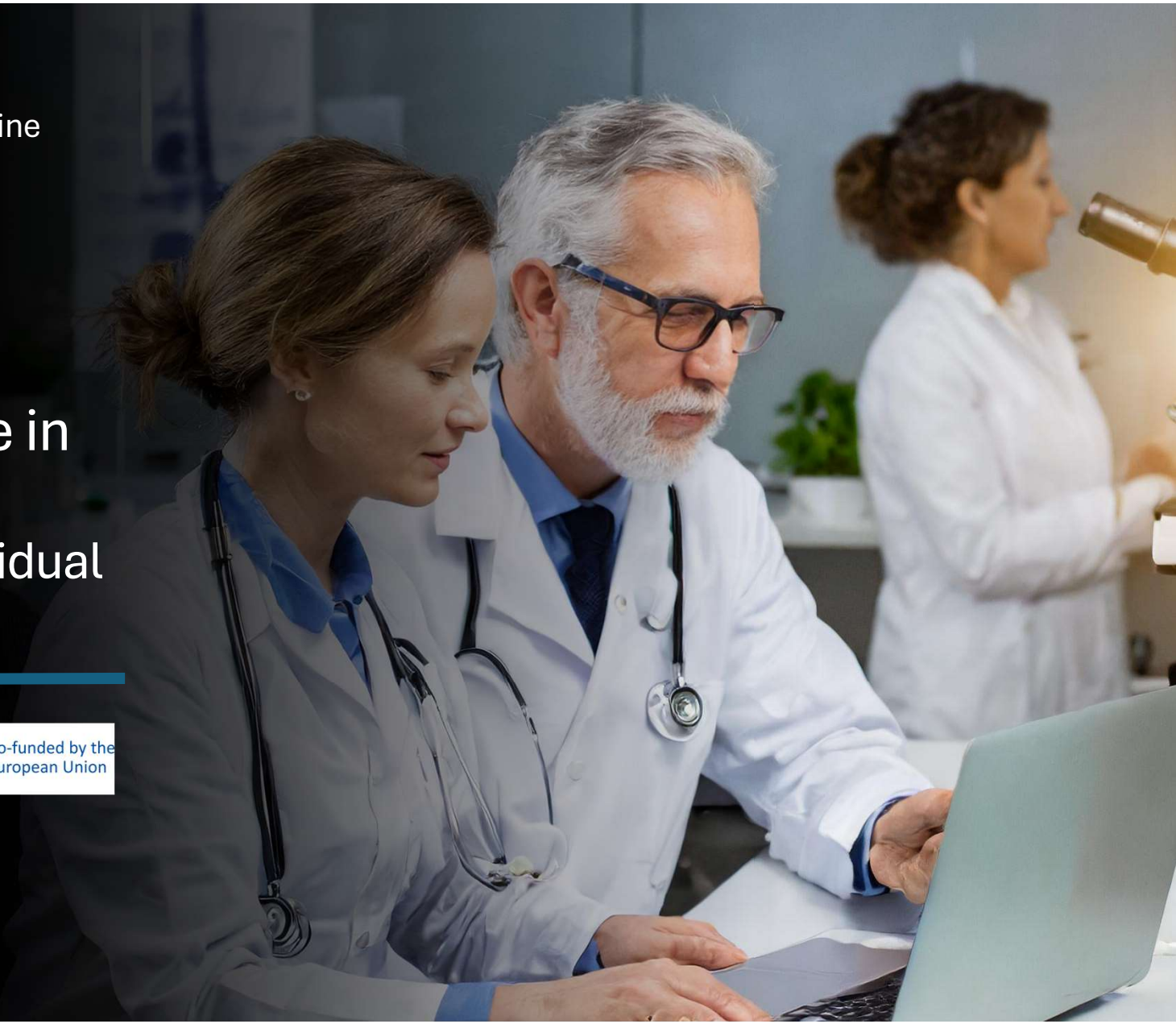




#HealthUnion
#personalisedmedicine

Personalised Medicine in Practice

– from a system to an individual perspective.



Welcome!

Ms. Anne Andersson

CEO at Stockholm Region EU Office.

Ms. Sanna Sjöblom

Policy Officer at the University Alliance
Stockholm Trio.



A system perspective and the challenges.

Dr. Malin Eklund.

PhD, Programme manager within
Sustainable Precision Health at
Vinnova.

VINNOVA
Sweden's Innovation Agency





Together

Together, we will make Sweden an innovative force in a sustainable world.

Innovation

Innovation is more important than ever,
and we need innovation in a broad sense

Vinnova support needs-driven research
and innovation

Vinnova is an active partner for
system transformation

PRESENTATION ABOUT VINNOVA

Identify Connect Fund



Photo: Johnér bildbank

VINNOVA

An aerial photograph of a vast green forest under a dramatic sunset sky. The sun is low on the horizon, casting a golden glow through the clouds. In the distance, a cityscape is visible, partially obscured by the forest. The overall mood is serene and hopeful.

SEK 3,4 billion

Our role as a funder is significant

Photo: Johner Bildbank

VINNOVA

PRESENTATION ABOUT VINNOVA

HORIZON EUROPE

We're the link to EU funding



Societal challenges

Innovative capabilities



Societal challenges

Sustainable industry

Sustainable food systems

Sustainable mobility

Sustainable precision health

Sustainable societies

Innovative capabilities

Digital transformation

Ecosystems for innovative companies

Future areas of innovation

Definition Personalised Medicine

Council conclusions from 2015

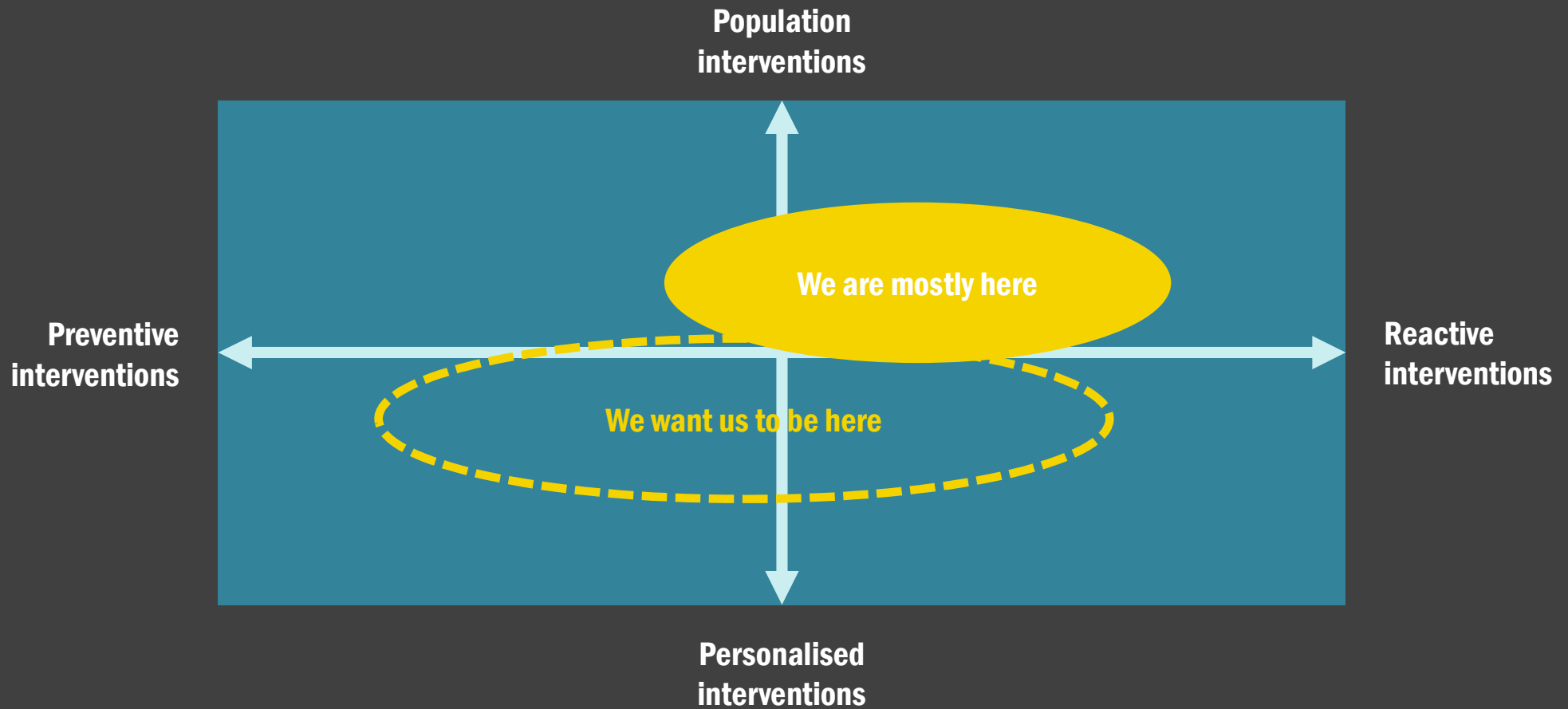
Personalised Medicine refers to:

'a medical model using characterisation of individuals' phenotypes and genotypes (e.g. molecular profiling, medical imaging, lifestyle data) for tailoring the right therapeutic strategy for the right person at the right time, and/or to determine the predisposition to disease and/or to deliver timely and targeted prevention.'

(https://ec.europa.eu/info/research-and-innovation/research-area/health-research-and-innovation/personalised-medicine_en)



Personalised Medicine



Why Personalised Medicine

In the EU on average, 18 years of the later stage of life are spent with at least one chronic disease, many of them avoidable. Yet most resources are spent on diagnosis and treatment, much less on preventative measures

1 euro invested in prevention can give 6 euros back https://www.oecd-ilibrary.org/social-issues-migration-health/the-heavy-burden-of-obesity_67450d7-en

1 euro invested in womans health can give 3 euros back McKinsey report [Closing the women's health gap: A \\$1 trillion opportunity to improve lives and economies | McKinsey](#)

A substantial percentage of prescribed drugs do not benefit the patient (genetics, poly-pharmacy, diet, insufficient clinical evidence, RWE etc)

30% ineffective drug prescription and adverse drug reactions can be avoided if we use pharmacogenomic information (Sven et al. Lancet 2023)

Why Personalised Medicine

1 euro invested in prevention of obesity gives 6 euros back https://www.oecd-ilibrary.org/social-issues-migration-health/the-heavy-burden-of-obesity_67450d7-en. 40% of cancers are preventable.

