research areas within the program
iii. Link COVID-19 research projects and research areas to the SciLifeLab infrastructure
iv. Create a COVID-19 national data portal

Table 1. Timeline of the formation of the SciLifeLab national COVID19 research program

Date	Milestones
20-Mar	SciLifeLab infrastructure facilities prioritize COVID-19 projects https://www.scilifelab.se/news/23865
22-Mar	**Press release:** KAW funds 50 MSEK to SciLifeLab for scale-up of testing and diagnosis https://kaw.wallenberg.org/press/knut-och-alice-wallenbergs-stiftelse-finansierar-omedelbar-utokad-coronatestning-med-50
25-Mar	**News:** SciLifeLab COVID-19 Action Plan launched and call for COVID-19 related proposals opened https://www.scilifelab.se/news/scilifelabs-handlingsplan-for-covid-19-lanserad-med-utlysning-till-forskarsamhallet-scilifelab-covid-19-action-plan-launched-with-open-call-to-the-research-community
30-Mar	Call closed: 285 proposals submitted!
1 -April	**Decision:** SciLifeLab Board decides to allocate 12 MSEK of national SciLifeLab funds to the SciLifeLab COVID-19 Open call
8-April	**Press release:** SciLifeLab samordnar storsatsning på diagnostik och forskning om Coronaviruset https://www.scilifelab.se/news/scilifelab-samordnar-storsatsning-pa-diagnostik-och-forskning-om-coronaviruset **Decision:** Director's decision to fund first phase of proposals, 11 focused on virus- and immunodiagnostics for COVID- 19 and six initiatives on sample collection and biobanks
04-May	**Decision:** SciLifeLab Board decides to fund in total 67 research proposals with 50 MSEK from KAW
07-May	**News**: SciLifeLab launches national COVID-19 research program with the 67 funded COVID-19 projects https://www.scilifelab.se/news/scilifelab-launches-national-covid-19-research-program
3-June	**Press release**: New national portal coordinated by SciLifeLab and Swedish Research Council makes research data on COVID-19 accessible https://www.scilifelab.se/news/new-national-portal-makes-research-data-on-covid-19-accessible
10-June	**Decision:** Director's decision in consultancy with the Chairman of the SciLifeLab Board to allocate 337.5 tSEK (of the 12 MSEK) national SciLifeLab funds for coordination of RAs May-September 2020

26-June	**Decision:** Director's decision in consultancy with the Chairman of the SciLifeLab Board to allocate 4.36 MSEK (of the 12 MSEK) to urgent RA research infrastructure needs and program data management support
29-June	**News**: National funding to strengthen the collaborative environment of SciLifeLab's COVID-19 research program https://www.scilifelab.se/news/national-funding-to-strengthen-the-collaborative-environment-of-scilifelabs-covid-19-research-program
11-Sep	**Decision:** Director's decision in consultancy with the Chairman of the SciLifeLab board to allocate 292.5 tSEK (of the 12 MSEK) national funds to coordination of RAs October-December 2020
6-Oct	**Decision:** Director's decision in consultancy with the Chairman of the SciLifeLab Board to allocate 6.425 MSEK (of the 12 MSEK) to development of COVID-19 program infrastructure and capabilities
23-Oct	Combating COVID-19 - *A national SciLifeLab initiative funded by the Knut and Alice Wallenberg Foundation* (open webinar)
11-Nov	COVID-19 Colloquium (program meeting)

Economy and Duration

The research program started in May 2020 (*section 1. Background and start of a research program*), and is currently planned to continue until the end of 2021, see below.

The 67 individual research projects within this program are funded by KAW. According to SciLifeLab terms, projects are initiated when project budgets have been approved, i.e. fulfill the instructions and conditions for KAW funding, and the conditions for funding been approved by the recipient and their Head of Department (Attachment A Conditions for funding, act no. VC2020-0015). Economical reporting of project costs during 2020 must be reported to KTH by 31st of January 2021, and costs for 2021 must be reported by 31st of January 2022, in KAW's template for requisition, and according to the instructions and conditions therein (Attachment C Requisition template for KAW funding).

The program and research area coordination are funded by SciLifeLab national funding during the period May until December 2020 (act no. VC2020-0023 and reallocation of resources within the SciLifeLab Operations Office 2020 budget), with a possibility for prolongation into 2021 (SciLifeLab budget decision in November 2020).

National funding allocated to the COVID-19 research program will also contribute to the development of the SciLifeLab infrastructure, by support of the SciLifeLab Data Centre and of the formation of new capabilities between researchers and SciLifeLab facilities, see section research areas and descriptions. In this the respect, the investments in the COVID-19 program will also have a long-term impact. Funding decisions are registered under VC2020-

0023, and Conditions for national funding are registered under VC2020-0026 (Attachment B).

2. Governance and organization

The national COVID-19 research program is governed by the SciLifeLab Board and managed by the SciLifeLab Director. The SciLifeLab Board is the highest decision-making body, however in March 2020 the board decided to delegate funding decisions during 2020 up to 12 MSEK to the SciLifeLab Director [4].

