Introduction to the Novo Nordisk Foundation Data Science Initiative
08 February 2021 @ SDU (virtually)

The NNF Data Science Initiative

Ulrik Nicolai de Lichtenberg
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The Novo Nordisk Foundation

Morten Bache
Senior Scientific Lead, PhD, Dr. Techn.
The Novo Nordisk Foundation

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Outline

- Introduction to the Novo Nordisk Foundation
- NNF Data Science Initiative – motivation and background
- INVESTIGATOR GRANTS
- COLLABORATIVE RESEARCH PROJECTS
- RESEARCH INFRASTRUCTURE
- Our reflections on 2020 and good advice for 2021 programs
- Questions

ABOUT NNF

It began with insulin

THE CLINICIAN
H.C. Hagedorn

THE INVESTOR
August Kongsted

THE SCIENTISTS
Marie Krogh and August Krogh

THE ENTREPRENEUR
Thorvald Pedersen

THE ENTREPRENEUR
Harald Pedersen

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Dividends

100% SHARES

novo holdings
Investors in life science

Dividends

28.1% SHARES*
75.8% VOTES

novo nordisk®

25.5% SHARES*
71.2% VOTES

novozymes®
Rethink Tomorrow

Grants

Awarded in 2019:
DKK 5.1 billion (EUR 680 million)

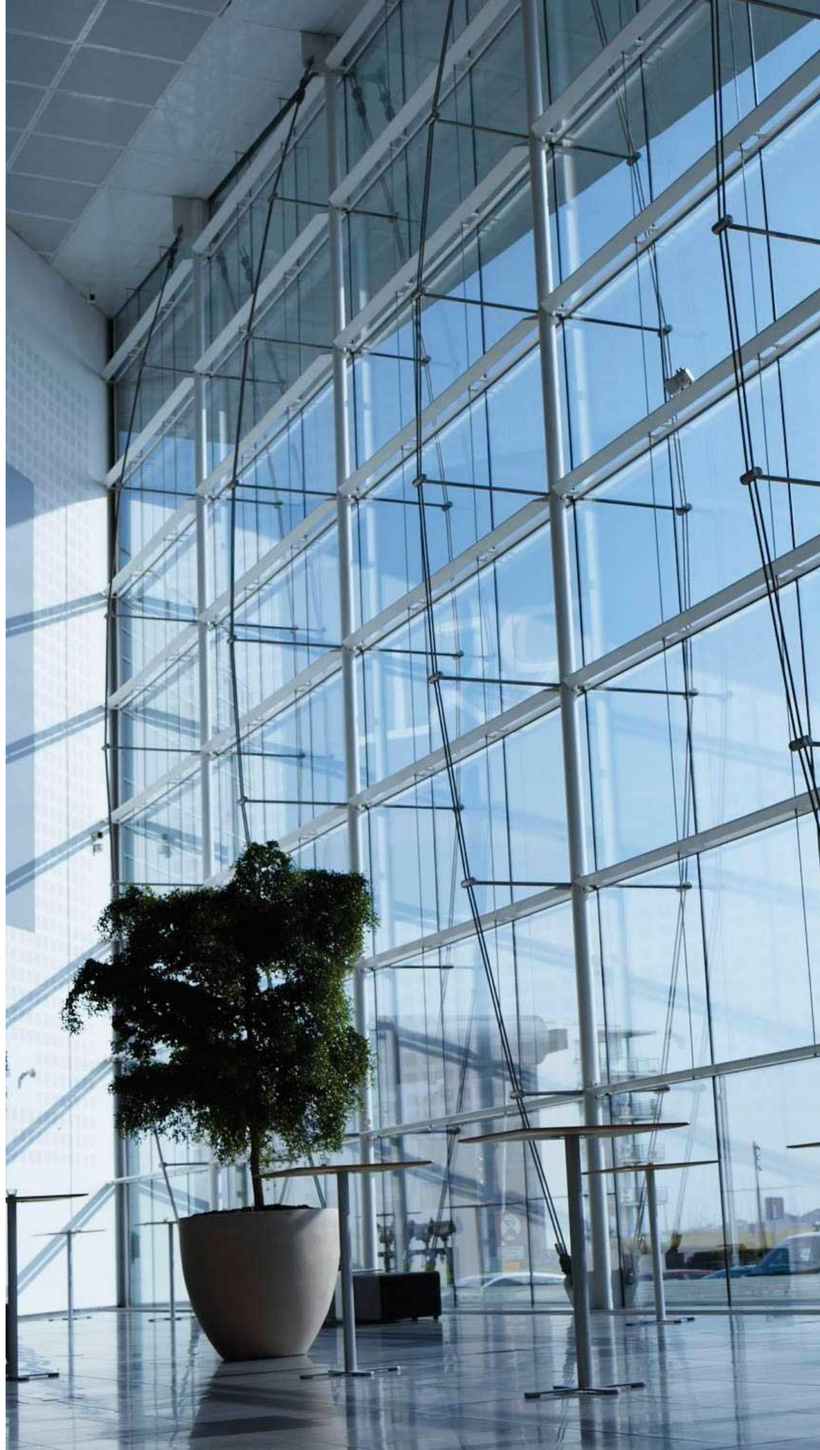
Paid out in 2019:
DKK 3.45 billion (EUR 460 million)

Scientific research
Diabetes treatment
Innovation
Education & outreach
Humanitarian and social causes

Investments (DKK 380 billion)

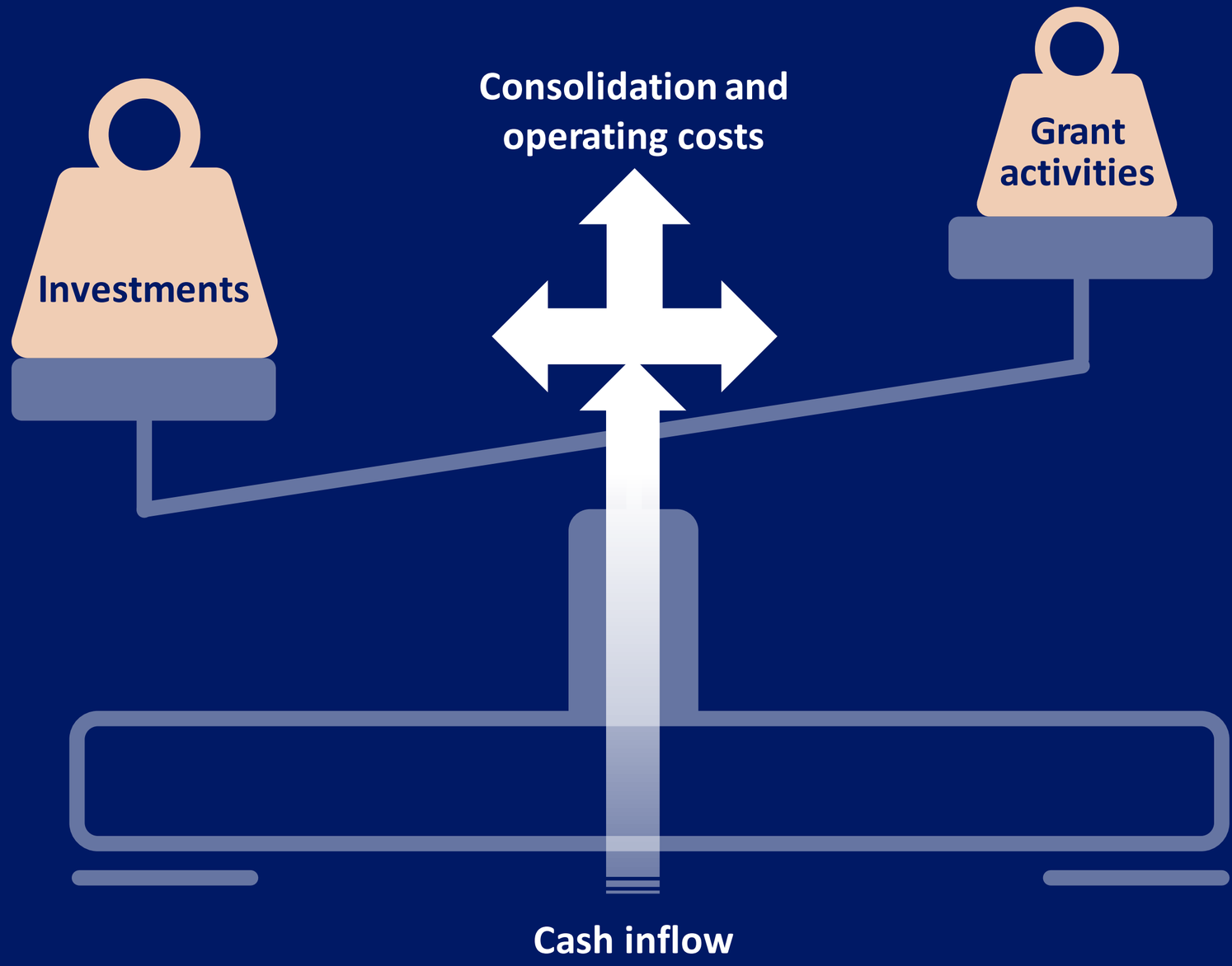
Investment result in 2019:
DKK 26 billion (EUR 3.5 billion)

Principal investments
Venture investments
Seed investments
Financial investments



*) Through Novo Holdings, the Foundation has A-shares in Novo Nordisk and Novozymes. A-shares have 10 times voting power per share

Allocation of funds



Vision and objectives

Our Vision

To contribute significantly to research and development that improves the lives of people and the sustainability of society

Our objectives

Grant-giving objectives

- to support physiological, endocrinological, metabolic and other medical research
- to support Danish research hospital activities within diabetes
- to support other scientific, humanitarian and social purposes

Corporate objective

- to provide a stable basis for the commercial and research activities of the Novo Group companies*

* and of companies in which the Novo Holdings A/S may hold a material equity interest or over which it may have material influence

Grant-awarding focus areas and long-term objectives

Biomedical and health science research and applications

Enable people to live healthier and better lives by facilitating research that advances knowledge of human health and disease, solves health challenges and develops the health care system.