1 euro invested in womans health give 3 euros back McKinsey report [Closing the women's health gap: A \\$1 trillion opportunity to improve lives and economies | McKinsey](#)

A substantial percentage of prescribed drugs do not benefit the patient (genetics, poly-pharmacy, diet, insufficient clinical evidence etc)

30% ineffective drug prescription and adverse drug reactions can be avoided if we use pharmacogenomic information (Swen et al. Lancet 2023)

We work on a continuum towards more stratified and individualised treatments as well as more precise health promoting interventions

Empirical medicin



Stratified medicine



Precision medicine



Preventive medicine



The European Partnership for Personalised Medicine

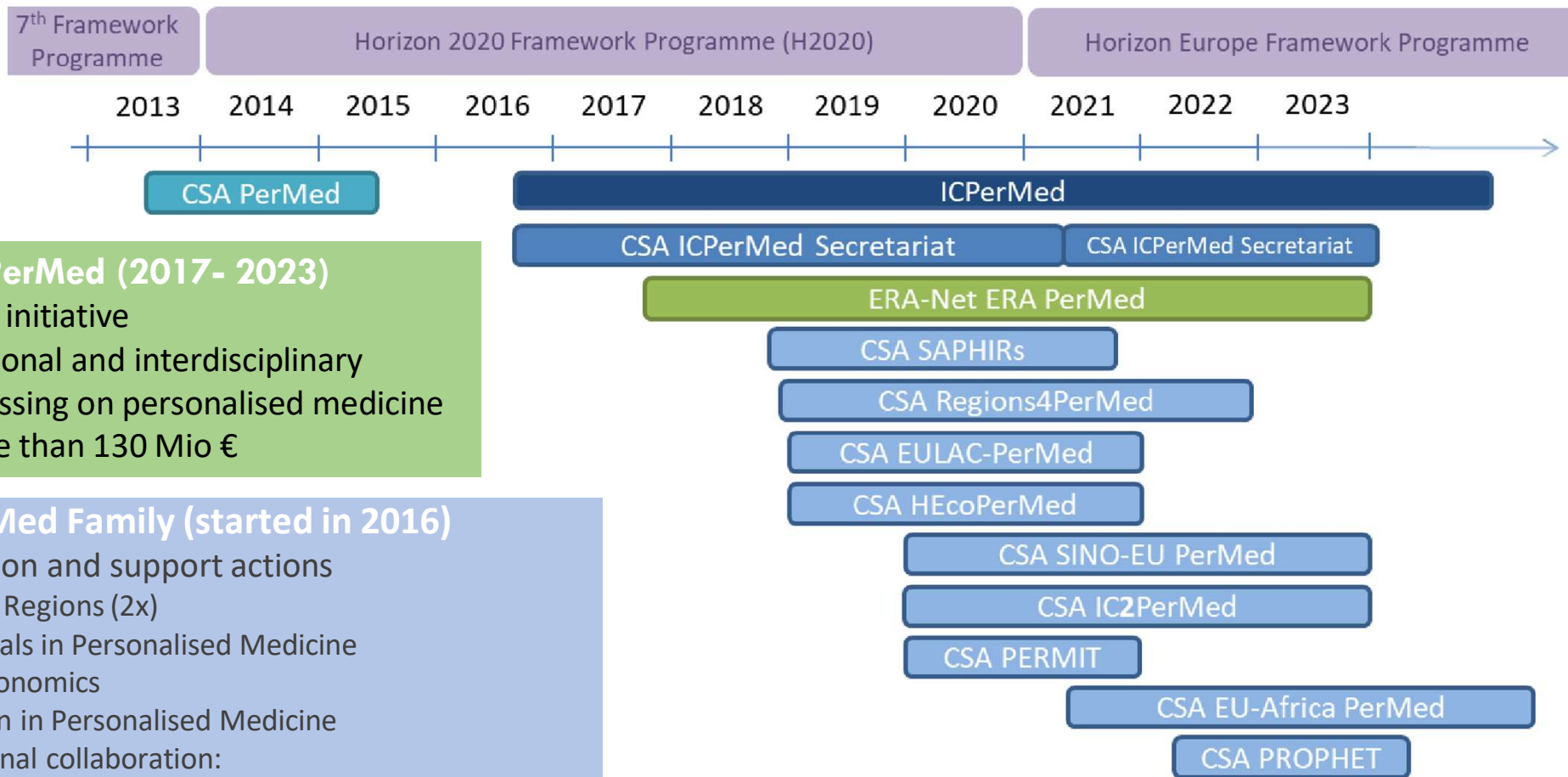
EP PerMed – Overview

<https://www.eppermed.eu/>
First call open "PMTargets"



“The vision of EP PerMed is to improve health outcomes within sustainable healthcare systems through research, development, innovation and implementation of personalised medicine approaches for the benefit of patients, citizens, and society.”

The EP PerMed European Context



ERA PerMed (2017- 2023)

- Joint funding initiative
- 111 transnational and interdisciplinary projects focussing on personalised medicine
- Budget: More than 130 Mio €

ICPeMed Family (started in 2016)

CSA – coordination and support actions

- European Regions (2x)
- Clinical trials in Personalised Medicine
- Health economics
- Prevention in Personalised Medicine
- International collaboration:
1x Latin and Caribbean Countries, 2x China, 1x Africa

Conference / Colloquium / Seminar
26 - 27 June 2023

Date
26 - 27 June 2023

Location
Stockholm, Sweden

Life Sciences – The Era of Personalised Medicine



Personalised Medicine

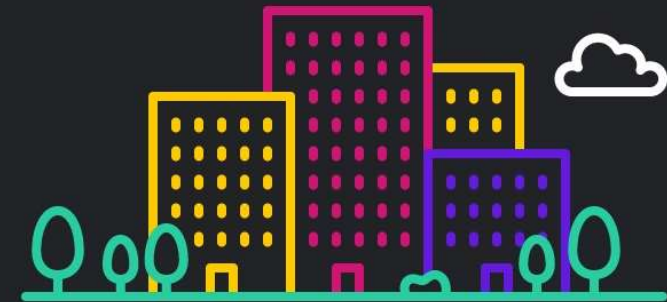
Part of a system for health



Personalised Medicine

Part of a system for health

- Individual at the centre
- Work on all three levels
- Precision on the level of the individual
- Precision in the tools and interventions used
- It should be easy to make a good choice



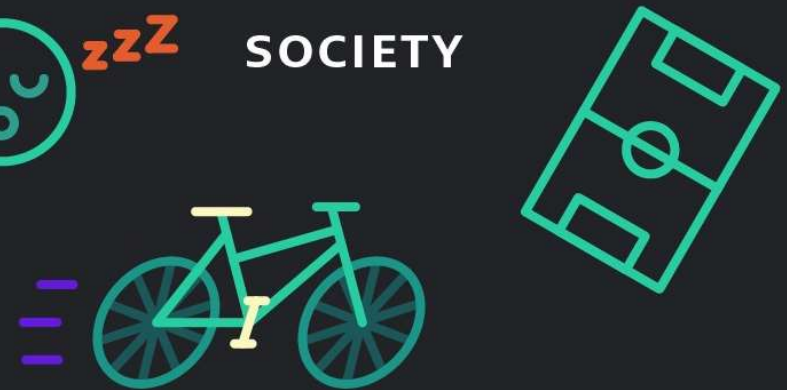
BIOLOGY



SOCIETY

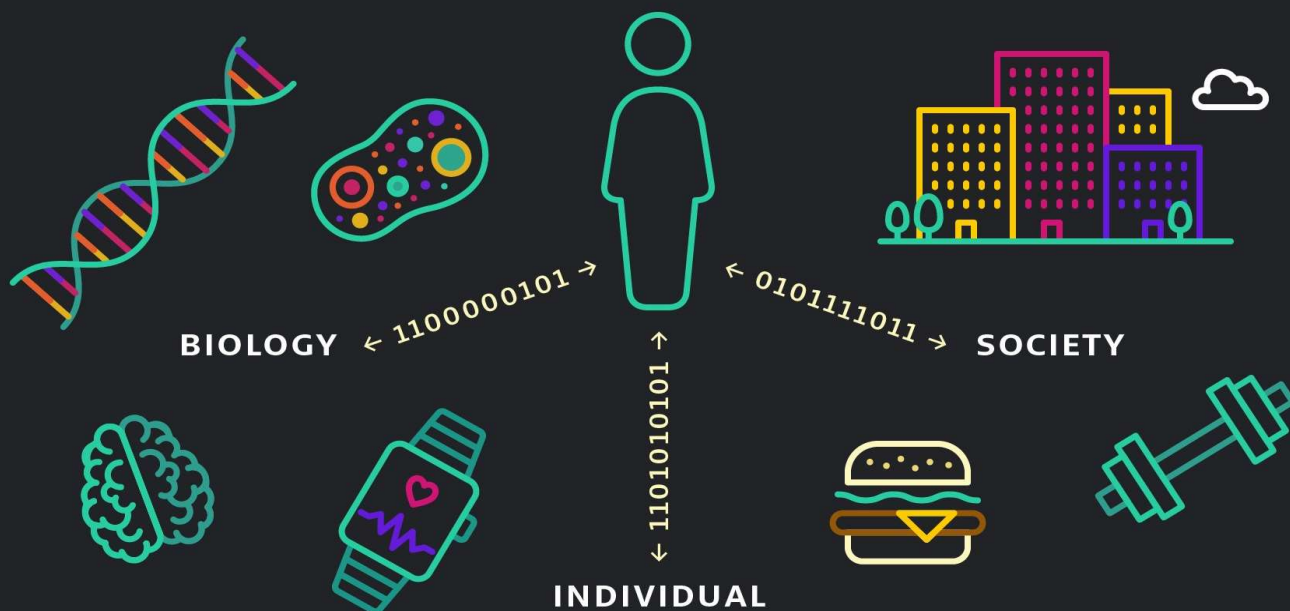


INDIVIDUAL



The Data Challenge

Three levels of data

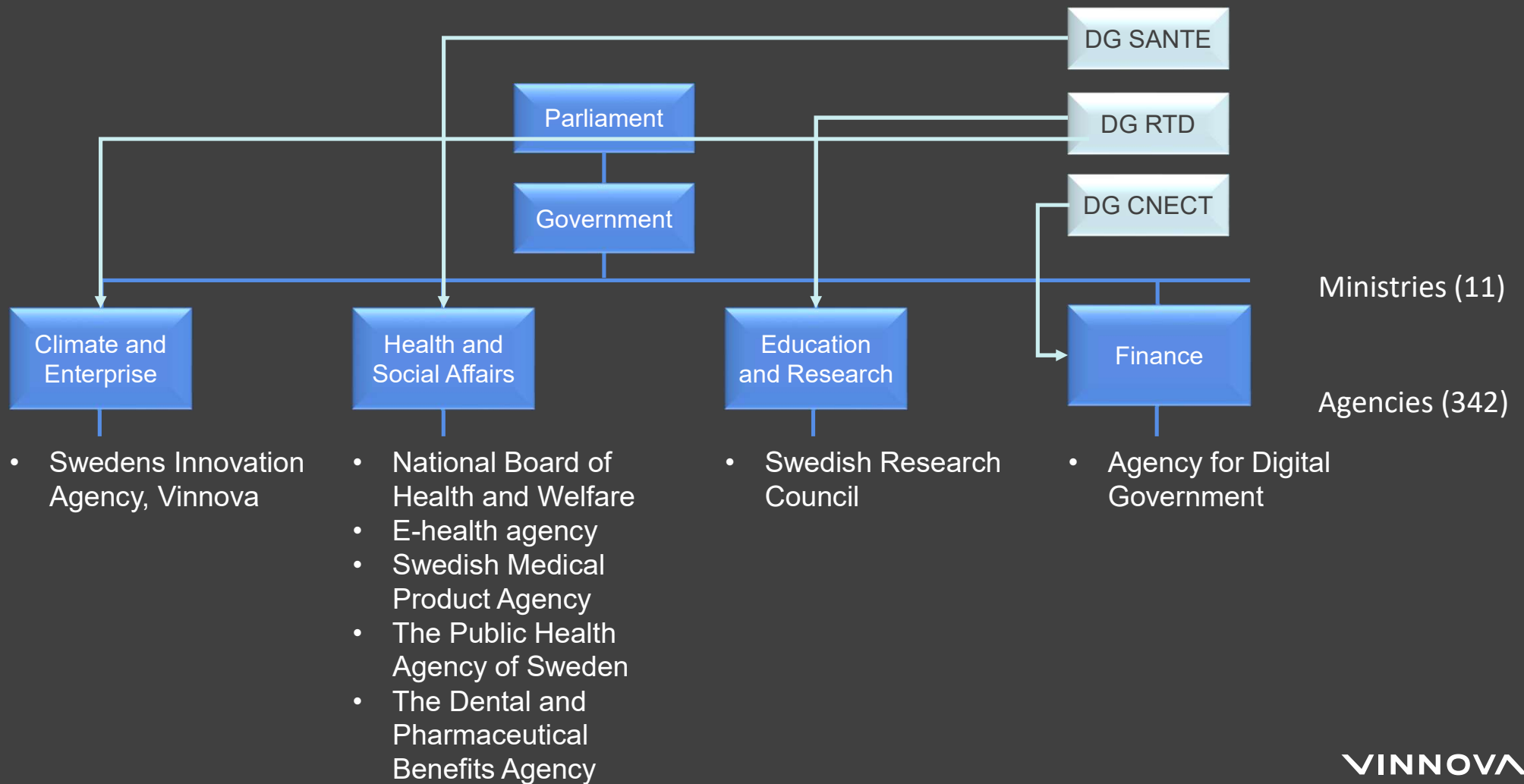


Utilisation of health data across all three levels essential to realize the full potential of PM.
(biology, individual/behaviour, societal/environmental)

Data need to be transformed into actionable information

A common vision and a roadmap towards a common framework ensuring high quality data and interoperability

The Swedish model of government administration



The Swedish healthcare system

The Swedish healthcare system is divided into three administrative levels, which are all governed by democratically elected politicians:



National government

The role of national government is to establish principles and guidelines, and to set the overall political agenda for Swedish health and medical care. This is done by means of laws and ordinances, or through agreements with the Swedish Association of Local Authorities and Regions. Example of current agreements concern areas such as shorter waiting times in cancer care, obstetrics and female health, pharmaceutical benefits and support for national quality registers. The Ministry of Health and Social Affairs is responsible for administrating that part of the Government budget that concerns areas such as public health and medical care.