SCILIFELAB BOARD

PROGRAM MANAGEMENT

SciLifeLab Director and Co-director,

Infrastructure director,

Head of Data Centre and
Program coordinators

9 RESEARCH AREAS
Coordinators and scientific lead

and 67 individual research projects
PIs

- Diagnostics for virus
- Data-driven research – models and AI
- Biomarkers and systems immunology
- Biobanks for COVID-19 research
- Viral sequence evolution
- Drug discovery and repurposing of drugs
- High-throughput and high-content serology
- Host cell systems biology and targets
- Environmental virus profiling
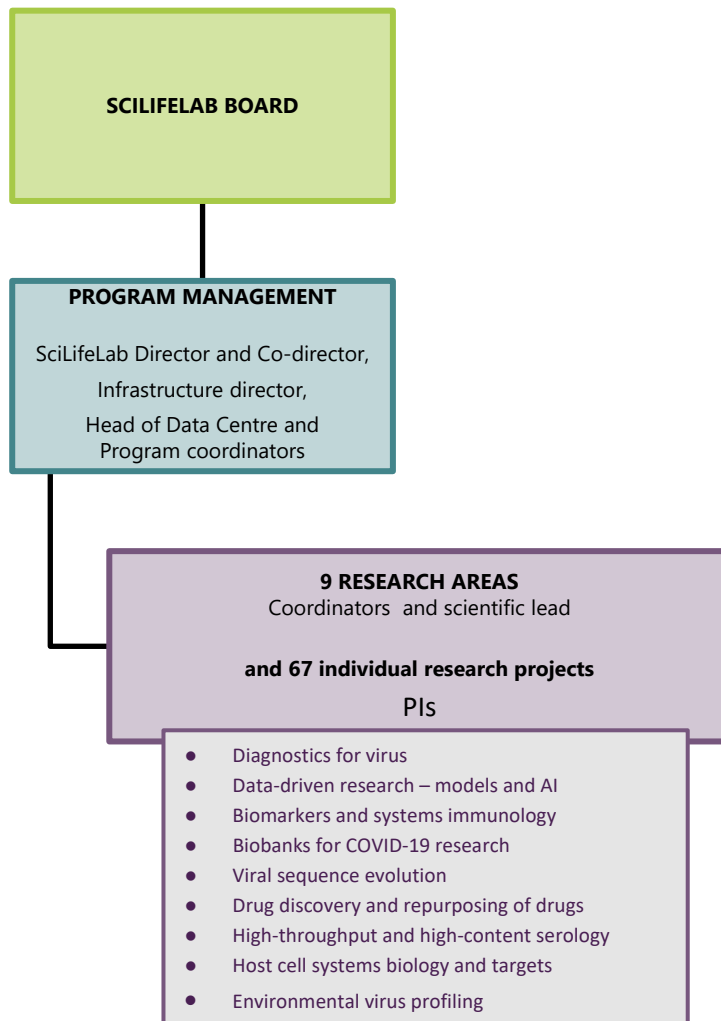
Figure 1. Program organization. The program management is led by the SciLifeLab Director and co-director and placed under the SciLifeLab Board. The 67 individual research projects are categorized and divided into nine research areas. Each research area is coordinated by a research area coordinator (RAC) and scientific lead.

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[4] SciLifeLab Board decision no 43, 4 May 2020

Program management, coordination and support

The COVID-19 research program is managed by the program management who discuss and plan the program activities, see responsibilities below. The program management is led by the SciLifeLab director and co-director, other members are the SciLifeLab infrastructure director (bridging the program with the SciLifeLab infrastructure), the head of SciLifeLab Data Centre, as well as two program coordinators (from the SciLifeLab Operations office). The program management connects to SciLifeLab base organization by using the SciLifeLab Board as the program steering group and by the SciLifeLab management group as an expert group providing the SciLifeLab angle to strategic discussions.

The program coordinators connect to the research areas via the nine research area coordinators (RAC) and their scientific leads, who together work with the research project PIs to enable collaborations and synergies (see section Coordination of Research areas) within and between the RA.

The program has additional support from the SciLifeLab Operations Office area specific support teams (financial, communication, external relations and event) as well as from the SciLifeLab Data Centre.

COVID-19 Research Program Directors:
SciLifeLab Director Olli Kallioniemi (KI) and SciLifeLab Co-Director Siv Andersson (UU)

SciLifeLab's infrastructure director:
Annika Jenmalm Jensen (KI)

COVID-19 Research Program Coordinators :
Disa L Hammarlöf, research coordinator at SciLifeLab operations office (KTH)
Heidi T Persson, project leader at SciLifeLab operations office (UU)

Data Centre
Johan Rung (UU), Head of SciLifeLab Data Centre

Responsibilities

- Run the research program (plan, follow-up, execute, evaluate activities)
- Support the Research area coordinators
- Organize meetings with Research area coordinators
- Promote open science and team science
- Promote cross-coordination between the research areas
- Communicate program achievements (together with research area coordinators as well as PIs of individual projects)
- Inform about new grants announced by other national or international funders

- Inform about progress at COVID-19 coordination update meetings (meeting for the SciLifeLab COVID-19 action plan)
- Prepare decisions for the SciLifeLab Board and SciLifeLab Director
- Collect status reports from Research area coordinators for SciLifeLab management and operations office

Coordination of the nine Research areas

The 67 individual research projects have been categorized and divided into nine research areas. Each research area is coordinated by a research area coordinator (RAC) and a scientific lead (table 2), who should be a senior researcher, a PI level facility/platform Director or a PI funded within this research program. The RAC and SL coordinate research areas together with the main aim to combat the COVID-19 pandemic, their responsibilities are listed below.