Patient-centred and research based care

Make Denmark a global leader in delivering patient-centred and research based care for people with diabetes and facilitate the development of patient-centred and research based care within diabetes co-morbidities and other endocrine disorders.

Life science research and industrial applications promoting sustainability

Act for and inspire development of a more sustainable world by supporting research that translates to life science solutions to benefit people and the environment.

Natural and technical science research and interdisciplinarity

Catalyse natural and technical science research, particularly in fields with potential interdisciplinary application to the life and health sciences and industrial biotechnology.

Education and outreach

Support general science education and cultivate scientific and technical competencies and engagement.

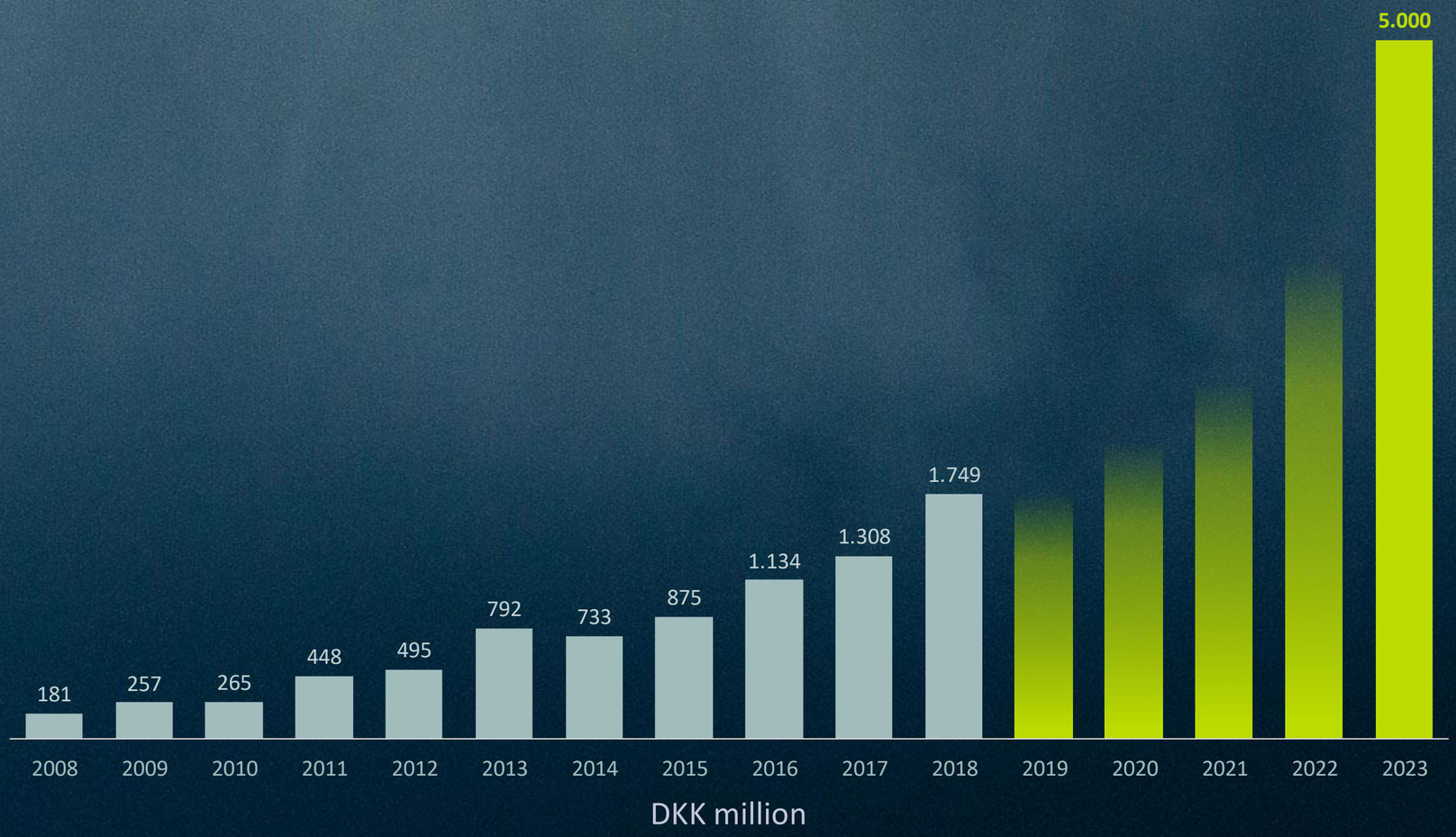
Innovation

To benefit people, promote life science ecosystems that translate scientific discoveries into products and solutions and drive growth.

Social, humanitarian and development aid

Improve the lives and prospects of vulnerable children and young people through health, education, developing competencies and other interventions.

Development in annual grant payout



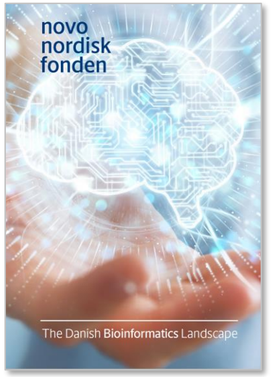
How we operate: models for awarding funding

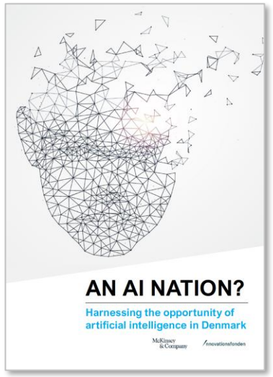
Universities and Hospitals		Health sector & private-public partnerships	Own initiatives (spin-outs)
Open competition • Fellowships • Research Programmes • Project grants • Symposia • Prizes	**NNF Research centers** • Metabolism, stem cells, biosustainability, proteins **Infrastructures** • Biobank, Genome center, MicroMAX **Other awards** • Stand-alone grants	**Steno Diabetes Centers** • SDC Copenhagen • SDC Sjælland • SDC Odense • SDC Århus • SDC Nordjylland	**BioInnovation Institute (BII)** Awarded DKK 392 million **LIFE** (Learn, Inspire, Fascinate, Engage) Expected DKK 1.6 billion