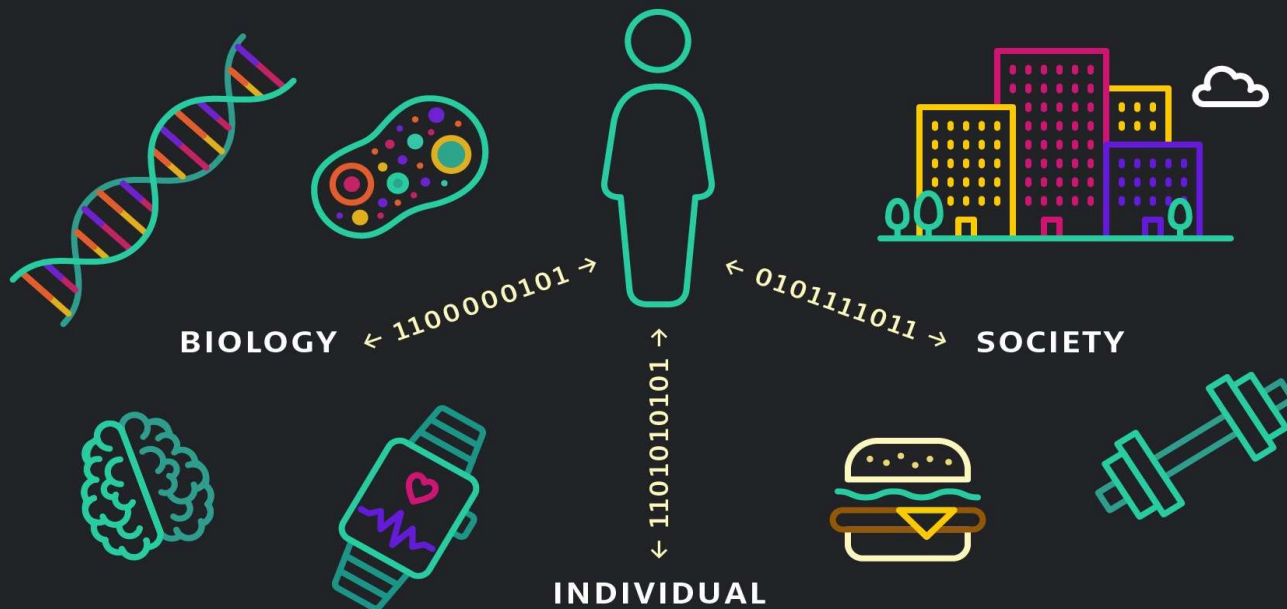
Regions (21)

It is the responsibility of the regions to organise health and medical care in such a way that all citizens have access to good care.

Municipalities (290)

Municipalities are responsible for care for the elderly, care for persons with physical and mental disabilities, support and services to persons who have completed therapy and been discharged from hospital and for school healthcare.

The Challenge of Multisectoral Governance



Inter-sectoral governance

Sectors: Academia, Public sector, Industry etc.

Society: Ministries, regions, municipalities, cities, civil society

Biology: Ministries, regions
DG Santé / Ministry Social affairs
DG RTD / Ministry of Research and Education
DG CNCT / Ministry of infrastructure, Ministry of Enterprise
Regions
Municipalities

Personalised Medicine part of a system for health

Implementation tracks

Prevention

Multi modal, dimensional diagnostics

Treatment modalities

Clinical study design

Data driven health and care

ENABLERS

Safe, secure and ethical health data utilisation

Skills and competence – new ways of working

Legal and economic framework incl reimbursement and business models as well as incentives

Citizen and patient involvement, engagement

Building evidence – health economics, HTA, RWE

VINNOVA

Food for thought

Research and Innovation need to be an integral part of health and care systems

Precision on the level of the individual and Precision in the tools and interventions used

We need to work with all three levels (biology/individual/society) to achieve a system for health that allows the individual to have more healthy years and a good quality of life

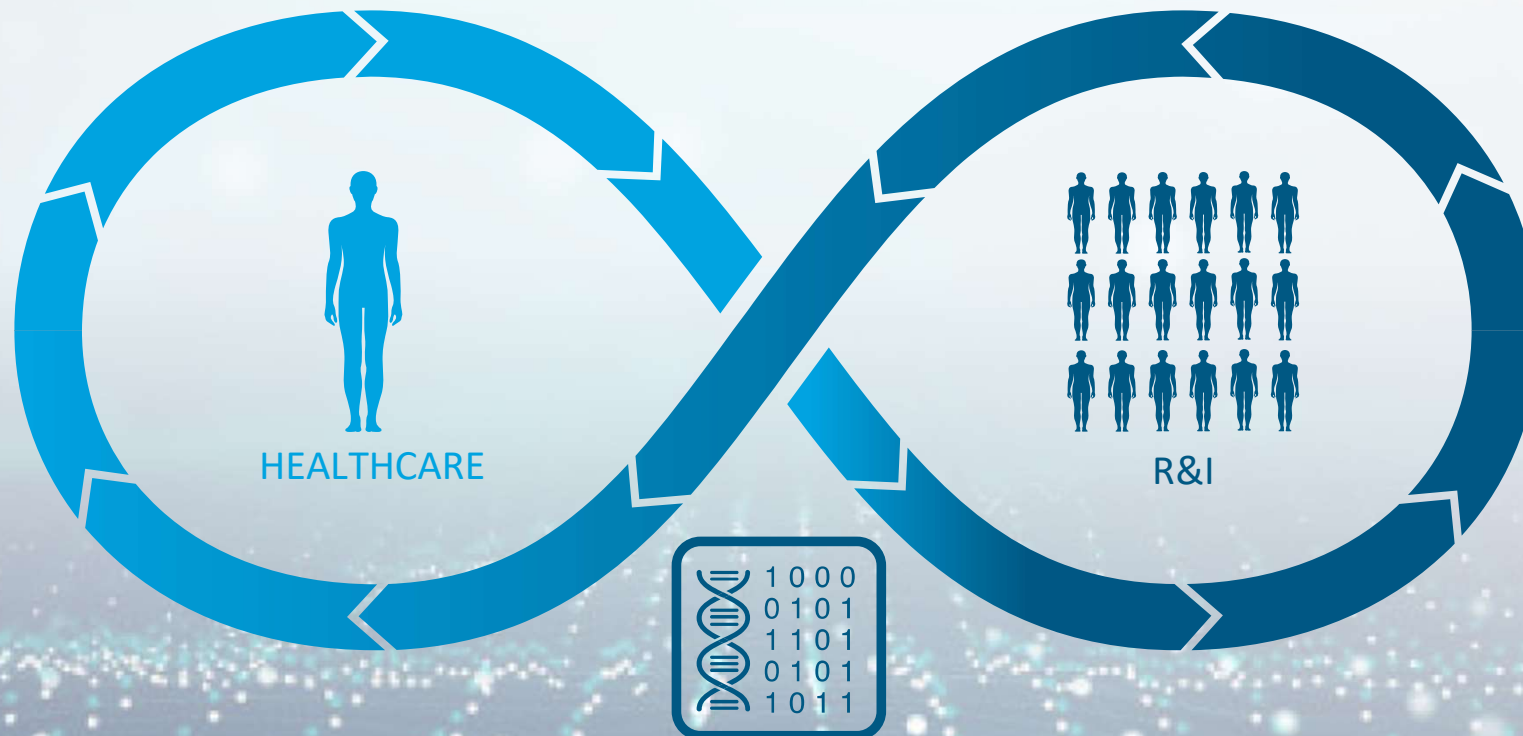
Personalised Medicine is an essential part of this system

Utilisation of health data at all three levels are essential to maximise the impact of Personalised Medicine (biology, individual and societal)

There is a need to achieve multi-sectoral governance and co-ownership including an appropriate legal framework, incentives, business and reimbursement models

Mission driven ways of working could be a useful tool. We need to agree on a common vision/s in combination with roadmaps and action plans to guide and maximise investments on a national and european level. Guiding and including a broad range of actors.

Research and Innovation an integral part of healthcare



TACK!

VINNOVA
Sveriges innovationsmyndighet



Vinnova.se



/Vinnova



@Vinnovase



/Minnovase

The impact on the individual.

Prof. Janne Lethiö

PhD at the Karolinska Institute and Scientific Lead, precision medicine at Science for Life Laboratory in Stockholm.



Karin, 59 years old

- Diagnosed with lung cancer in 2014
- 9 cm large tumour
- Disseminated to spine and thighbone
- Prognosis: 2 years survival



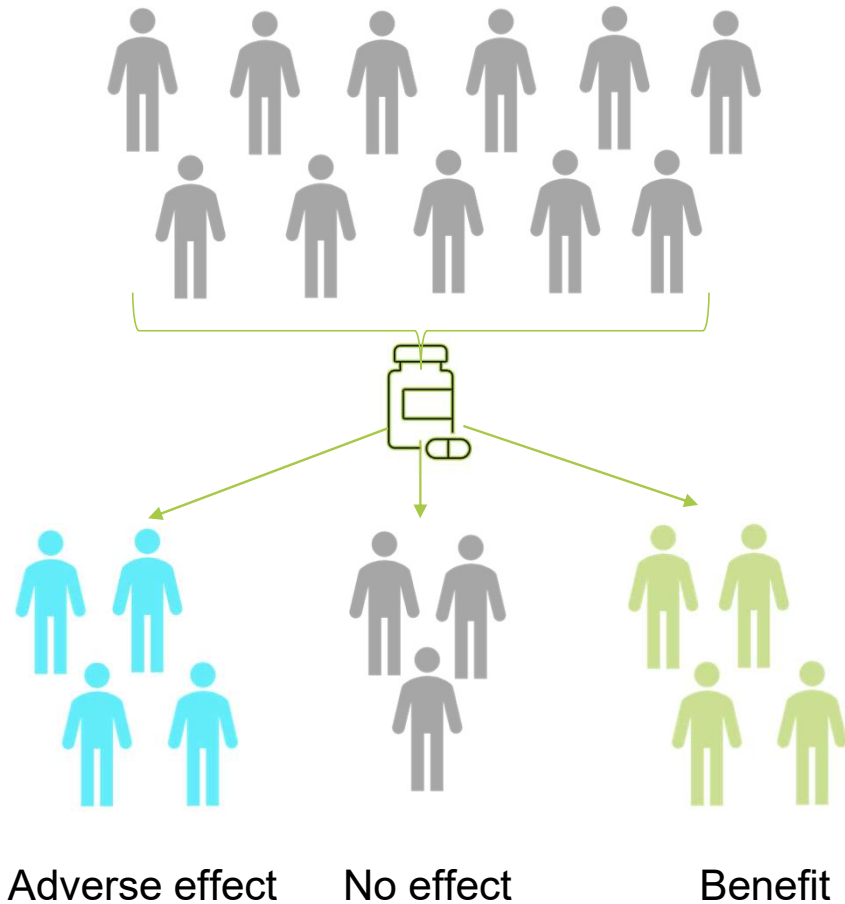
Karin's treatment

- Conventional chemotherapy with severe side effects
- New possibility; genomic analysis of the tumour
- ALK-mutation → treatment with ALK inhibitor
- Tumours reduced and some even disappeared
- Relapse in 2016, 2018 and 2020
- New ALK inhibitors and treatment with Leksell Gamma Knife®