Table 2. Research area coordinators and Scientific leads for the 9 research areas

Research Area	Coordinator	Affiliation	Scientific lead	Affiliation
Biobanks for COVID-19 research	Jeannette Lundblad Magnusson (Sandra Falck, KTH May-July 2020)	Karolinska University Hospital	Mia Phillipson	UU
Diagnostics for virus	Not appointed		Ulf Gyllensten	UU
Viral sequence evolution	Alice Sollazzo	UU	Ulf Gyllensten	UU
High-throughput and high-content serology	Maria Pernemalm (Sandra Falck, KTH May-June 2020)	KI	Janne Lehtiö	KI

Biomarkers and systems immunology	David Gotthold	KTH	Jacob Odeberg and Petter Brodin	KTH/KI
Host cell systems biology and targets	Marjo Puumalainen	KI	Oscar Fernandez- Capetillo and Päivi Östling	KI
Drug discovery and repurposing of drugs	Jeannette Dypbukt	KI	Kristian Sandberg and Anna- Lena Gustavsson	UU /KI
Environmental virus profiling	Alice Sollazzo	UU	Anna J. Székely	UU
Data-driven research – models and AI	Ola Spjuth	UU	Johan Rung	UU

Responsibilities of Research area Coordinators and Scientific leads:

General

- Organize a first get together research area meeting (where projects get to present their plans and to discuss possible synergies)
- Organize follow-up meetings within the research area
- Collect statistics and report status from the projects to the SciLifeLab management, Data Centre and Operations Office upon request
- Communicate achievements from the research area and its projects (include updating the Research area specific web site with news, statistics, status updates etc.)
- Coordinate grant plans for other funding initiatives (national and international)
- Participate in COVID-19 research program research area coordinator meetings

Scientific and technological

- Promote open science and team science
- Develop SciLifeLab capabilities
- Promote available access to SciLifeLab infrastructure
- Support links between researchers and SciLifeLab infrastructure

- Promote collaborations with other COVID-19 research initiatives internationally
- Support cross-coordination between the research areas

Data sharing

- Promote available access to SciLifeLab Data Centre
- Support links between researchers and SciLifeLab Data Centre
- Promote usage of SciLifeLab provided data tools for open science and work according to FAIR principles
- Support projects with data handling plans and support their connection to the COVID-19 data portal provided by the SciLifeLab Data Centre https://www.scilifelab.se/data/services-covid-19/

3. Data management and sharing (DC support)

Open data and data sharing are expected from the research projects within this program, and accepting these terms was a basis for the project to receive funding. Therefore, Data Centre received a specific mission to support the research program[5]. This support by provides researchers with tools and services to allow for open data and data sharing as well as collaborative work within and between the research areas and program COVID-19-related research projects.

Tools and services made available through SciLifeLab Data Centre for the National COVID-19 program (see https://www.scilifelab.se/data/services-covid-19/):

- **National COVID-19 Data Portal,** coordinated by SciLifeLab - provides information, guidelines, tools and services to support researchers to utilize Swedish and European infrastructures for data sharing, in particular the European COVID-19 Data Portal. It is regularly updated with new services, tools and data (https://covid19dataportal.se).
- **Slack.** A system for fast paced, dynamic, interactive discussions.
- **Confluence.** A system for collaborative work, where content can be created, shared or edited in workspaces for example for individuals, projects or teams. Share and edit information, documents, manage tasks and project plans.
- **Nextcloud.** For sharing and storage of larger files. A Dropbox style file sharing option for files and data, storage provided by SciLifeLab.
- **SciLifeLab Data Repository (**powered by Figshare, https://figshare.com). A repository to publish any kind of data, documents, figures, presentations, etc. according to FAIR guidelines. It provides version control and ability to annotate meta data, and you can work on submissions until you actively choose to publish. There is a possibility to add license information for how to use the material, and a permanent DOI will be generated for each submission.
- **Data Stewardship Wizard,** a system for Data Management Plans (DMPs). Such plans are required by many funders, including the Swedish Research Council (VR). The Data Stewardship Wizard at SciLifeLab provides templates and guidelines and support particularly configured for life science research projects.

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[5] SciLifeLab national funding act no. VC2020-0023: 1+1 MSEK to Data Center COVID-19 program data management support, June 26 and October 6.