Reactive grant awarding → *Proactive grant awarding*

ABOUT THE NNF DATA SCIENCE INITIATIVE

Background: Setting the scene



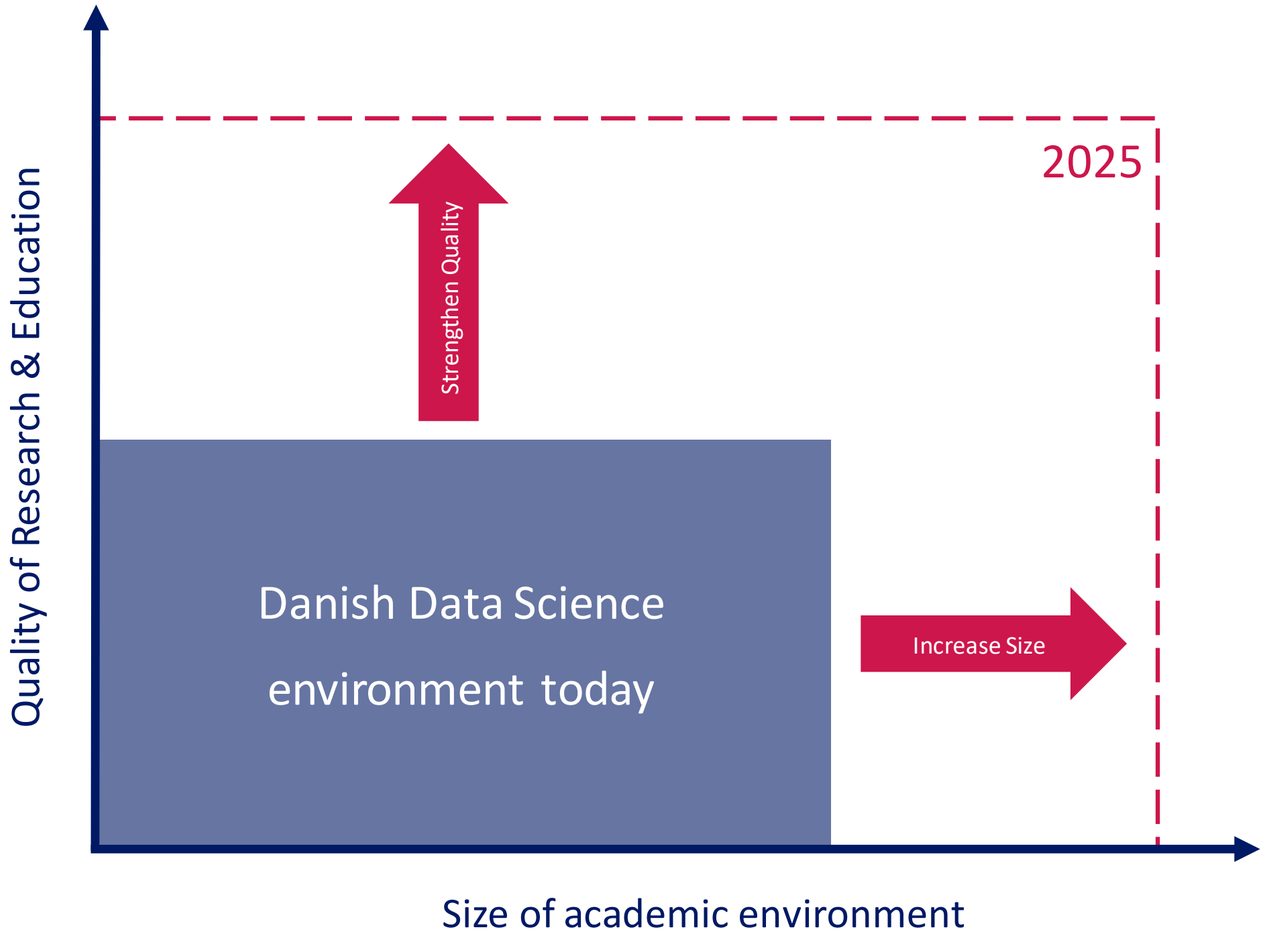


Challenges identified

- The Danish research environment (universities, hospitals) as well as the pharma/biotech sector (incl. Novo Nordisk, Novozymes & other Novo Holdings companies) rely on access to skilled data scientists to maintain excellence and growth
- Too few data scientists are being educated and there is fierce competition from other industries for top talents (tech, finance, manufacturing, etc.)
- Shortage of funding and senior faculty means that the existing academic environment cannot increase its production of MSc, PhD and post-doc level candidates in data science
- Data science (in research) is often seen as a support function
- There is a lack of role models and a clear visible career path in academia

NNF programme focused on
academic capacity building

Intended impact of the NNF Data Science Initiative



- Large and excellent workforce within data science
- Strong Danish position in AI and data science
- Improved Healthcare
- Innovation for the benefit of society
- Steps taken towards a more sustainable society

The NNF Data Science Initiative

Purpose

Support Data Science research and education in Denmark

Impact

- Increased educational output of candidates
- University faculty retained in academia
- Recruitment of foreign talent to Denmark

Motivation

Access to skilled data science resources is key to future growth and excellence across the Danish research- and innovation environments, healthcare sector, and life science industry.

The challenge

The academic environment cannot currently meet the demand for candidate output in Data Science and is now also at risk of loosing it's senior faculty to industry.

Research Funding via Open Competition Programmes

Evaluated by a new International Data Science Committee

National Network

Data Science
Collaborative Projects

Data Science
Investigator Grants

Data Science
Research Infrastructure

Data Science Academy

- Educational courses and training
- Symposia and networking events
- PhD & post-doc scholarships
- Visiting Professorships
- Vocational Training

Under Development

We are well on the way

December 2019

410 mio. kr. fra Novos ejere til data-eksperter: "En julegave til Danmark"

De få, der bliver uddannet i datavidenskab, bliver revet væk. Nu skal en ny stor-satsning fra Novo Nordisk Fonden sikre, at Danmark ikke bliver kørt over på data-fronten.

Birgitte Nauntofte er direktør i Novo Nordisk Fonden. | Foto: Jeppe Michael Jensen/Ritzau Scanpix

Relaterede

FINANS

AF JESPER KILDEBOGAARD

Offentliggjort: 20.12.19 kl. 08:17

Danmark har brug for flere, der kan håndtere store mængder data. Og derfor går Novo Nordisk Fonden nu ud med en ny bevilling på hele 410 mio. kr., som over tre år skal være med til at styrke hele data-feltet.

December 2020

Novo Nordisk Foundation awards DKK 138 million under its new data science and artificial intelligence initiative

The 2021 Data Science open call programs

Data Science
Collaborative Research Projects

Funding for collaborative projects involving data science within the Foundation's stategic focus areas

Grant budget in 2020

- up to 60 million DKK

Grant sizes

- up to 25 million over 5 years

Key Information

- Research collaborations between data scientists and domain experts (medical doctors, basic scientists, etc.)
- At least one co-applicant must be a Danish-based data science group. Consortium call be all data scientists.
- International partners are welcome but not as main applicants

Data Science
Investigator Grants

Funding for excellent independent data science group leaders at different career stages

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Key Information

- Emerging Investigator
  Senior post-doc or Assistant Professor level
- Ascending Investigator
  Associate/assistant Professor level
- Distinguished Investigator
  Full Professor level

Data Science
Research Infrastructure

Funding for shared super computers, hardware, GPUs, equipment, and "data as infrastructure"

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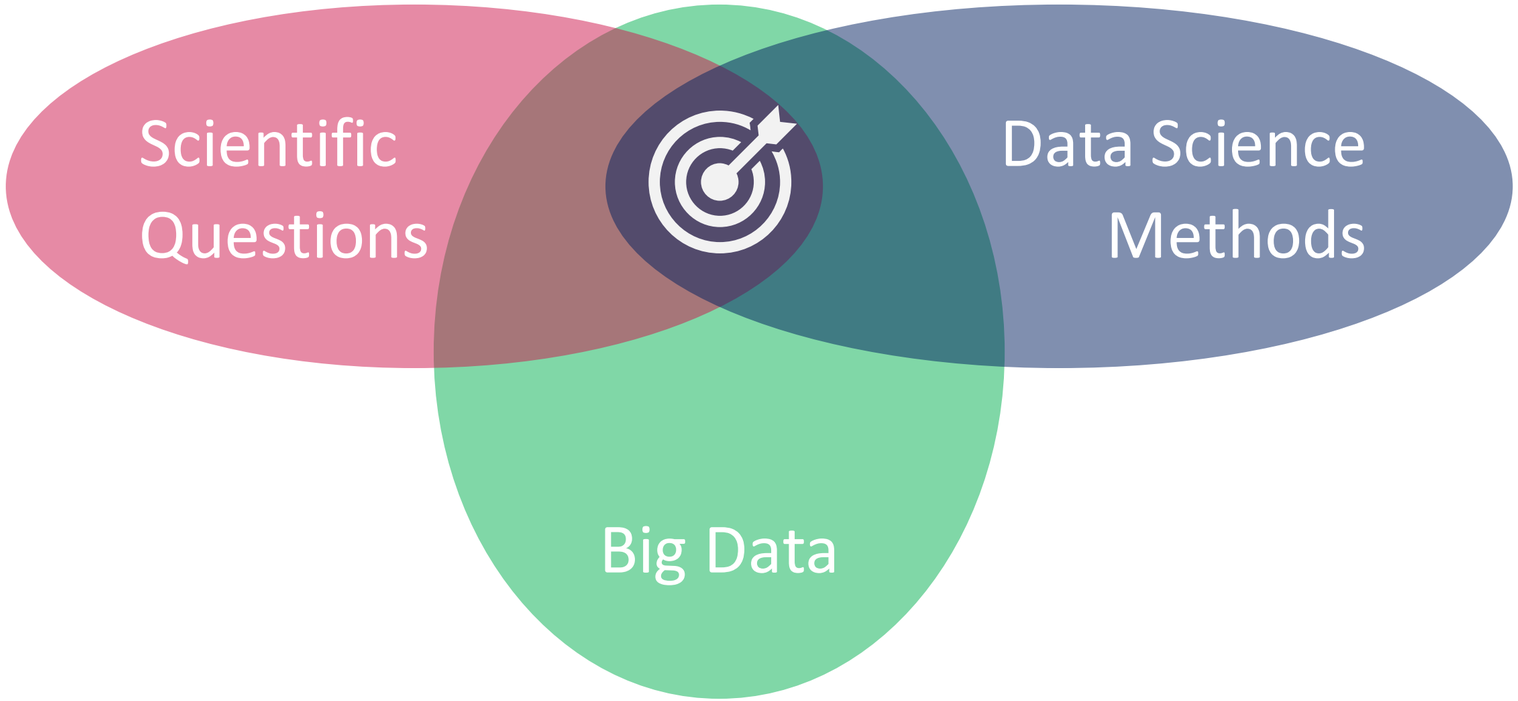
Key information

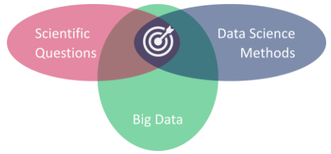
- Infrastructure must be open and shared
- Promotion of FAIR principles
- Can fund staff position to run the infrastructure
- "Data as infrastructure" projects may include data collection, curation, engineering and management

THE RESEARCH SCOPE

Addressing **relevant problems/questions** with **big data** and **data science methods**



Research scope



A. Development of new algorithms, methods and technologies within data science, artificial intelligence (incl. machine learning and deep learning), data engineering, data mining, statistics, applied math, computer science, big data analytics, etc.