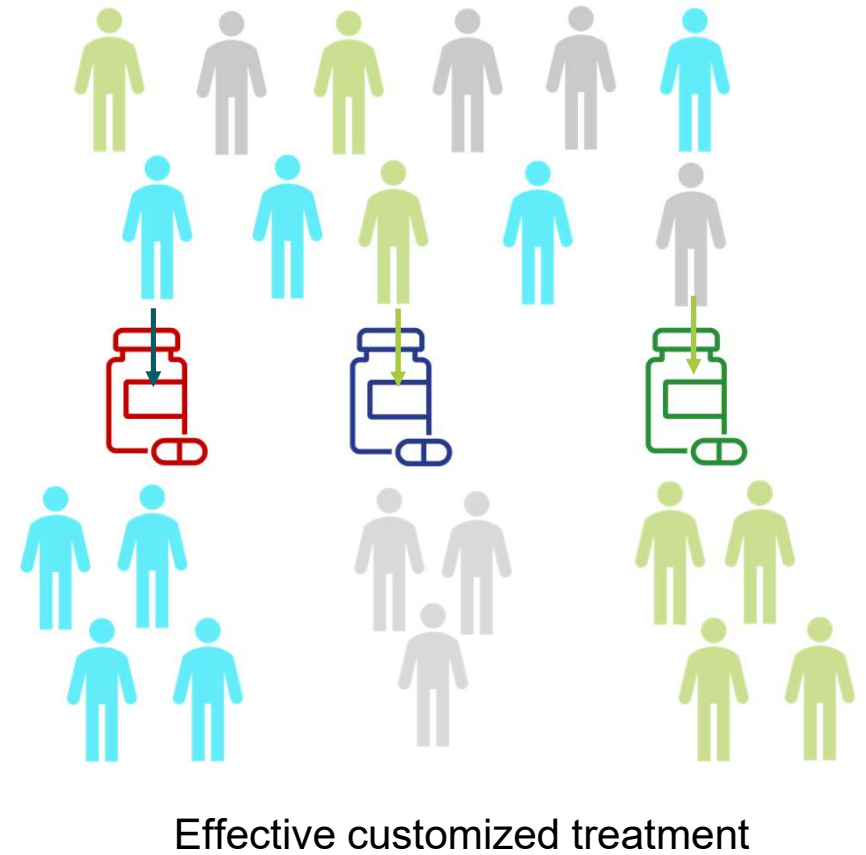


Personalised medicine concept

Conventional treatment strategy



Precision medicine



What does this mean in 30 years timeline, lung cancer example



Karolinska
Institutet

KAROLINSKA
UNIVERSITY HOSPITAL

Treatment
development

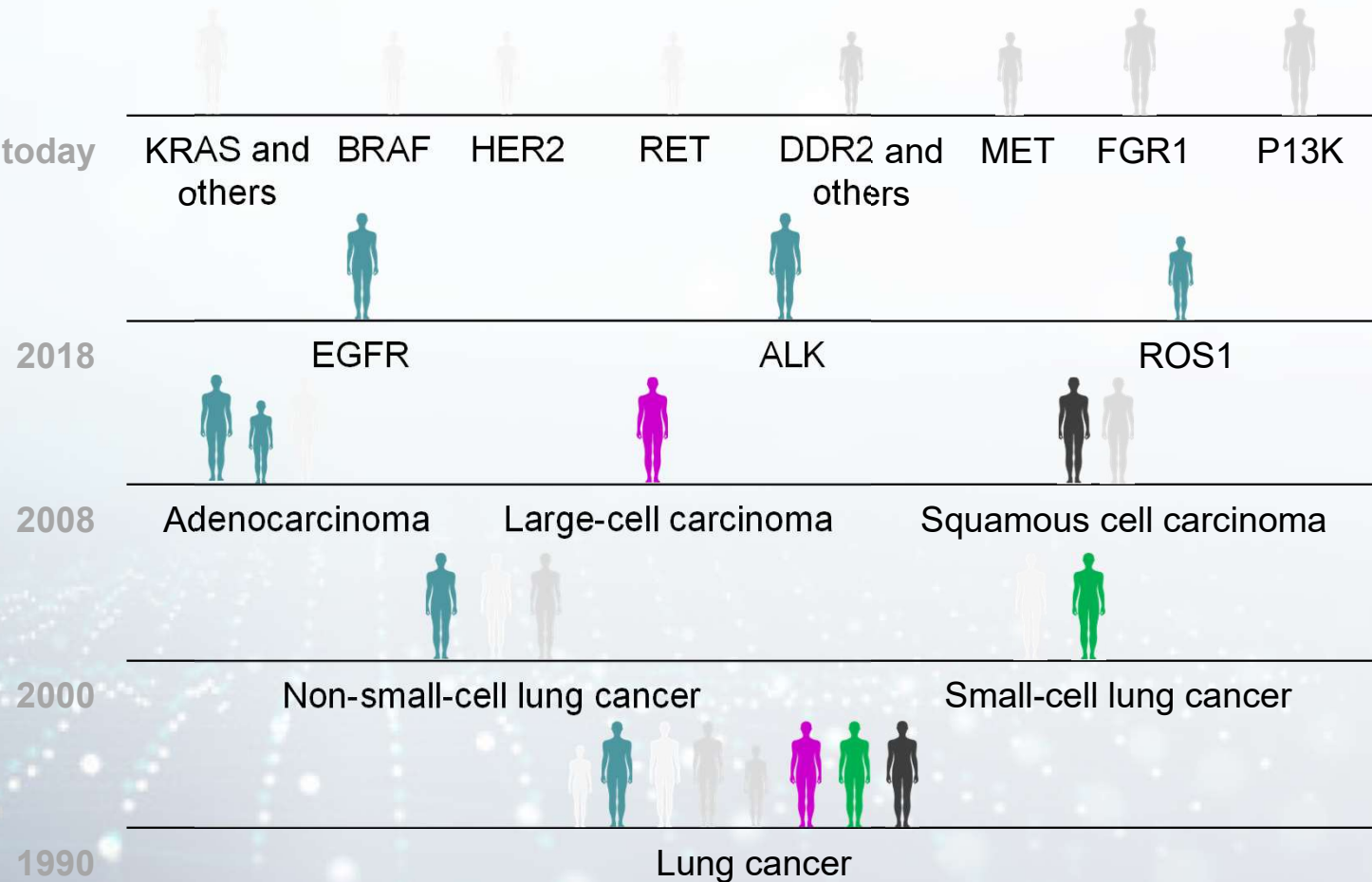
Targets today

Gene panels

Mutation analysis

Protein markers by
histopathology

Histopathology, Imaging



A paradigm shift in healthcare is required in order to offer *equal patient acces* to precision medicine



Karolinska
Institutet

KAROLINSKA
UNIVERSITY HOSPITAL

Developments in modern diagnostics...

2005

Human Genome Project
2.7 BUSD
Years / genome

2023

NovaSeq X

Comprehensive
Affordable
Rapid

...a plethora of new targeted treatments ...

FDA approved drugs for lung cancer

Year	Chemotherapy	Targeted Drugs	Immunotherapy
1940	1	0	0
1950	1	0	0
1960	1	0	0
1970	1	0	0
1980	1	0	0
1990	1	0	0
2000	1	1	0
2010	1	2	1
2020	1	3	2

Rapid development of targeted treatments and biomarkers

...and new possibilities for analysing very large data

- Medical records
- Radiology scans
- Histology slides
- Genomics
- Proteomics
- Spatial transcriptomics
- Treatment regimen
- Familial history

AI

Clinically actionable data

<https://doi.org/10.1016/j.jccell.2022.09.012>

Unique ecosystem in Stockholm



Stockholm University

KTH Royal Institute
of Technology

Karolinska University
Hospital

'Hagastaden'
Life Science Cluster

Karolinska Institutet

SciLifeLab



SciLifeLab

Vision: for Sweden to be a world-leading nation in life science

Mission: Enable life science research that would otherwise not be possible



Research Community
300 affiliated research groups
~ 1500 scientists



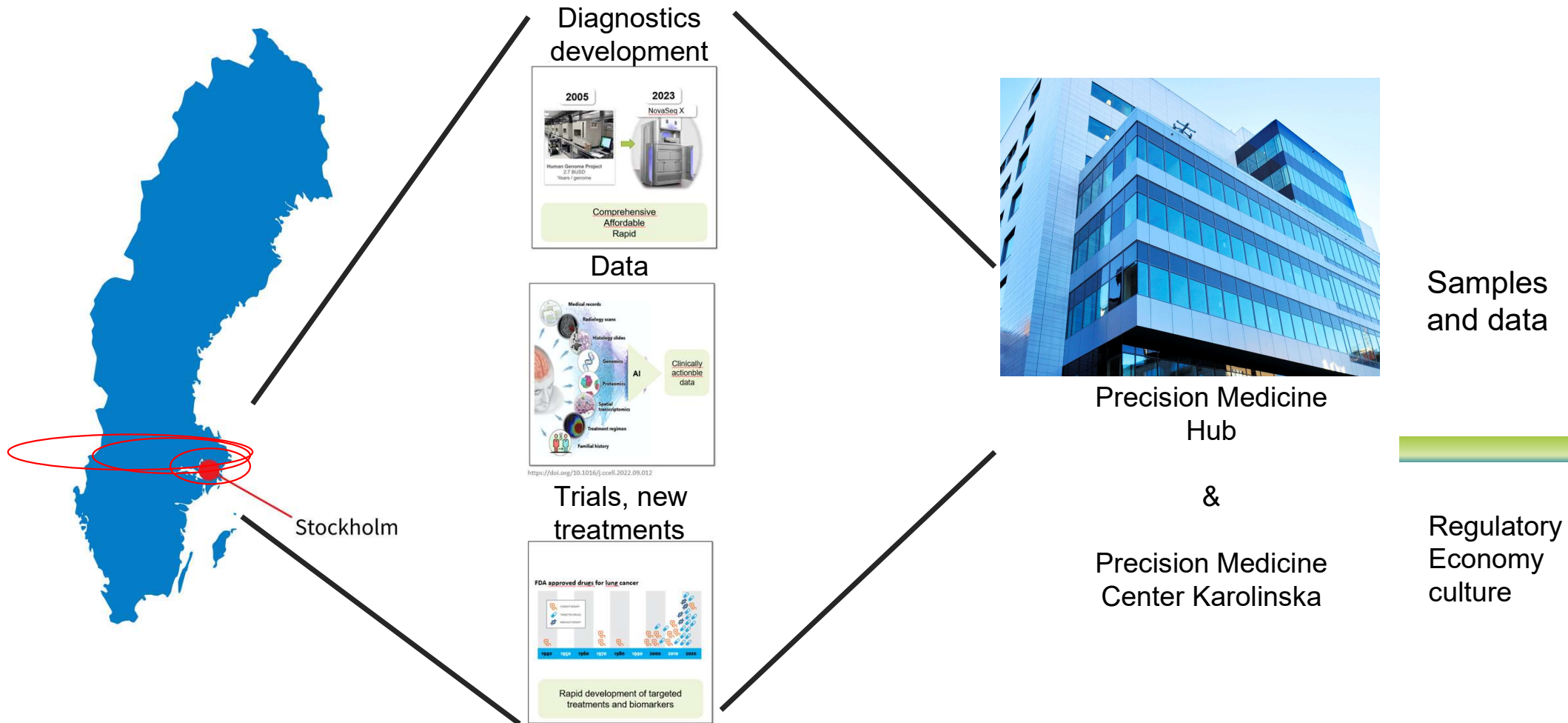
Data-driven life science
National research program
2021-2032
~ 400 data scientists