4. Connections with SciLifeLab infrastructure

Since March 20, SciLifeLab facilities have been asked to prioritize service of COVID-19 projects in their work-flow, to make their advanced technologies and expertise available to these researchers. This prioritization applies also to projects outside of the COVID-19 research program. The facilities are asked to keep a special track record on these projects, and what overall impact this re-prioritization might have had on the facility's normal workflow. This information will be shared with the SciLifeLab Board, management group, in the annual report and to external parts (but will not be used as basis for facility evaluations). Prioritization should be applied during the term of the national COVID-19 research program at SciLifeLab, until December 31, 2021.

Facilities are encouraged to report any COVID-19 related news and achievements to news@scilifelab.se.

To remove infrastructure bottle-necks and meet urgent needs identified by the research areas, and to promote formation of new capabilities at SciLifeLab infrastructure, national SciLifeLab funding has been allocated to better meet the needs of the COVID-19 research program. All SciLifeLab platforms were eligible to apply for this support, not only those directly connected to the RA.

5. Communication in the community

PIs within the research program are urged to actively communicate and share information, data, preliminary results and news from their research. This is all in accordance with the goals of open science, transparency and reproducible research. This can be done through the SciLifeLab website, news channels and systems provided by SciLifeLab Data Centre.

Program coordinators are responsible for communicating program achievements and Research area coordinators together with PIs achievements from their respective research area and its projects. This includes adding and updating content on the website, informing SciLifeLab communications officers about news, upcoming press releases, new publications and other progress as outcomes of the program and research area.

Website

The aim is to maintain an up to date program website (https://www.scilifelab.se/scilifelab-efforts-during-the-covid-19-pandemic/the-scilifelab-national-covid-19-research-program/).

Program coordinators are responsible of the content on the main COVID-19 research program web pages, whilst research area coordinators are responsible for the content on the research area specific pages including information on the individual project pages. Research area coordinators that are not employed at SciLifeLab Operations Office will receive practical help with updating the website by sending material to website@scilifelab.se.

News and press releases

Any news or potential press releases are sent to news@scilifelab.se.

Press releases connected to research publications are primarily made from the researcher´s host university and SciLifeLab writes news items based on the release and share it in social media. Generally, press releases from SciLifeLab are made for organizational changes, new efforts, collaborations etc.

Data sharing is a key component of this COVID-19 national research program. At the same time, research efforts addressing the COVID-19 pandemic are of large interest for the general public. Therefore, SciLifeLab makes a distinction on how it handles peer-reviewed material versus pre-print publications. As a general guideline, peer-reviewed material may be highlighted in the SciLifeLab news feed (website, newsletter, social media), with a broader target audience and where the quality of reporting is of major importance. Unpublished research data and pre-print publications, shared for the purpose of enabling research in accordance with open science, transparency and reproducible research, can be

shared using the national and/or international resources, including those available through the Swedish COVID-19 Data Portal, see section 3 Data management and sharing.

Communication material, guidelines and templates:

Program coordinators will provide templates for communication purposes upon request.

SciLifeLab graphic guidelines and templates:
https://www.scilifelab.se/staff/communications/visual-identity/

Power point slide describing the COVID-19 research project

To be enable communication about research projects a power point slide set (max of 3-4 slides for each RA) is collected and updated regularly. The ppt should describe the aim of project and impact on society (Goals/Objectives, project plan), results and conclusions (preferably as figures, charts and tables) and short about method if applicable, preferably as a figure (template provided by program coordinators). The updated slides are shared at the research program website.

6. Reporting RA achievements

To follow the research program development and achievements RAs are asked to report status, news, statistics and common achievements from the research projects as well as from the research areas to the SciLifeLab management, Data Centre and Operations Office.

The first reporting was requested at the start of the program, when all research project PIs were asked to submit a short project description, shared through the website. Each RA will further be asked for a mid-term report (due December 4, 2020) and a final report (due December 3, 2021), compiled by the RA scientific lead and coordinator together with their RA PIs. Reporting will be done in reporting template provided by SciLifeLab. Reported deliverables will be used in the report to the KAW as well as in annual reports to the Ministry of Education and Research, as well as in other web-based or printed material that describes SciLifeLab activities.

This document describes the background of SciLifeLab:s national COVID-19 program. Follow-up reports will describe the results of the program.

When publishing results from the funded project, funding through the SciLifeLab National COVID-19 Research Program should be referred to as *SciLifeLab/KAW national COVID-19 research program project grant*.

7. Research area membership and descriptions

To enable knowledge transfer and synergies, the 67 projects have been connected to each other, through the categorization of each project into one of nine research areas. These involve projects studying COVID-19 at the molecular, cellular, patient, population and environmental level as well as on a methodological level (e.g. bioinformatics, sequencing, immunology, chemical biology and drug testing). In addition, capabilities, such as biobanking, that facilitate other research areas were funded.