B. Applications of data science within the Foundation's **scientific focus areas**

Biomedical & health sciences

Life science and industrial applications promoting sustainability

Natural and technical sciences

What is outside scope?

- *projects without potential future applications within the NNF's scientific focus areas*
- *projects with no novelty in terms of development or application of data science methods*

Advice: It must be clear from your application how your projects fits the research scope!

Methods development-oriented projects

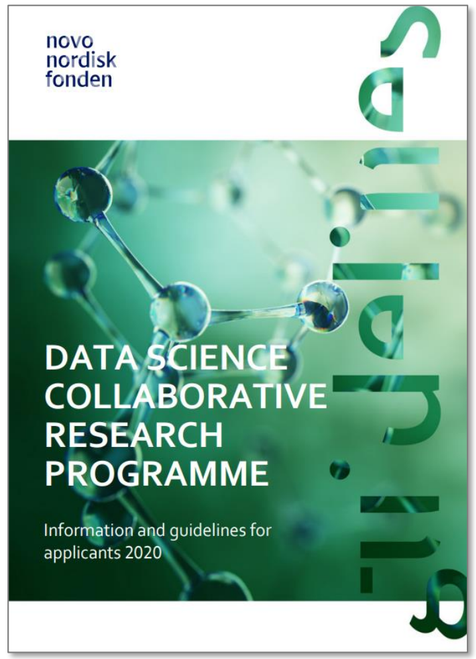
Projects concerned with data science methods development, should remember to argue/show the relevance for potential future application and impact within life science, health science, biotechnology, etc.

Application oriented projects

Projects which have their primary focus on application of data science methods must describe and explain the novelty and impact of their data science approach, be it development of novel methods or novel applications of existing methods.

See the written guideline (on-line) for details…

Guidelines for Applicants



The Novo Nordisk Foundation's scientific focus areas

Biomedical and Health Sciences supports basic research in biomedicine that paves the way for advances in translational medicine and innovative clinical applications. Among the key topics are: basic biomedical research, translational biomedical research and technologies, clinical research, health-related data science infrastructure and applications, and research in patient-centred healthcare and treatment systems.

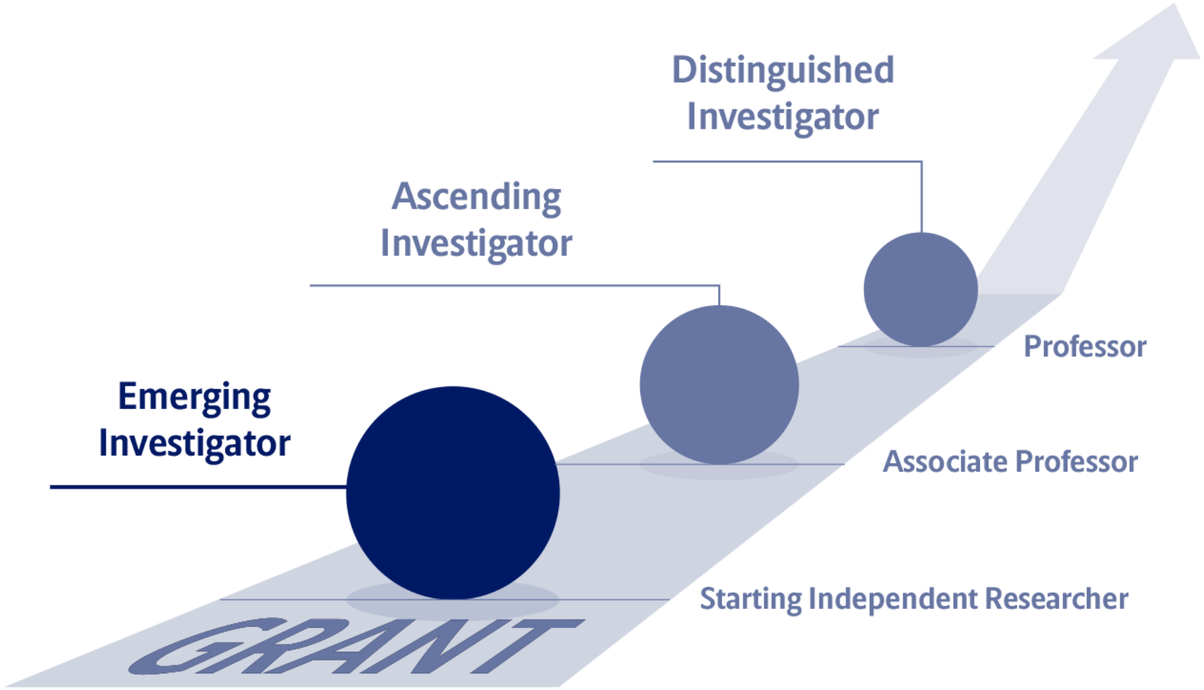
Life Science and Industrial Applications Promoting Sustainability addresses the escalating global sustainability challenges and the potential to make a positive impact for the environment. The research areas that are supported are within industrial biotechnology and environmental biotechnology, plant science, agriculture and food biotechnology as well as ecosystems research related to these areas. Basic research, platforms, and technologies enabling research on sustainability are included.

Natural and Technical Sciences supports fundamental research within the natural and technical sciences, including, e.g., physics, chemistry, mathematics, data science, and technical sciences. The research must have potential interdisciplinary application in biomedicine, health sciences, or biotechnology; this application need not be in the project period but could be beyond. Focus areas include interdisciplinary research, quantum technologies with potential application in the life sciences, data science, and health- and med-tech.

INVESTIGATOR GRANTS

Data Science Investigator Grants

– an extension of the NNF research leader programme



Data Science

Investigator Grants

Funding for excellent independent data science group leaders at different career stages

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Østerbro svømmehal, source: minby.dk

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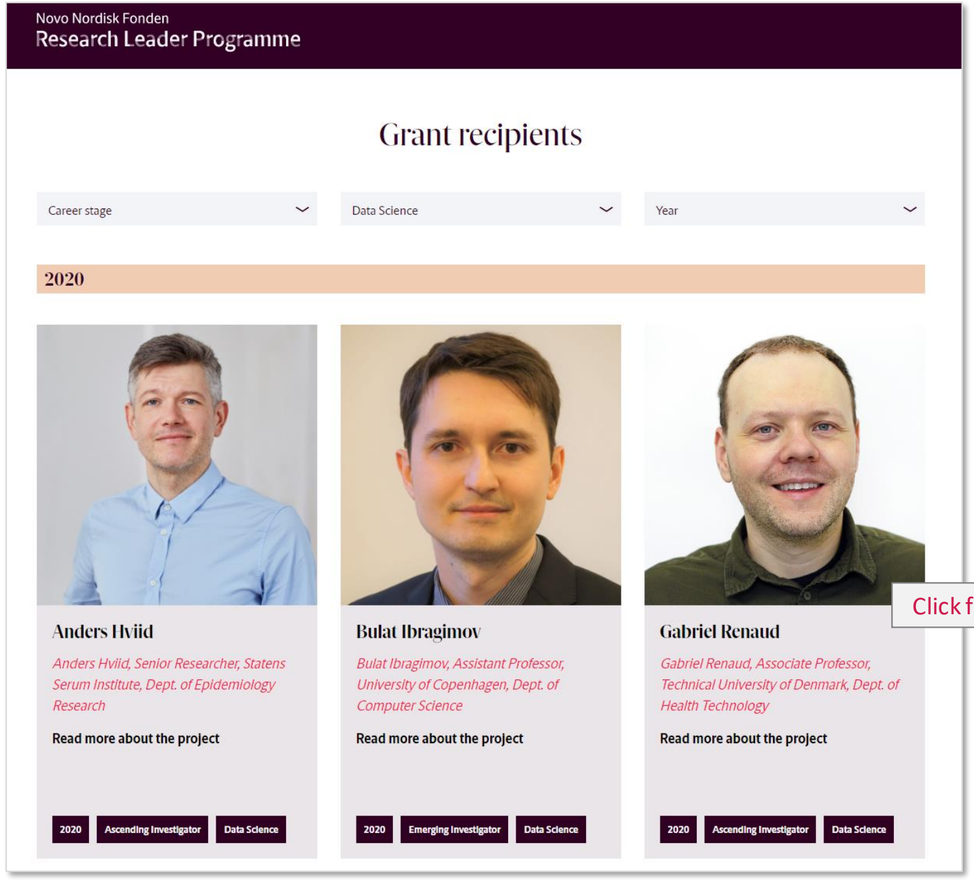
https://researchleaderprogramme.com