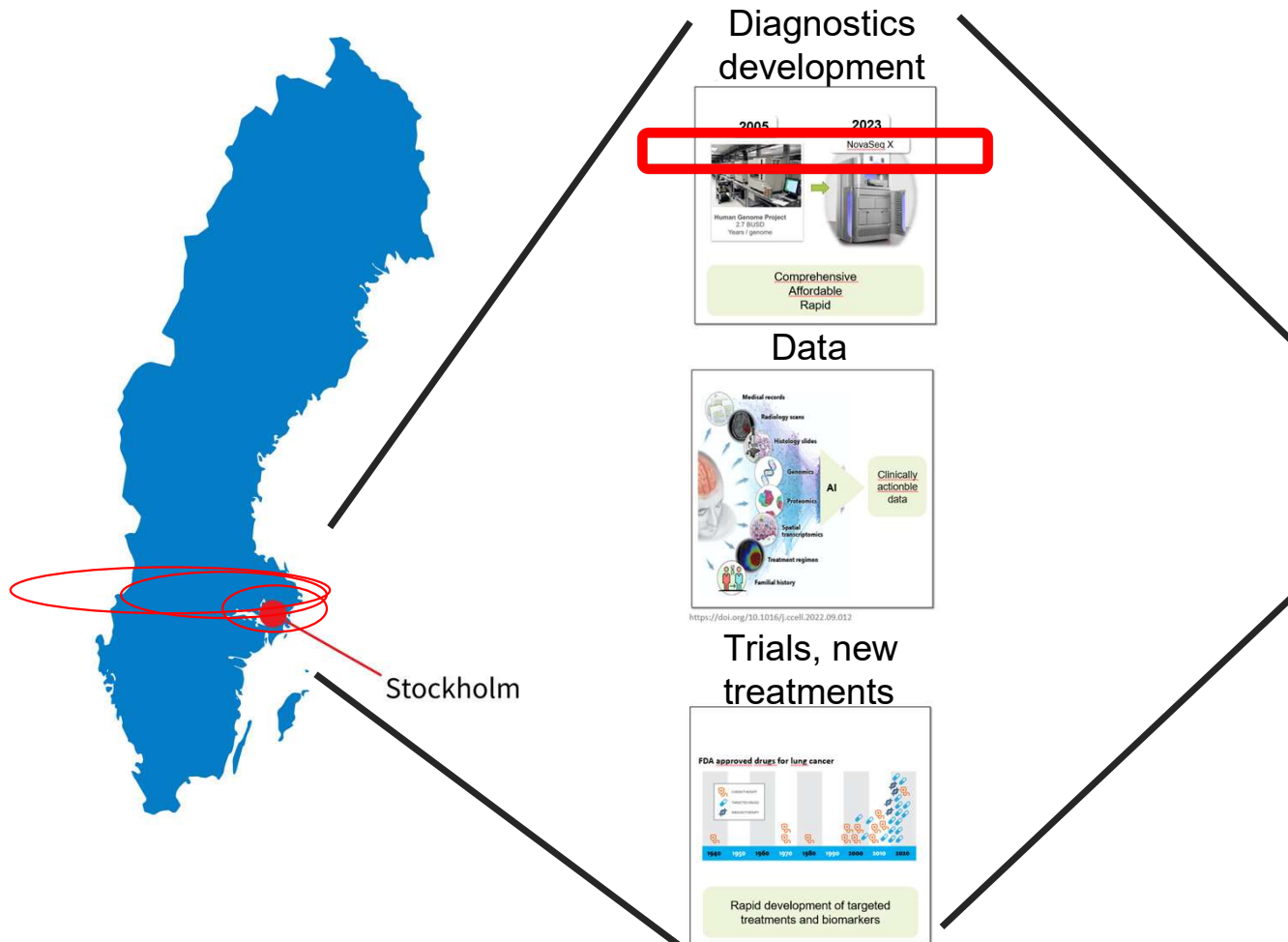
Technology Infrastructure
10 technology platforms, 40 units
>1700 users and 4000 projects per year
> 600 technology experts



From paper to action in Stockholm, national and European level



From paper to action in Stockholm, national and European level



Precision Medicine Hub & Precision Medicine Center Karolinska



SciLifeLab 10 Technology Platforms



BIOINFORMATICS



GENOMICS



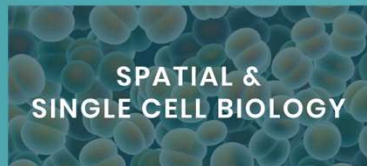
CLINICAL GENOMICS



CLINICAL PROTEOMICS
& IMMUNOLOGY



METABOLOMICS



SPATIAL &
SINGLE CELL BIOLOGY



CELLULAR &
MOLECULAR IMAGING



INTEGRATED
STRUCTURAL BIOLOGY



CHEMICAL BIOLOGY &
GENOME ENGINEERING

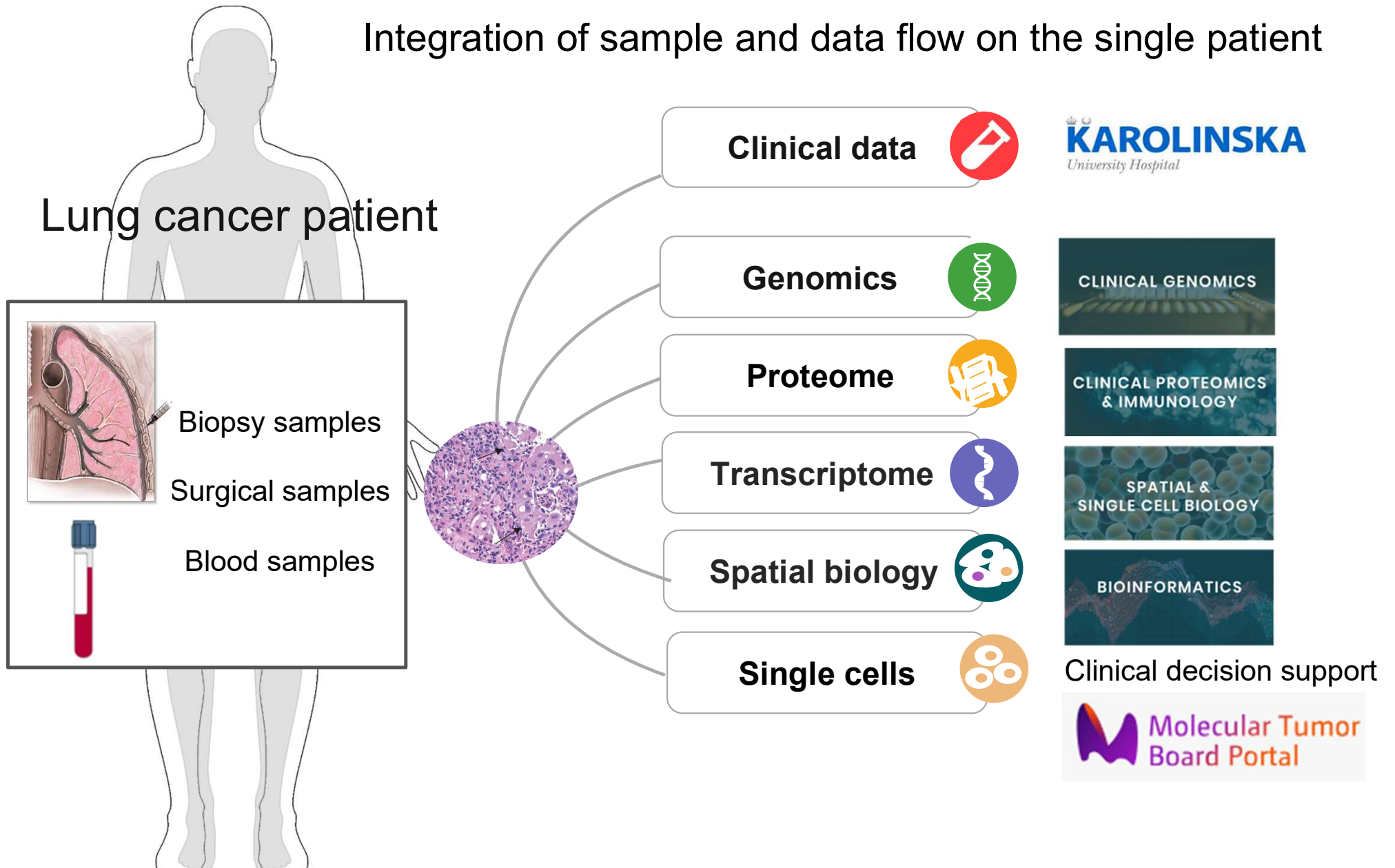


DRUG DISCOVERY
& DEVELOPMENT

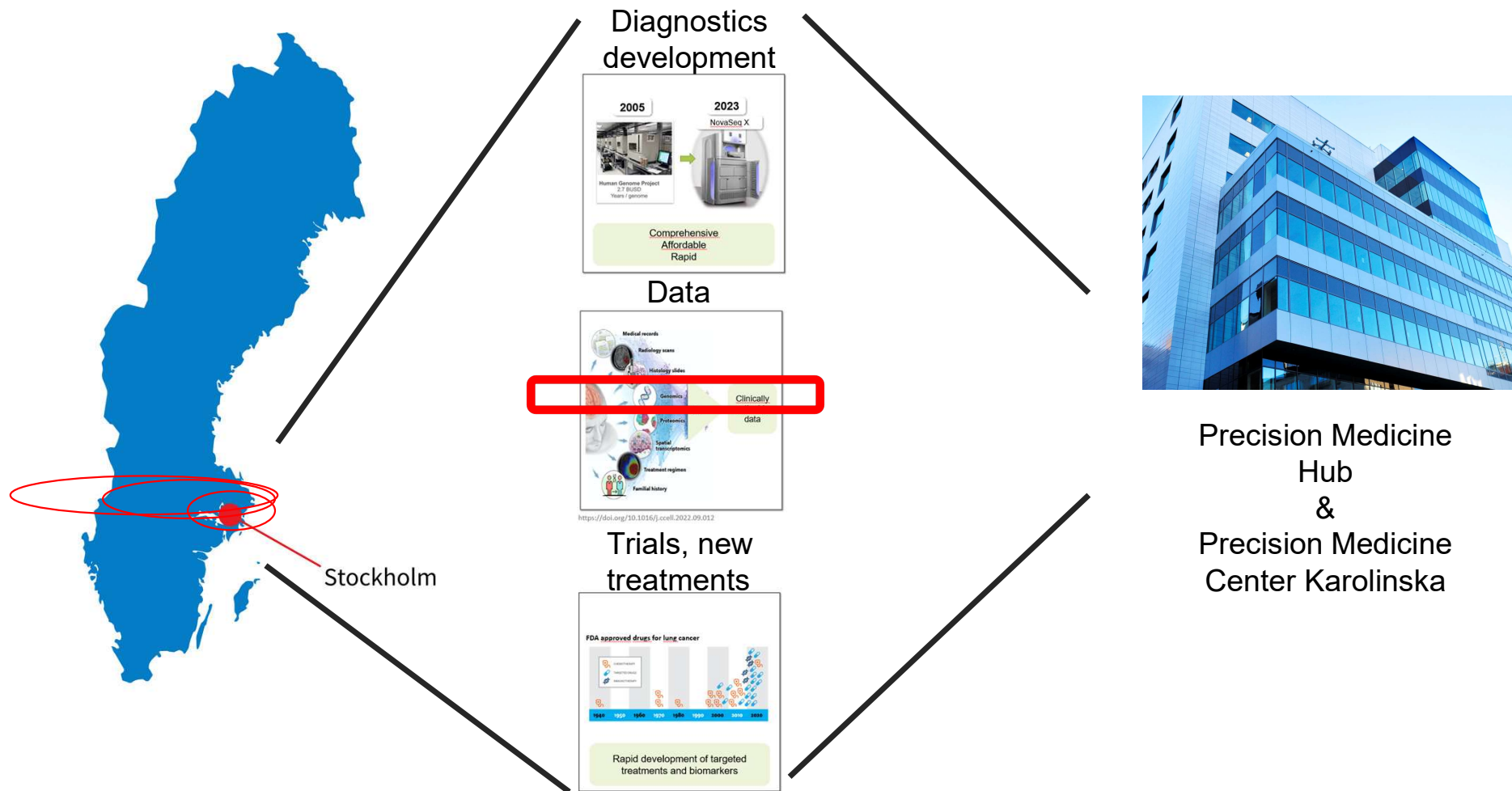
Precision Medicine Capability



Integration of sample and data flow on the single patient



From paper to action in Stockholm, national and European level





**Clinicians, patients and researchers
make decisions based on data...
...bad data, bad decisions, good data, good decisions**