RA membership

Each Principle Investigator (PI) is automatically assigned a membership to the RA their project belongs to. One PI can be a member of more than one RA and thus have multiple memberships, but one RA should be considered the primary one (for reporting purposes.) The RA membership can be changed if agreed with scientific leads and coordinators at both RAs (the original assignment and the new membership) and must be reported to the program coordinators.

Program members, i.e. PIs with COVID-19 project funding (from KAW) are expected to actively participate in RA activities, comply to the confidentiality and agreements within the RA, and program reporting.
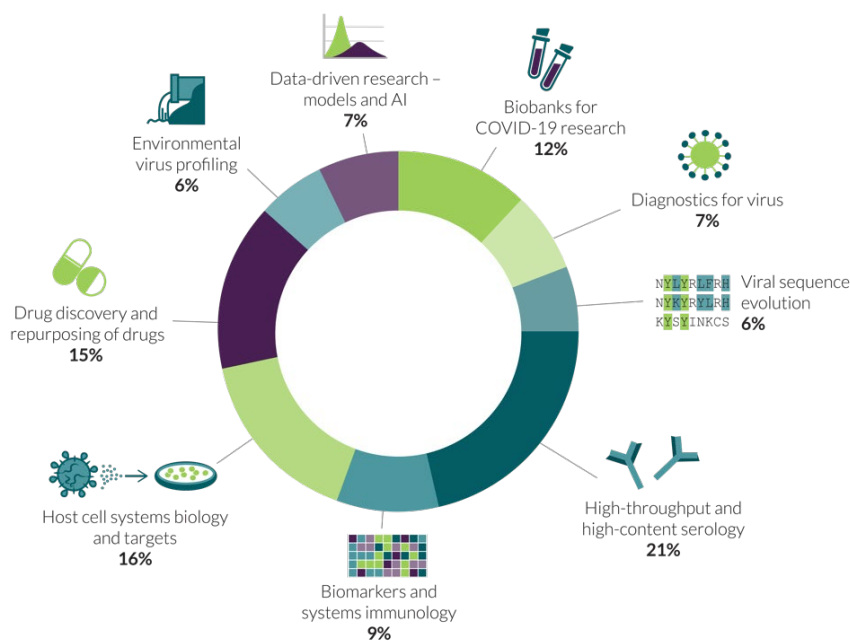

Figure 2. An overview of the National SciLifeLab Covid-19 research program and the nine research areas. Proportion of projects in each research area is indicated as a percentage.

Description of the nine research areas and projects funded in each:

Biobanks for COVID-19 research

This research area aims at developing and coordinating biobanking of COVID-19 samples (e.g. multiple sample types and longitudinal follow-up) for current and future national research efforts. The ambition is sharing best practices and coordinating samples available for research. The work is carried out in collaboration with Biobank Sweden.

This area consists of 8 individual projects, all together funded by a total of 7,7 MSEK from KAW. Led by researchers at Uppsala University, Karolinska Institutet, Umeå University, University of Gothenburg, Lund University and Örebro University. National funding has been allocated to the RA for coordination and biobanking of clinical samples (June 26, 610 tSEK), and to support sample collection capabilities and sample quality (October 6, in total 1 MSEK).

Scientific Lead: Mia Phillipson, *Uppsala University*
Coordinator: Jeannette Lundblad Magnusson*, Karolinska University Hospital*,
jeannette.lundblad@scilifelab.se
(Sandra Falck, KTH May - July 2020)

- **Uppsala COVID-19 ICU Biobank**
  Michael Hultström, *Uppsala University*

- **Building Capacity – the Sahlgrenska COVID-19 Biobank**
  Magnus Gisslen, *University of Gothenburg*

- **COVID-UMU: Sample collection and understanding the transition from mild to severe COVID-19**
  Clas Ahlm, *Umeå University*

- **Assessment of SARS-CoV-2 specific antibodies in adults, and building a repository of samples from seroconverted asymptomatic adults**
  Åsa Torinsson Naluai, *University of Gothenburg*

- **The spread of SARS-CoV-2 monitored by the serum samples routinely obtained through maternal screening and blood donor screening**
  Martin Sundqvist, *Örebro University*

- **The COMMUNITY Study- COVID-19 Biomarker and Immunity Study**
  Charlotte Thålin, *Karolinska Institutet/Danderyd Hospital*

- **Establishing a biobank of clinical specimens for studying evolution of viral diversity and development of immune response, including inflammation, seroprevalence and protective**

antibodies, in SARS-Cov2 infection (Biobank)
Patrik Medstrand, *Lund University*

- **A biomarker-based approach to rapidly identify COVID-19 patients at high risk of severe disease and mortality at 3 emergency departments in Region Skåne**
  Toralph Ruge, *Lund University*

In addition to the above, blood samples from infected patients that are acquired through the Hans-Gustaf Ljunggren project (KI) will be biobanked at the Stockholm Medical Biobank. The swab samples from health care and elderly care personnel that undergo qPCR analyses at Lars Engstrand's facility (KI) will be stored for the regions at the KI Biobank.