novo nordisk fonden

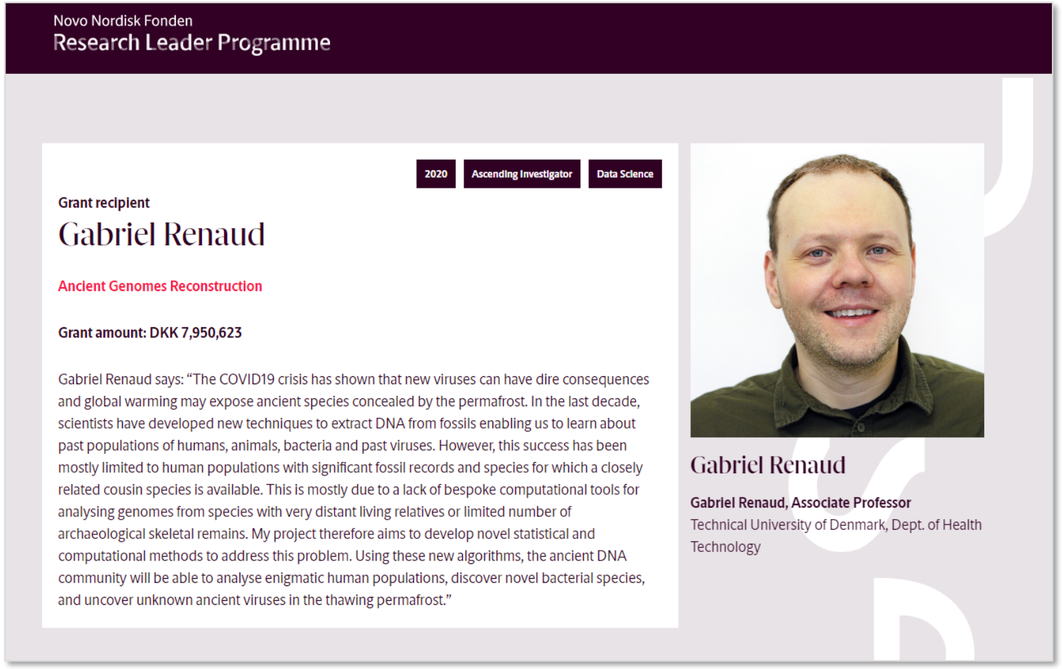
2020 Data Science Investigator Grant recipients

Types	Investigator	Job title	Department and Institution	Project title	Grant sum
EMERGING	Julius Kirkegaard	Postdoctoral Fellow	Niels Bohr Institute University of Copenhagen	Differentiable Physical Models for Data Analysis in Biology	DKK 7,202,086
EMERGING	Bulat Ibragimov	Assistant Professor	Computer Science University of Copenhagen	Leveraging Artificial Intelligence for Pancreatic Cancer Diagnosis, Treatment Planning and Treatment Outcome Prediction	DKK 7,879,373
EMERGING	Tugce Karaderi	Assistant Professor	Center for Health Data Science University of Copenhagen	Data Science Approaches to Study Epidemiological and Genetic Underpinnings of Hypothyroidism to Pave the Way for Precision Medicine	DKK 9,175,424
ASCENDING	Martin Andersen	Associate Professor	Applied Mathematics and Computer Science Technical University of Denmark	Scalable Optimization for Data Science	DKK 7,702,145
ASCENDING	Anders Hviid	Senior Researcher	Epidemiology Research Statens Serum Institut	Identifying Heterogeneous Treatment Effects with Machine Learning	DKK 9,052,063
ASCENDING	Gabriel Renaud	Associate Professor	Health Technology Technical University of Denmark	Ancient Genomes Reconstruction	DKK 7,950,623
DISTINGUISHED	Susanne Ditlevsen	Professor	Mathematical Sciences University of Copenhagen	Statistical Inference for Coupled Stochastic Processes with Multiple Timescales and Changing Environments	DKK 8,195,513
DISTINGUISHED	Niels Richard Hansen	Professor	Mathematical Sciences University of Copenhagen	CLUE: Causal Learning for Unstructured Events	DKK 8,409,592

Detailed info @ the NNF Research Leader programme website



Click for details

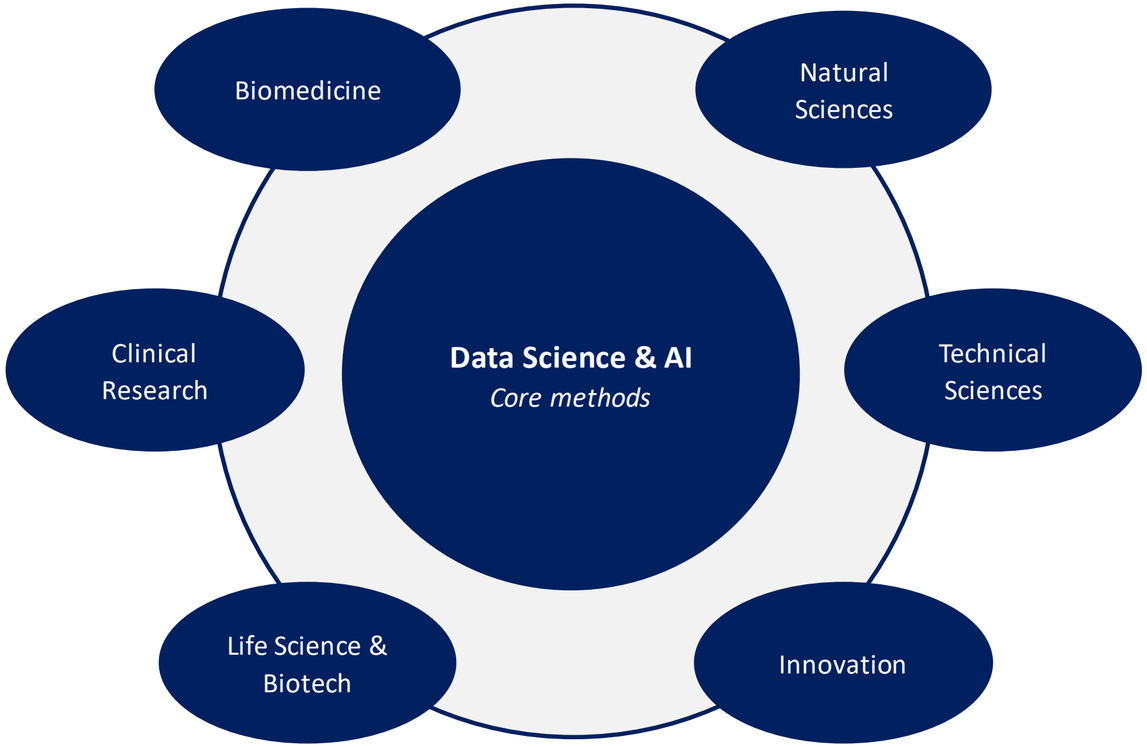


https://researchleaderprogramme.com/recipients

COLLABORATIVE RESEARCH PROJECTS

Data Science Collaborative Research projects

Inspired by Challenge, Synergy, Tandem, etc.



Data Science

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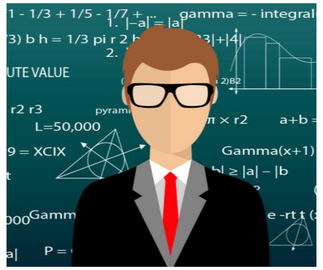
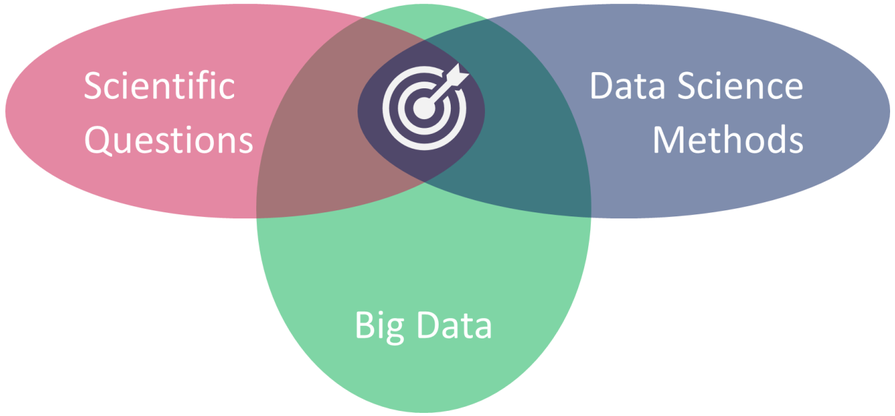
Prof Hansen, MD

Collaboration

Prof Jensen, Data Scientist





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2020 Collaborative Research Project Grants

Center for Basic Machine Learning Research in Life Science (DKK 29,984,002)

Development of fundamental machine learning algorithms and methods tailored to Life Science applications, such as protein engineering and optimization, sequence variation, genomics, medical imaging, drug discovery, etc.