New data structure to catalyse co-creation



HEALTHCARE

COLLABORATION

RESEARCH



Applications with patient data

- 35-40 (772)
- "manual" data extraction



Health care provider platform

- Reported data
- Diagnoses
- Procedures
- Drug treatments
- Quality register reported data
- CDR
- GDR

diagnoses
 procedures
 drugs



Data preparation

- Pseudonymized data
- Data sets
- Metadata
- Annotation
- Curation
- Quality Assurance
- Collaboration



Research

- Extracted data
- External data sets



NOW

GOAL



SciLifeLab and Wallenberg National Program for Data-Driven Life Science (DDLs)



12 year national research program, 2021-2033

- Funding 310 million Euro
- Recruitment of 39 high-profile research leaders
- 260 Ph.D. students in academia & industry
- 210 postdoctoral positions in academia & industry
- National data science platform
- Data Science Nodes, dedicated personell for filling the gap between research and implementation.

*Knut och Alice
Wallenbergs
Stiftelse*

 **SciLifeLab**

WALLENBERG CENTRES FOR MOLECULAR MEDICINE

WASP—HS

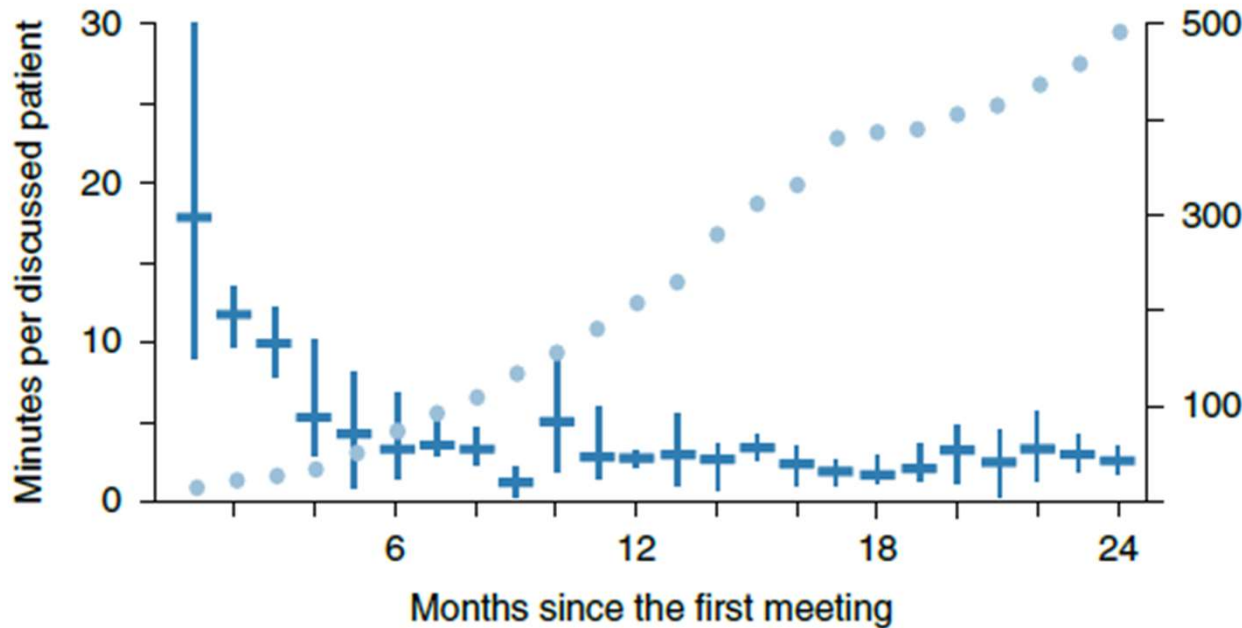
WASP | WALLENBERG AI
AUTONOMOUS SYSTEMS
AND SOFTWARE PROGRAM



Connecting cutting edge experts and hospitals cross Europe



d Time and number of patients discussed during the CCE molecular tumor board meetings



representatives of
old **(virtual)**
board meetings

MTBP reports
clinical

are agreed

EU DIGITAL health data collaboration in Sweden

European Genomic Data Infrastructure

Bengt Persson
Uppsala University



EDIH Health Data Sweden

Sebastian Meijer
KTH



European Federation for Cancer Images

Katrine Riklund
Umeå University



Testing and Experimentation Facility for Health

Daniel Lundqvist
Karolinska Institutet



National feasibility study, leveraging strategic digital capacity to store and use health data, within the expert areas: **ELSI, Technical Infrastructure, Semantic Interoperability.**

Project managers & point of contact



Natalia Kotova

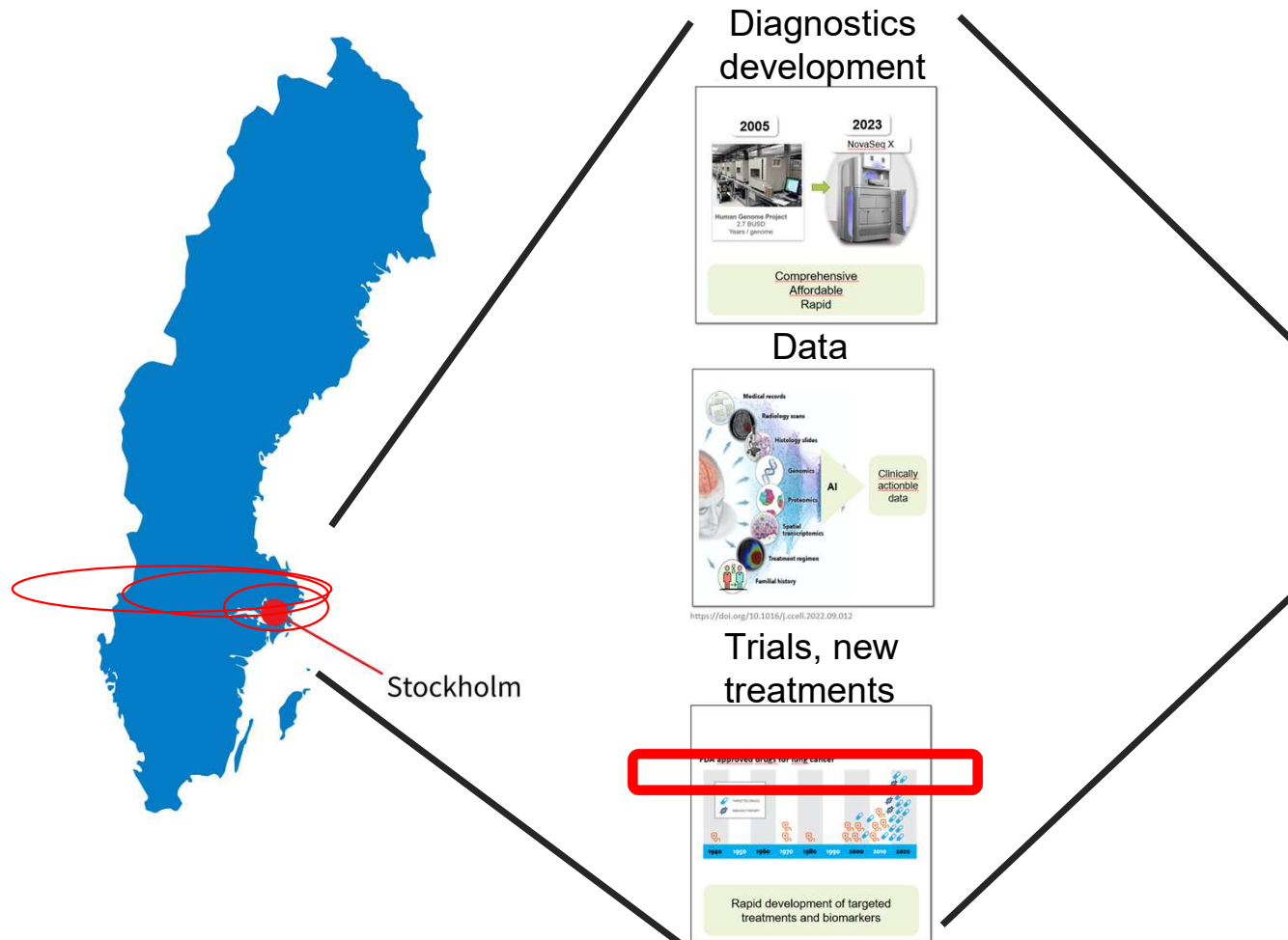


Rikard Lövström

Coordinated by
 **SciLifeLab**

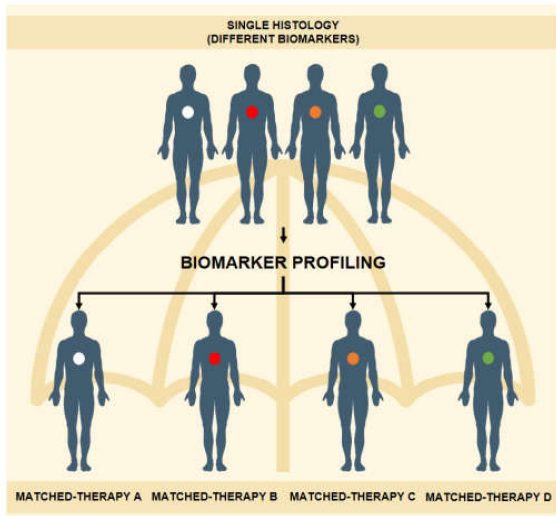
Funded by
VINNOVA
Sweden's Innovation Agency

From paper to action in Stockholm, national and European level

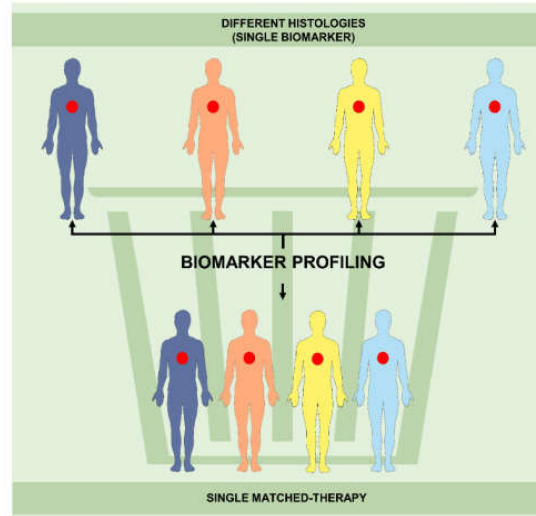


Precision Medicine
Hub
&
Precision Medicine
Center Karolinska

State of the art - Clinical trial designs for precision medicine



(a)