Diagnostics for virus

This research area aims at developing alternative viral RNA diagnostics by:

1. Establish testing capacity using alternative technologies to that used in the main testing program, as backup capacity and to ascertain self-sufficiency in case of deficiency of testing reagents from the present suppliers.
2. Examine alternative technologies that would enable simpler, cheaper and faster testing, as well as testing outside the health-care system such as self-sampling and self-testing. This part will harness the wide range of advanced technologies developed by SciLifeLab research groups.

The projects will be able to connect with the KI´s and SciLifeLab´s Centre for Translational Microbiome Research laboratory (https://www.scilifelab.se/covid-19/kaw-program/sars-cov-2-testing/), to test and compare methods.

This area consists of 5 individual projects, all together funded by a total of 2,3 MSEK from KAW. Led by researchers at Uppsala University, Karolinska Institutet and Stockholm University.

Scientific Lead: Ulf Gyllensten, *Uppsala University*

- **Simple and cheap remote test for infection based on HCR**
  Björn Högberg, *Karolinska Institutet*

- **COVID-19 screening test design**
  Masood Kamali-Moghaddam, *Uppsala University*

- **iLACO-Sweden**
  Vicent Pelechano, *Karolinska Institutet*

- **Extraction-free high-sensitive RT assay for SARS-CoV-2 RNA detection**
  Björn Reinius, *Karolinska Institutet*

- **RCA-COVID-DIA**

Mats Nilsson, *Stockholm University*

Viral sequence evolution

This research area aims at developing capabilities for viral genome sequencing of all positive patients to follow mutations and enable tracing of infection spread. The large-scale genome sequencing capability will also contribute to establishing a database of genome variation in collaboration with similar sequencing efforts such as the UK COVID-19 Sequencing Consortium.

This area consists of 4 individual projects, all together funded by a total of 1,7 MSEK from KAW. Led by researchers at Uppsala University, Karolinska Institutet and Stockholm University. On October 6, 700 tSEK national funding was allocated to COVID-19 program sequencing capability, both to support coordination of environmental and COVID-19 samples, and build-up of long-term capability for Environmental virus profiling.

Scientific Lead: Ulf Gyllensten, *Uppsala University*,
Coordinator: Alice Sollazzo, *Operations Office, SciLifeLab*, alice.sollazzo@scilifelab.uu.se

- **COVseq – Developing COVseq for mass-scale SARS-CoV-2 sequencing**
  Nicola Crosetto, *Karolinska Institutet*

- **A community resource for SARS-CoV-2 structure, interactome and evolution**
  Arne Elofsson, *Stockholm University*

- **Rapid cDNA and direct RNA sequencing of SARS-CoV-2 using Oxford Nanopore**
  Lars Feuk, *Uppsala University*

- **Analysis of essential genes and validity as drug targets**
  Tomas Nyman, *Karolinska Institutet*

High-throughput and high-content serology

The research area aims at building capabilities for high-throughput serology diagnostics and national testing, as well as contributing to point-of -care testing setup. Furthermore, understanding the nature of immune response, exploring infection epidemiology and neutralizing antibody development are crucial for this area.

This area consists of 14 individual projects, all together funded by a total of 11,9 MSEK from KAW. Led by researchers at KTH Royal Institute of Technology, Uppsala University, Karolinska Institutet, Stockholm University, Umeå University, University of Gothenburg and Lund University. National funding has been allocated to the RA to support data analysis and logistics (June 26, 600 tSEK) and the development of a cross-facility capability related to epitope mapping (October 6, 960 tSEK).

Scientific Lead: Janne Lehtiö, *Karolinska Institutet*
Coordinator: Maria Pernemalm, *Karolinska Institutet*, maria.pernemalm@scilifelab.se (Sandra Falck, KTH May - July 2020)

- **Optimized expression of the SARS-Cov-2 Spike protein in mammalian cells for serology testing and functional studies**
  Fredrik Sterky, *University of Gothenburg*

- **Production of SARS-CoV-2 surface proteins in HEK293 cells**
  Juni Andréll, *Stockholm University*

- **Biological investigations of COVID-19 in cancer patients**
  Gunilla Enblad, *Uppsala University*

- **Peptides for serological test of COVID-19 antibodies and as molecular tools**
  Ulf Göransson, *Uppsala University*

- **Seroprevalence and predictors of COVID-19 disease severity in two areas of Sweden**
  Anne Lindberg, *Umeå University*

- **Large-scale production of a bio-safe antigen of COVID-19 and chimeric bat coronaviruses**
  Kenta Okamoto, *Uppsala University*

- **Translational serology for a population-wide assessment of COVID-19 immunity**
  Jochen Schwenk, *KTH*

- **Multiplex analysis of immune response against COVID-19**
  Sophia Hober, *KTH*

- **Rapid development of novel antibody assays diagnosing COVID-19**
  Jan-Åke Liljeqvist, *University of Gothenburg*

- **Human antibodies against the SARS-CoV-2 spike protein**
  Mats Ohlin, *Lund University*

- **Characterization of the B cell response during SARS-CoV-2 infection**
  Karin Loré, *Karolinska Institutet*

- **PLA-based large-scale analysis of Corona virus immunity**
  Ulf Landegren, *Uppsala University*

- **Neutralizing human B-cell derived monoclonal antibodies to SARS-CoV-2**
  Pontus Nordenfelt, *Lund University*

- **SICoV - Serological Investigations on SARS-CoV-2 and other coronaviruses - improved diagnostics and knowledge**
  Åke Lundkvist, *Uppsala University*

Biomarkers and systems immunology

This research area aims at creating capabilities for discovery and validation of diagnostic, predictive, prognostic and therapeutic biomarkers. In addition, building capabilities for systems immunology and systems virology of COVID-19 infected patients, as well as concepts towards individualized monitoring and targeting of cytokine storms are also part of the aim.