Name	Title	Department
Ole Winther (PI)	Professor @ KU/DTU	Biology / Applied Mathematics and Computer Science
Aasa Feragen-Hauberg	Professor @ DTU	Applied Mathematics and Computer Science
Søren Hauberg	Professor @ DTU	Applied Mathematics and Computer Science
Jes Frellsen	Assoc. Professor @ DTU	Applied Mathematics and Computer Science
Anders Krogh	Professor @ KU	Computer Science & Health Data Science (SUND)
Wouter Boomsma	Assoc. Professor @ KU	Computer Science

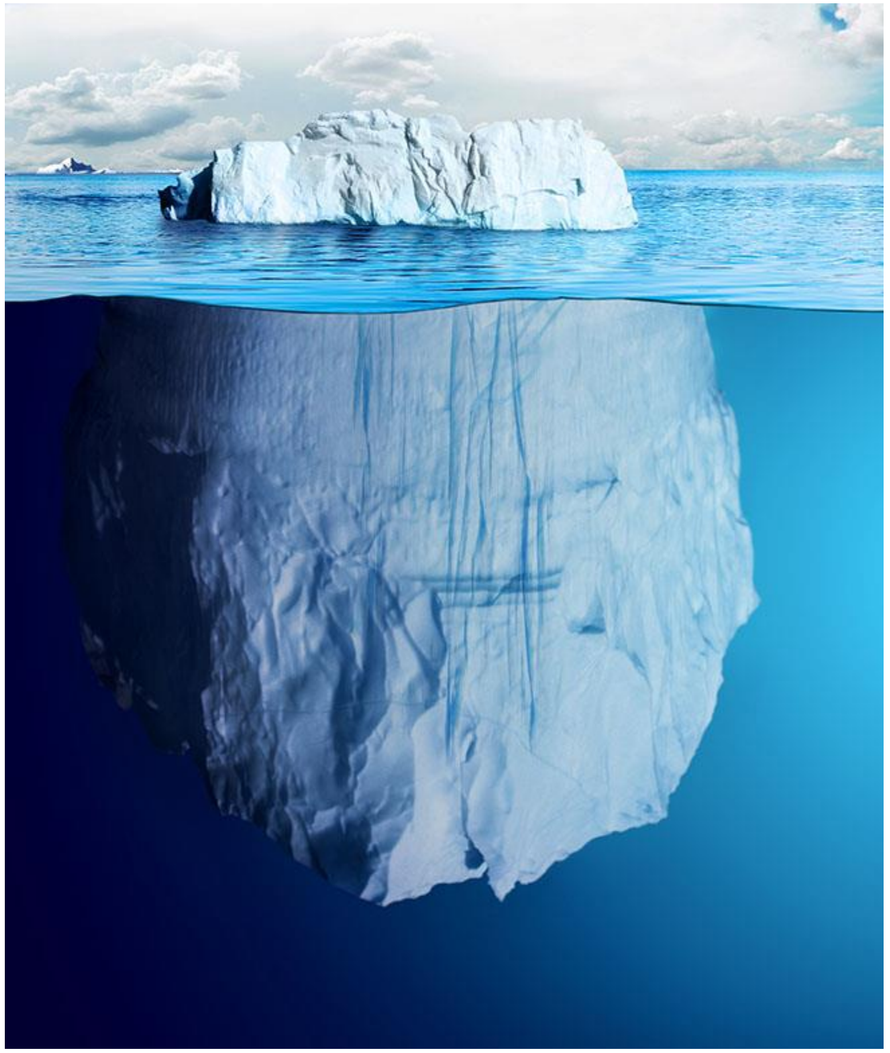
Machine Learning Methods for Data-driven Discovery of Antibiotic Resistance Plasmid Dissemination and Evolution (DKK 14,983,392)

Develop and apply deep learning methods to discover and monitor bacterial plasmid dissemination and evolution in massive sequencing data sets, with the aim of finding new ways to study and combat antimicrobial resistance.

Name	Title	Department
Søren Sørensen (PI)	Professor @ KU	Department of Biology
Simon Rasmussen	Associate Professor @ KU	NNF Center for Protein Research
Alexander Sczyrba	Professor @ Bielefeld U, Germany	Center for Biotechnology

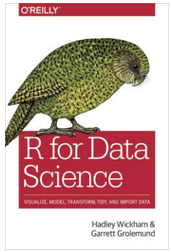
RESEARCH INFRASTRUCTURE

Supporting that which enables excellent data science…



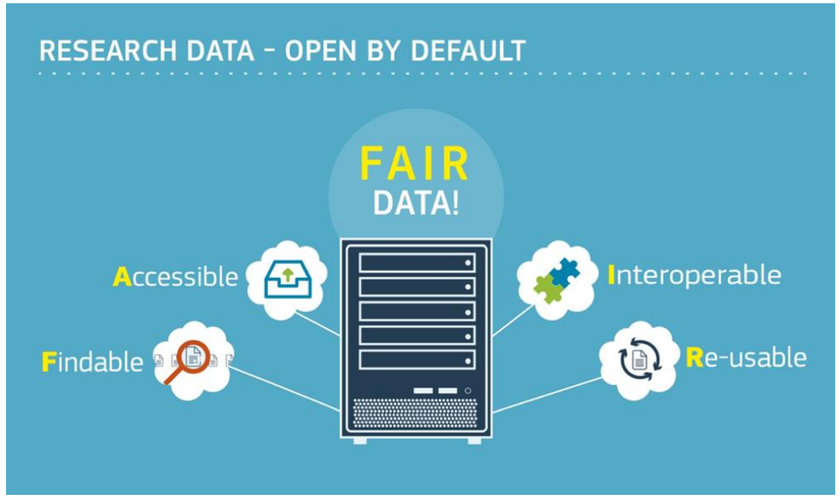
TensorFlow

scikit learn



- Clean data
- QC data
- Access data
- Find data
- Generate data
- Encode data
- Engineer data
- Organize data
- Reformat data

Data Science Research Infrastructure 2021



https://www.openaire.eu/how-to-make-your-data-fair

https://escience.sdu.dk/index.php/news/forskningens-dogn-the-danish-science-festival-experience-sdus-supercomputer-abacus2-0-april-27th-2019-from-1000-1600/

Data Science
Research Infrastructure

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2020 Collaborative Research Project Grants

National Health Data Science Sandbox for Training and Research (DKK 17,764,483)

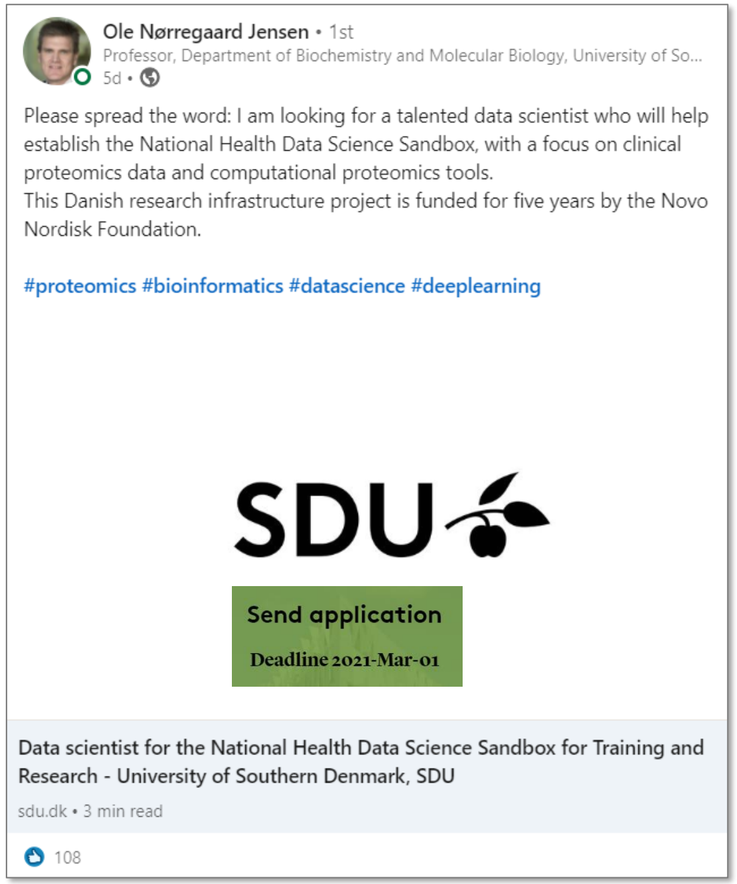
This national collaboration will establish a shared national sandbox environment with data, tools and infrastructure for training students and researchers in analyzing health data, without compromising the privacy or rights of patients.