(b)

Park, J *et al.*, <https://doi.org/10.3322/caac.21600>

Di Liello, R *et al.*, <https://doi.org/10.3390/life11111253>

Tsimberidou, A *et al.*, <https://doi.org/10.1016/j.semcancer.2020.09.006>



FOCUS
The Swedish Precision Cancer Medicine Trial

Trial Designgroup:

NASTRO

Diagnostics:

gms
Genomic Medicine Sweden

SciLifeLab

Partners:

IHE TLV
TUMORCELLS, OCM
LACEMED/UPDR/ANUVERKET

lif The research-based pharmaceutical industry **Medtech**

Nr NÄRVERKET MOT CANCER **Lungcancer** föreningen



Project management:

IQVIA



Extraordinary development since 2018 – from 35 to 80 companies

Apodemus/Curovir
 Asarina Pharma
 Attgeno
 Axelar
 BGI-Hongkong Co. Ltd
 Buzzard Pharmaceutical
 Dilafor
 Ebba Biotech
 Eurocine Vaccines
 Gesynta Pharma
 Handfast
 Heartrunner Sweden
 ImCred Patent
 Lipidor
 NBMI Science
 NeuroVive
 Pharmaceutical
 ObsteCare
 Palette Life Sciences
 PKxpert
 Pleonova
 Promore Pharma
 Sigrid Therapeutics
 Sixera Pharma
 Umecrine Cognition

Xbrane
 Pelago

Affibody Medical
 Chiesi Pharma
 EnginZyme
 ITB-MED
 Symcel
 Xbrane Biopharma

SOBI
 Karolinska
 Development
 Jansen | J&J

Adlego Biomedical
 Aprea Therapeutics
 Cartana
 Cytacota
 EMPE Diagnostics
 Hepapredict
 Immunscape
 Larodan
 Medigelium
 Semair Diagnostics
 Sinsa Labs
 Vesicode

Bayer
 Index Diagnostics
 Index Pharma
 TSS

Colibri Ventures	Technologies
Disruptive	Noquo Foods
Materials	Nuiteq
Elypta	Ostomycure
Empros Pharma	Sangair
Emune	Selenozyme
Genagon	Shigeru
Therapeutics	Sirona
Hadean Ventures	VOC Diagnostics
Höberg	Zozium
Kancera	Waters
Moligo	

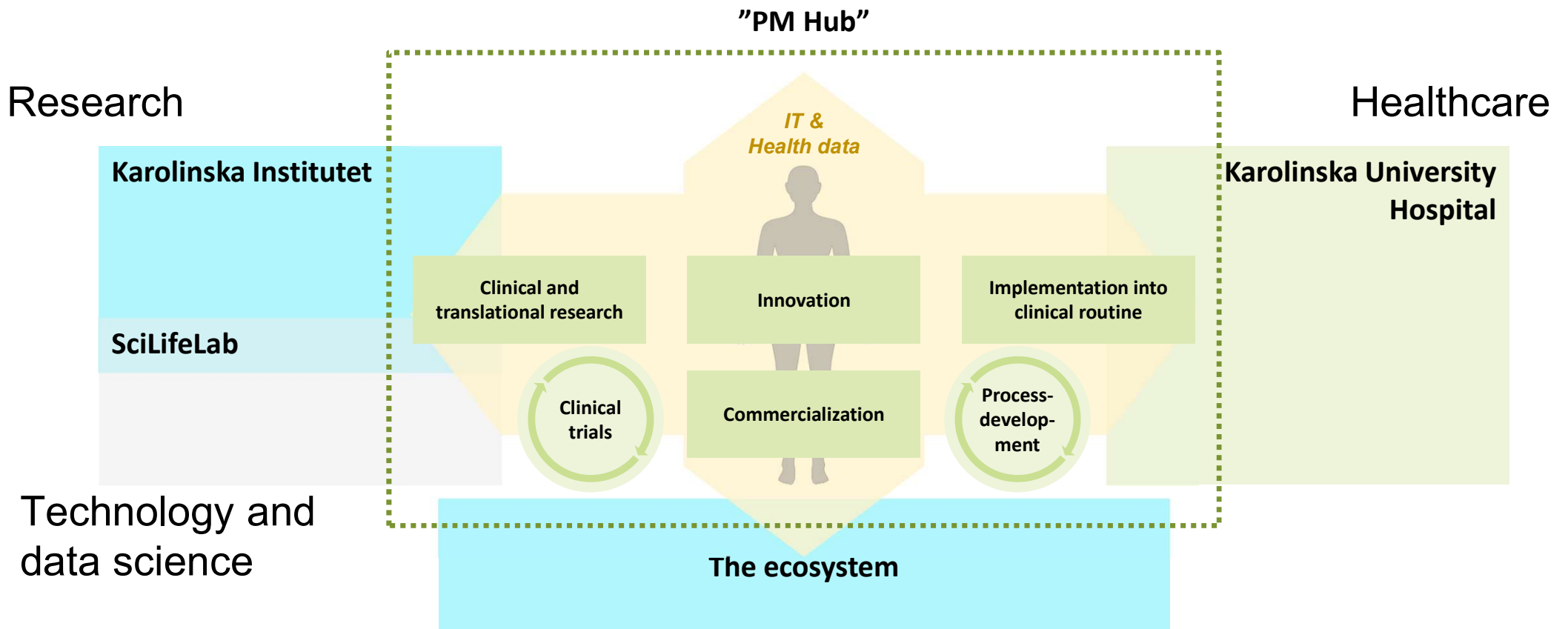
Ana Cardio
 ApiRays
 Attgeno
 Cartana
 Collective Minds
 Radiology
 Developeration
 Digital Diabetes Analytics
 FenoMark Diagnostics
 Geras Solutions
 Gesynta Pharma
 Heart Runner Sweden
 HepaPredict
 Medify
 Asthma Tuner
 MindMend
 Minnity
 Moligo Technologies
 Neobiomics
 Northern Light
 Diagnostics
 Holistal
 Predictomics
 Prognostix
 Pwelt
 Sigrid Therapeutics
 Stck Cell

The “PM hub” forming a concrete ecosystem



Karolinska
Institutet

KAROLINSKA
UNIVERSITY HOSPITAL





2010: Pilot Rare Disease Genomics (IEM)

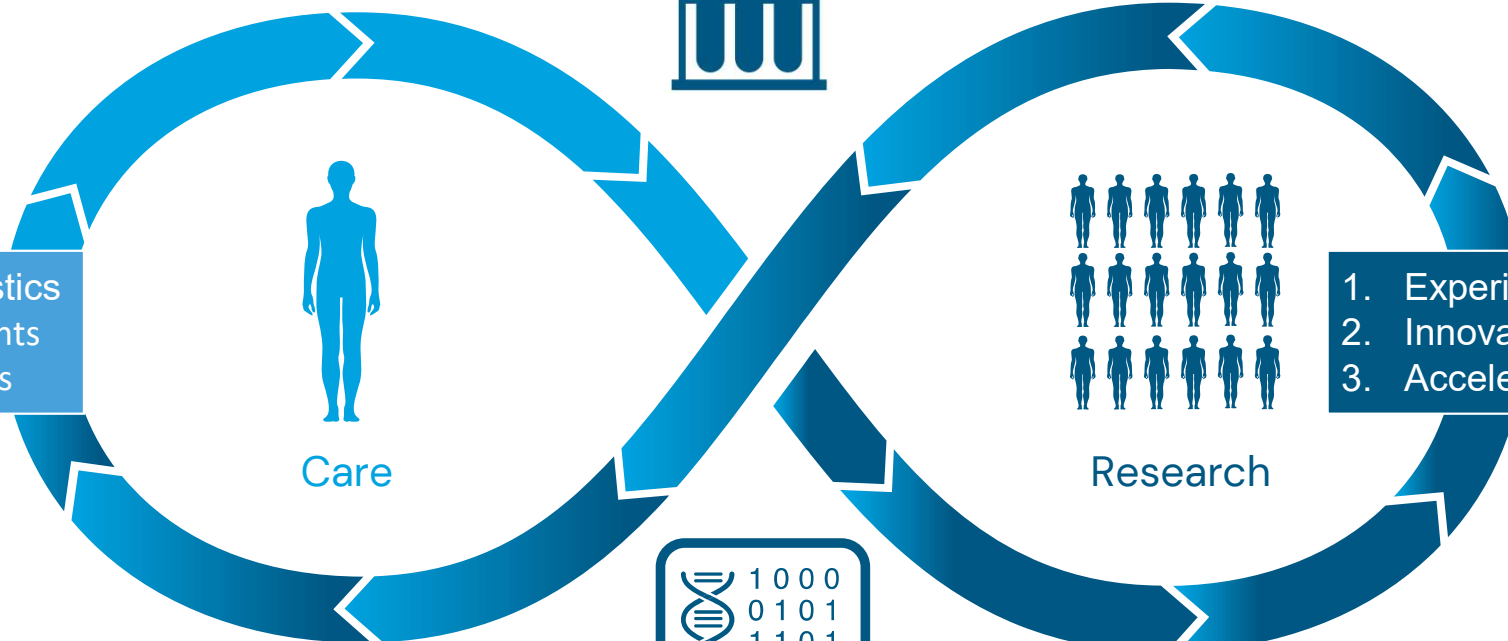
2013: Clinical – Academic Partnership, Karolinska - Clinical Genomics

2016: “Joint unit” for introduction of genomics into clinical diagnostics

2017: Genomics Medicine Center Karolinska - GMCK

2021: Precision Medicine Center Karolinska - PMCK

Samples



1. Improved diagnostics
2. Matching treatments
3. Improved outcomes

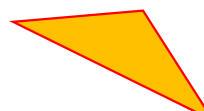
Care

1. Experimental diagnostics
2. Innovative clinical trials
3. Accelerated research

Research



Data



Towards citizen science
Including every patient, starting
from molecular profiling

Research and technology forms
backbone to precision medicine

Karin today, 10 years later

- 2021: A chronic/manageable disease
Medication twice a day
- Very good quality of life with
minor side effects
- Large family: husband, 3 children
and 12 grandchildren
- Enjoys travelling, sports and
social activities





Thank you!



Q&A

Dr. Monica Åberg Yngwe
Public Affairs and Stakeholder
Relations Lead and Deputy Managing
Director EIT Health Scandinavia.