This area consists of 6 individual projects, all together funded by a total of 6,6 MSEK from KAW. Led by researchers at KTH Royal Institute of Technology, Karolinska Institutet, University of Gothenburg, Lund University and Linköping University. Together with RA Biobanks for COVID-19 research, Biomarkers and systems immunology received national funding support to ensure sample quality and adequate sample collection capabilities (October 6, 300 tSEK).

Scientific Lead: Jacob Odeberg, *KTH* **and Petter Brodin,** *Karolinska Institutet,* **Coordinator:** David Gotthold, *Operations Office, SciLifeLab,* david.gotthold@scilifelab.se

- **Identification of plasma biomarkers for risk stratification of hospitalised COVID-19 patients**
  Jacob Odeberg, *KTH*

- **Prediction of severe disease in COVID-19**
  Lars-Magnus Andersson, *University of Gothenburg*

- **Taking back the control of the SARS-CoV2 antiviral immune response as a mean to neutralize the COVID-19 disease pathogenicity**
  Marie Larsson, *Linköping University*

- **Systems immunology analyses of the cytokine storm in COVID-19**
  Petter Brodin, *Karolinska Institutet*

- **Establishing a biobank of clinical specimens for studying evolution of viral diversity and development of immune response, including inflammation, seroprevalence and protective antibodies, in SARS-Cov2 infection (Research project)**
  Patrik Medstrand, *Lund University*

- **Dynamics and longevity of the specific adaptive immune response in COVID-19 patients**
  Davide Angeletti, *University of Gothenburg*

Host cell systems biology and targets

This research area aims at creating capabilities for discovery and functional understanding of the virus interactome and host effects, and build capabilities for high-throughput (chemical and CRISPR) analysis of virus-infected cells. Furthermore, the projects aim to build cell models, assays and data.

This area consists of 11 individual projects, all together funded by a total of 5,3 MSEK from KAW. Led

by researchers at Uppsala University, KTH Royal Institute of Technology, Karolinska Institutet, Lund University and Umeå University. On June 26, 1 MSEK national funding was allocated to the program to support for BSL3 access for COVID-19 research projects.

Scientific lead: Oscar Fernandez-Capetillo and Päivi Östling, *Karolinska Institutet*
Coordinator: Marjo Puumalainen, *Karolinska Institutet*, marjo.puumalainen@scilifelab.se

- **Functional characterization of COVID-19-host response using single-cell transcriptomics and CRISPR screens**
  Anna Överby Wernstedt, *Umeå University*

- **Immediate molecular response to SARS-CoV-2 infection**
  Jonas Klingström, *Karolinska Institutet*

- **Mapping SARS-CoV-2 host-pathogen interactions for drug repurposing**
  Ylva Ivarsson, *Uppsala University*

- **Viral-host interaction of SARS-CoV-2 protein corona**
  Maria Pernemalm, *Karolinska Institutet*

- **Profiling of host proteins associated to the envelope of SARS-CoV-2**
  Claudia Fredolini, *KTH*

- **Genetic screens to identify novel determinants of SARS-CoV-2 infection**
  Oscar Fernandez-Capetillo, *Karolinska Institutet*

- **CoronaCETSA**
  Leo Hanke, *Karolinska Institutet*

- **Identification of host factors targeted by coronaviruses by Thermal proteome profiling**
  Oscar Fernandez-Capetillo, *Karolinska Institutet*

- **High throughput imaging platform**
  Erdinc Sezgin, *Karolinska Institutet*

- **Human precision cut lung slices as an ex vivo model for studying SARS-CoV2 infection and identifying potential therapies**
  Darcy Wagner, *Lund University*

- **Cas13-CoV**
  Claudia Kutter, *Karolinska Institutet*

Drug discovery and repurposing of drugs

This research area aims at setting up capabilities for drug discovery and repurposing of existing drugs

for COVID-19, and starting pilot projects towards identification of lead molecules (chemicals and biomolecules). Additional aim is to coordinate technologies, capabilities and national expertise, such as data-driven (chemoinformatic) approaches.

This area consists of 10 individual projects, all together funded by a total of 8,7 MSEK from KAW. Led by researchers at Uppsala University, KTH Royal Institute of Technology, Karolinska Institutet and University of Gothenburg. National funding has been allocated to the RA for support of database build-up and compound center (June 26, 800 tSEK), and for maintenance of the chemistry-centric data portal for COVID-19, and development of capabilities in ChemoInformatics and Computational chemistry (October 6, 700 tSEK).

Scientific lead: Kristian Sandberg, *Uppsala University*, and Anna-Lena Gustavsson, *Karolinska Institutet*
Coordinator: Jeannette Dypbukt, *Karolinska Institutet,* jeannette.dypbukt@scilifelab.se

- **NEVERMORE COVID – Establishing a drug discovery platform for corona virus disease**
  Kristian Sandberg, *Uppsala University*

- **A high-quality drug repurposing set**
  Anna-Lena Gustavsson, *Karolinska Institutet*

- **Multi-level profiling of Coronavirus-infected cells by combining Viral Entry Assays, Cell Painting, and DrugSEQ**
  Ola Spjuth, *Uppsala University*

- **Spatial single cell mapping of SARS-CoV-2 interacting host proteins for quick and targeted drug repurposing**
  Charlotte Stadler, *KTH*

- **FragCor - Fragment based NMR screen targeting SARS-Cov-2 proteins**
  Göran Karlsson, *University of Gothenburg*

- **An adaptable therapeutic technology platform to treat SARS-CoV infections in immune suppressed individuals**
  Sara Mangsbo, *Uppsala University*

- **Rapid testing for treatment of COVID-19**
  Kristina Nyström, *Sahlgrenska University Hospital*

- **Discovery of SARS-CoV-2 Inhibitors by Virtual Screening of Ultra-large Chemical Space**
  Jens Carlsson, *Uppsala University*

- **Chemographic characterization of compounds binding to seven identified molecular targets from SARS-CoV-2**
  Anders Backlund, *Uppsala University*

- **Distributed computing to generate the druggable conformational ensemble of sars-cov-2 proteins**
  Lucie Delemotte, *KTH*

Environmental virus profiling

This research area aims at setting up high-throughput virus testing capability at SciLifeLab from environmental samples, and start pilot projects towards systematic longitudinal monitoring of COVID-19 cycles from environmental samples (e.g. wastewater). Furthermore, it aims at comparing data with human sampling and contributing towards understanding epidemics.

This area consists of 4 individual projects, all together funded by a total of 3 MSEK from KAW. Led by researchers at Uppsala University, KTH Royal Institute of Technology, Stockholm University and SLU. National funding has been allocated to the RA for support of infrastructure required to create a national function for biobanking of environmental samples for virus monitoring (June 26, 300 tSEK), and for the establishment of a national resource dedicated to environmental monitoring of infectious agents, an environmental virus biobank and profiling capability at SciLifeLab (October 6, 1.5 MSEK in total). In addition, national funding has been allocated to the development of a COVID-19 program sequencing capability, that will support coordination of environmental samples, and be a long-term capability for Environmental virus profiling (see RA section Viral sequence evolution).

Scientific Lead: Anna J. Székely, *Uppsala University*
Coordinator: Alice Sollazzo, *Operations Office, SciLifeLab*, alice.sollazzo@scilifelab.uu.se

- **SARS-CoV-2 in sewage water as a tool for monitoring the potential circulation of the viruses in the population and rate of infections (SARS-CoV-2@WWTP)**
  Zeynep Cetecioglu Gurol, *KTH*

- **Sewage as a proxy for SARS-CoV2 prevalence**
  Maja Malmberg, *SLU*

- **Detection, monitoring and genetic evaluation of SARS-CoV2 in wastewater treatment plants**
  Anna J. Székely, *Uppsala University*

- **Surface persistence and SARS-CoV-2 exposure in the Stockholm Subway**
  Klas Udekwu, *Stockholm University*

Data-driven research – models and AI

This research area aims at developing data collection capabilities for development of advanced

models, integrating national and international data sets (SciLifeLab and EBI COVID-19 data hubs). Promote FAIR and real-time open science and integration of molecular and medical data.

This area consists of 5 individual projects, all together funded by a total of 2,8 MSEK from KAW. Led by researchers at Uppsala University, KTH Royal Institute of Technology, Karolinska Institutet, Linköping University and Lund University.

Scientific Lead: Johan Rung, *SciLifeLab Data Centre and Uppsala University*
Coordinator: Ola Spjuth, *Uppsala University,* Ola.Spjuth@farmbio.uu.se

- **A multi-level digital twin framework for COVID-19: from mechanisms of disease ethiology, to clinical decision-support and epidemiology**
  Gunnar Cedersund, *Linköping University*

- **Building a platform with AI models, datasets and web applications for fighting COVID-19**
  Emma Lundberg, *KTH*

- **Artificial intelligence-based knowledge curation to direct COVID-19 research and public health efforts**
  Sonja Aits, *Lund University*

- **COVID-19 – a population-based project of ICU patients**
  Emma Larsson, *Karolinska Institutet (will be combined with project below)*

- **Characterization of ICU treated COVID patients in Sweden**
  Jonathan Grip, *Karolinska Institutet (will be combined with project above)*