#HealthUnion
#personalisedmedicine

Thank you!



stockholmregion.org



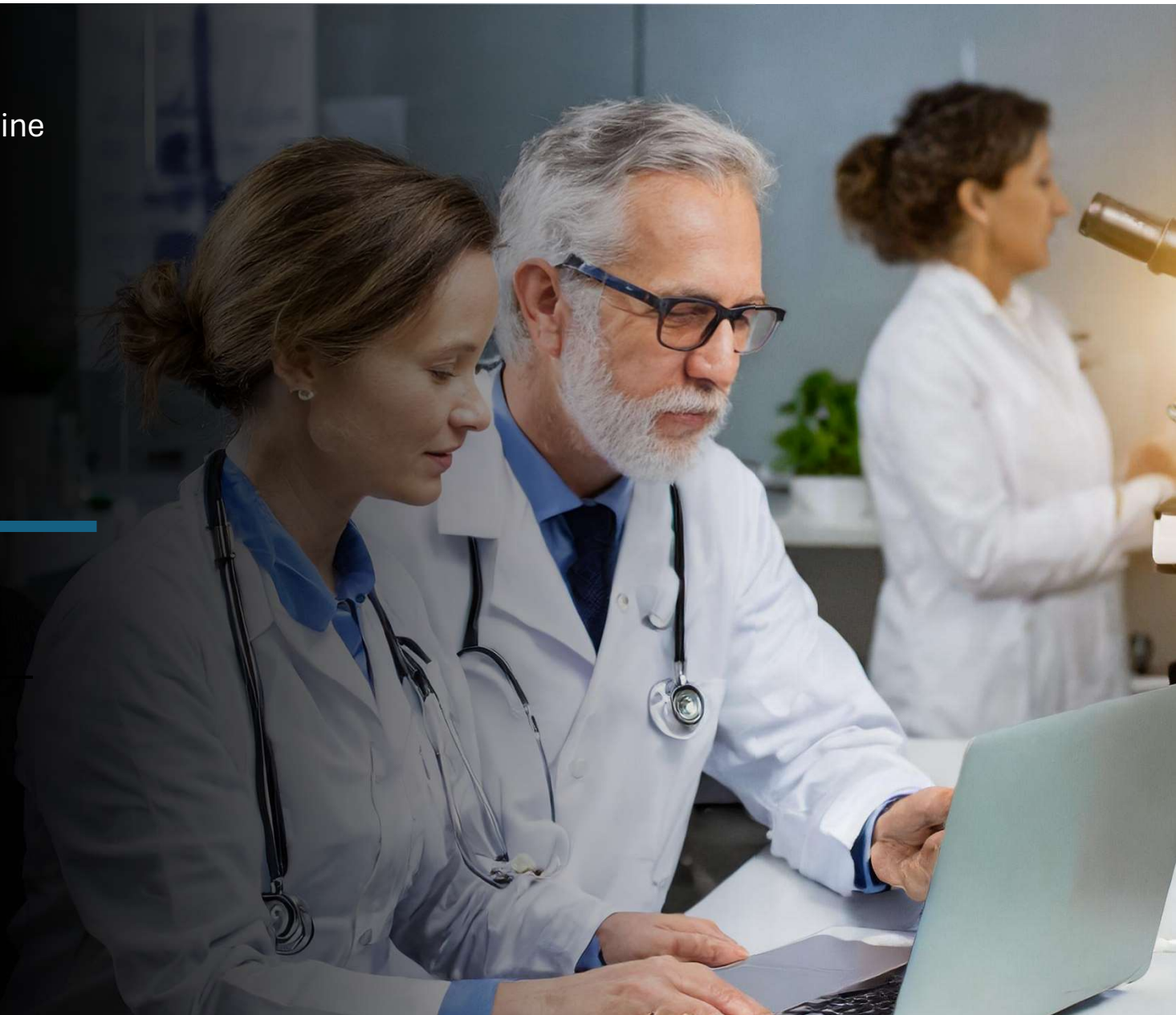
[@sthlm_euoffice](https://twitter.com/sthlm_euoffice)



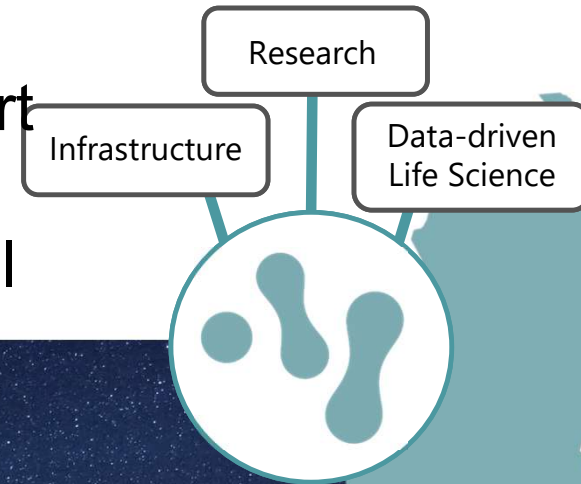
[@sthlm_euoffice](https://facebook.com/sthlm_euoffice)



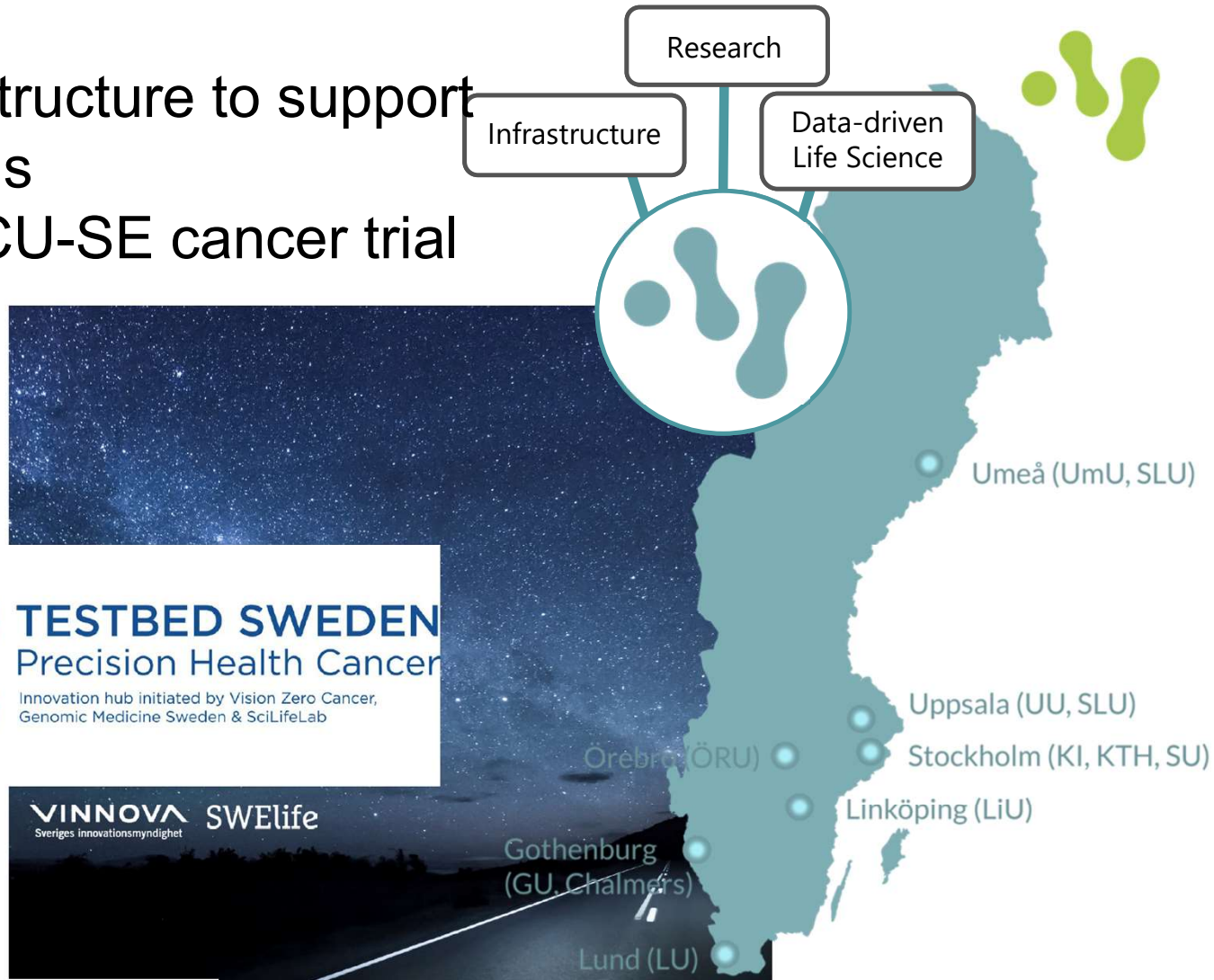
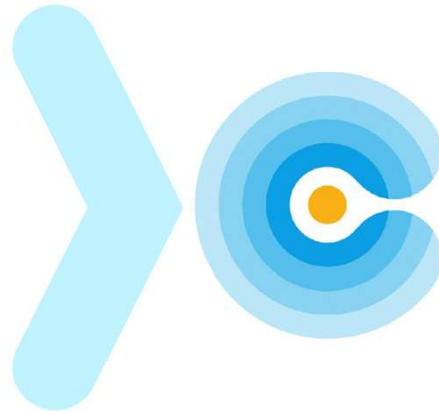
[@Stockholm-Region-EU-Office](https://linkedin.com/company/Stockholm-Region-EU-Office)



Contribute to national infrastructure to support clinical trials in precision medicine , FOCU-SE cancer trial



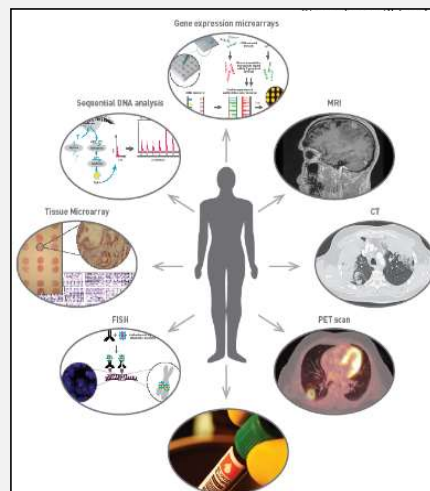
“Stars align”



PM hub Diagnostics Development

1

Precision medicine Hub



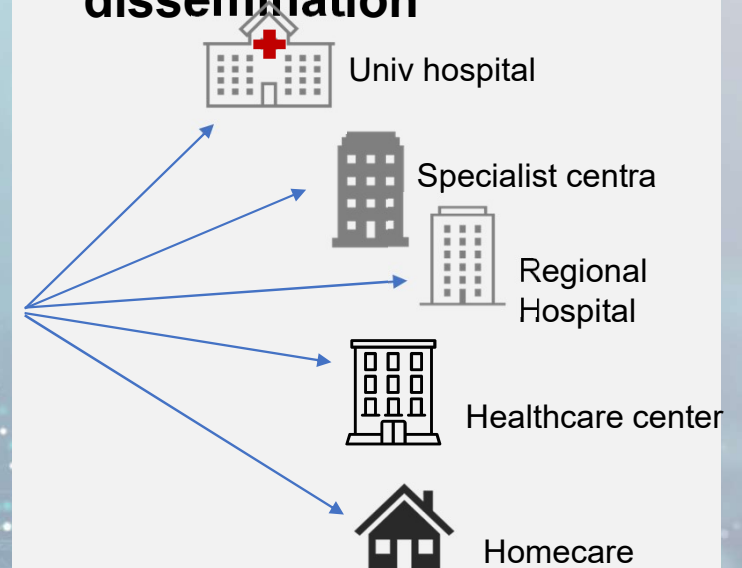
Molecular Tumour Board

- Data generation
- Data analysis and merge
- Retaining competens
- Trial inclusion
- Development and testing tools
- Second line treatment selection support



2

Healthcare levels dissemination



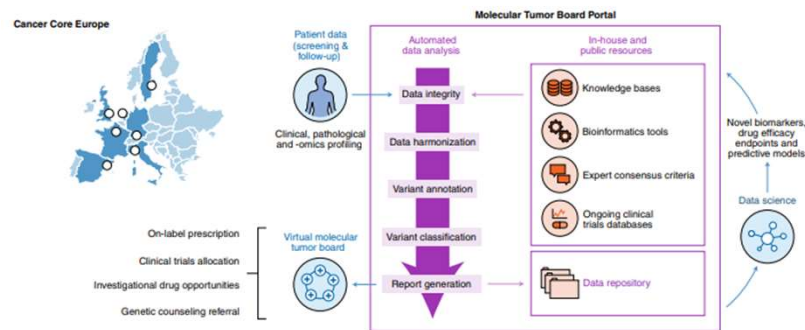
Structured testing and introducing new technologies and data-analysis and tools

Tools development, translating complex data to clinical actions



correspondence

Support systems to guide clinical decision-making in precision oncology: The Cancer Core Europe Molecular Tumor Board Portal



Tamborero et al. **Nature Medicine** 2020

- (1) Retrieval of **clinical, pathology & molecular** data
- (2) Data files **integrity & harmonization** processes
- (3) Tumor variants **annotation & classification**
- (4) **Report generation & sharing**

(NCT03767075)
Cancer Core Europe Basket
of Baskets trial*
collaboration