Anders Krogh, Professor @ Center for Health Data Science, University of Copenhagen

The OpenNeuroPET Archive – A Molecular Neuroimaging Archive (DKK 10,144,473)

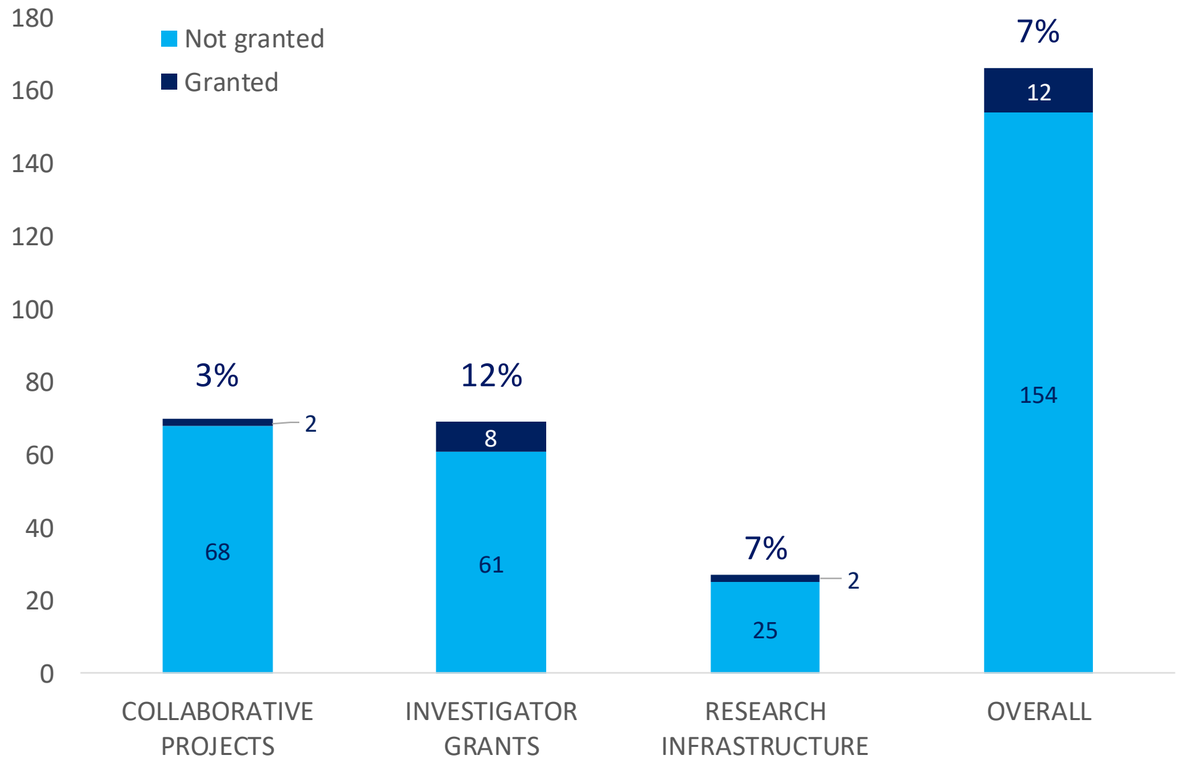
The project will establish an open-access database and platform for sharing and analyzing brain imaging data (PET). It will enable researchers worldwide to share data to advance brain research and medical imaging technology.

Gitte Moos Knudsen, Professor @ Neurobiology Research Unit, Rigshospitalet



The 2020 statistics

2020 Data Science Open Call statistics



Applications received

Total:

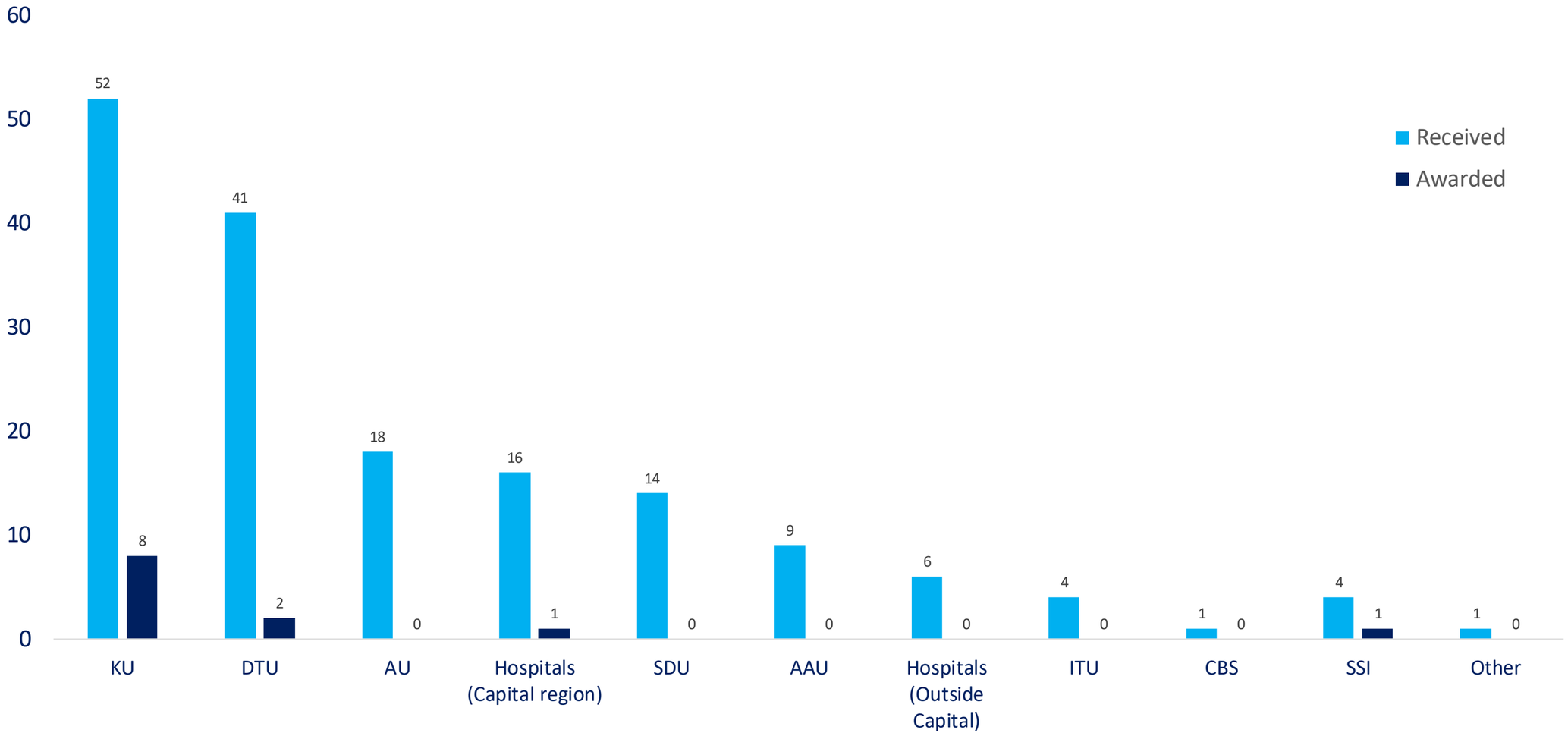
- 168 applications
- 16% female applicants (main)

Grants awarded

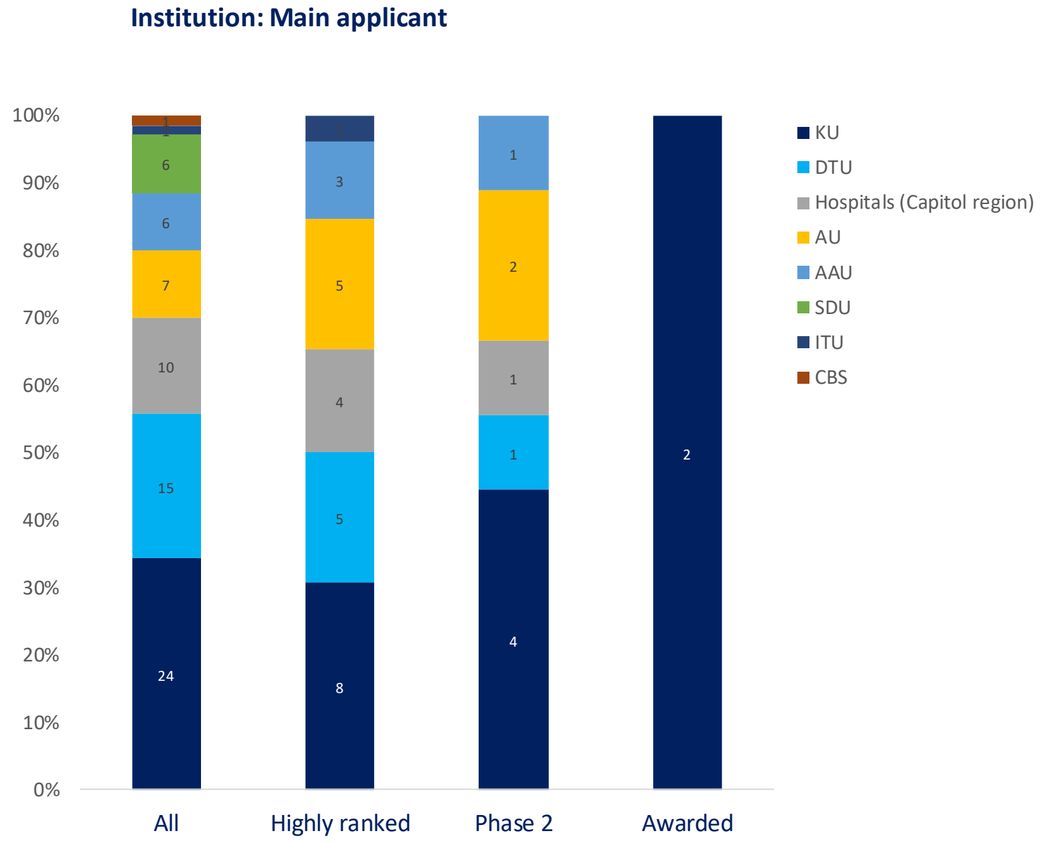
Total:

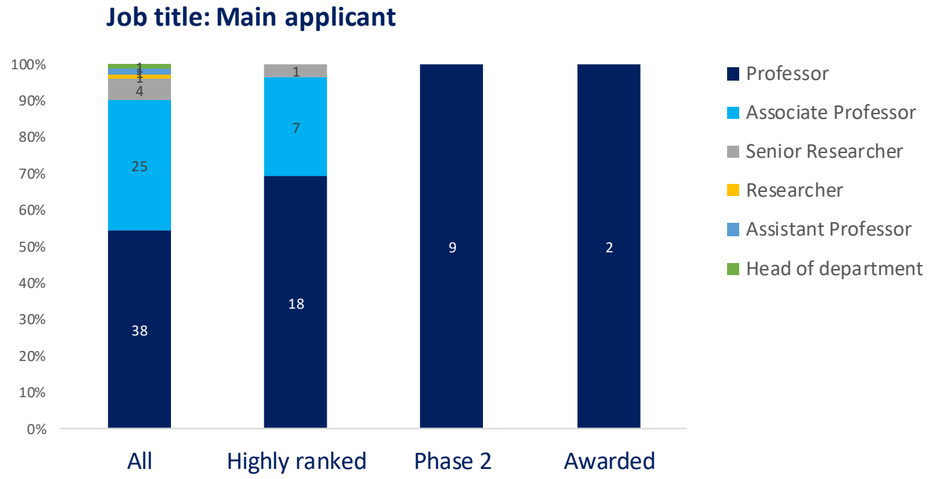
- 12 grants awarded (7%)
- 25% female grant recipients

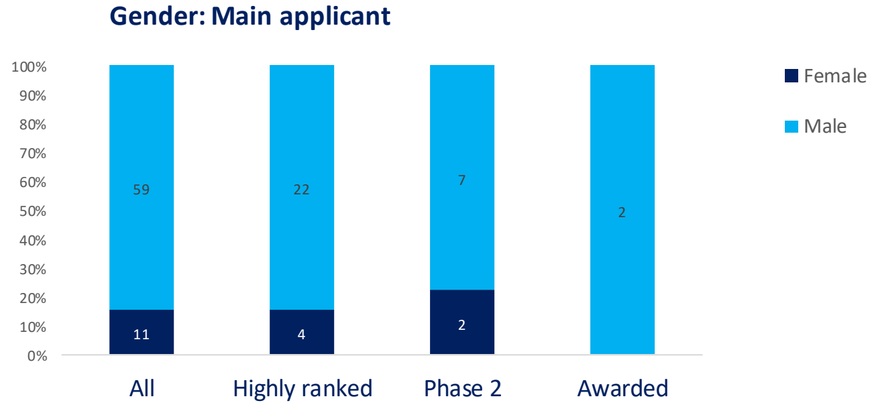
Where did the applications come from?



2020 Statistics: Collaborative Research Projects



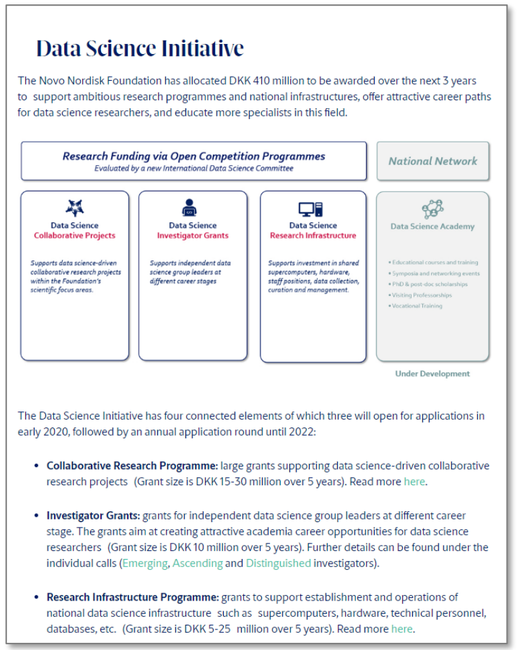




APPLYING IN 2021

All the details are on our homepage!

Initiative page



Data Science Initiative

The Novo Nordisk Foundation has allocated DKK 410 million to be awarded over the next 3 years to support ambitious research programmes and national infrastructures, offer attractive career paths for data science researchers, and educate more specialists in this field.

Research Funding via Open Competition Programmes
Evaluated by a new International Data Science Committee

National Network

Data Science Collaborative Projects
Supports data science-driven collaborative research projects within the Foundation's scientific focus areas.

Data Science Investigator Grants
Supports independent data science group leaders at different career stages

Data Science Research Infrastructure
Supports investment in shared supercomputers, hardware, staff positions, data collection, curation and management.

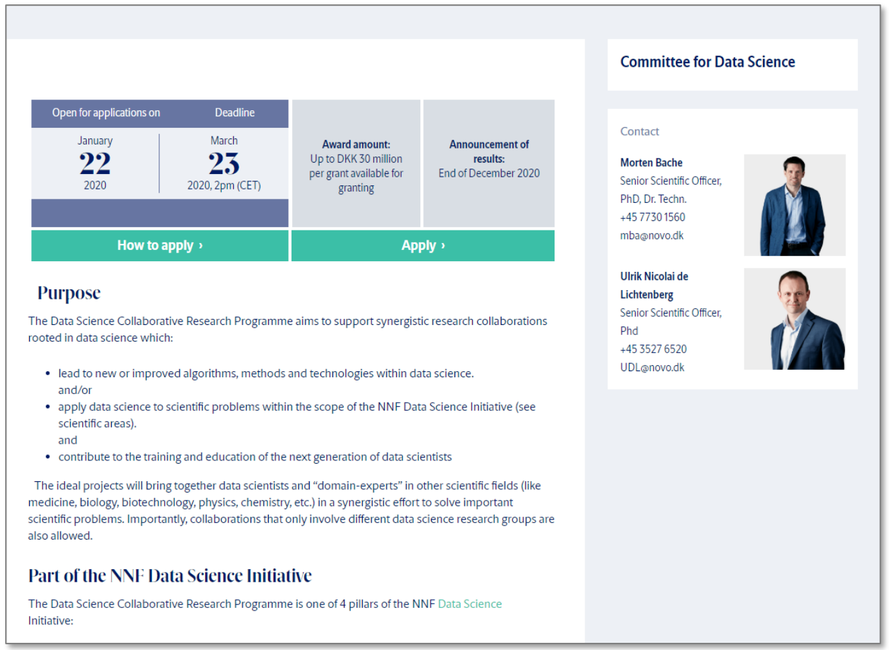
Data Science Academy
- Educational courses and training
- Symposia and networking events
- PhD & post-doc scholarships
- Visiting Professorships
- Vocational Training

Under Development

The Data Science Initiative has four connected elements of which three will open for applications in early 2020, followed by an annual application round until 2022:

- **Collaborative Research Programme:** large grants supporting data science-driven collaborative research projects (Grant size is DKK 15-30 million over 5 years). Read more here.
- **Investigator Grants:** grants for independent data science group leaders at different career stage. The grants aim at creating attractive academia career opportunities for data science researchers (Grant size is DKK 10 million over 5 years). Further details can be found under the individual calls (Emerging, Ascending and Distinguished investigators).
- **Research Infrastructure Programme:** grants to support establishment and operations of national data science infrastructure such as supercomputers, hardware, technical personnel, databases, etc. (Grant size is DKK 5-25 million over 5 years). Read more here.

Specific call pages



Open for applications on	Deadline	Award amount:	Announcement of results:
January 22 2020	March 23 2020, 2pm (CET)	Up to DKK 30 million per grant available for granting	End of December 2020

How to apply › Apply ›

Purpose

The Data Science Collaborative Research Programme aims to support synergistic research collaborations rooted in data science which:

- lead to new or improved algorithms, methods and technologies within data science.
  and/or
- apply data science to scientific problems within the scope of the NNF Data Science Initiative (see scientific areas).
  and
- contribute to the training and education of the next generation of data scientists

The ideal projects will bring together data scientists and "domain-experts" in other scientific fields (like medicine, biology, biotechnology, physics, chemistry, etc.) in a synergistic effort to solve important scientific problems. Importantly, collaborations that only involve different data science research groups are also allowed.

Part of the NNF Data Science Initiative

The Data Science Collaborative Research Programme is one of 4 pillars of the NNF Data Science Initiative:

Committee for Data Science

Contact

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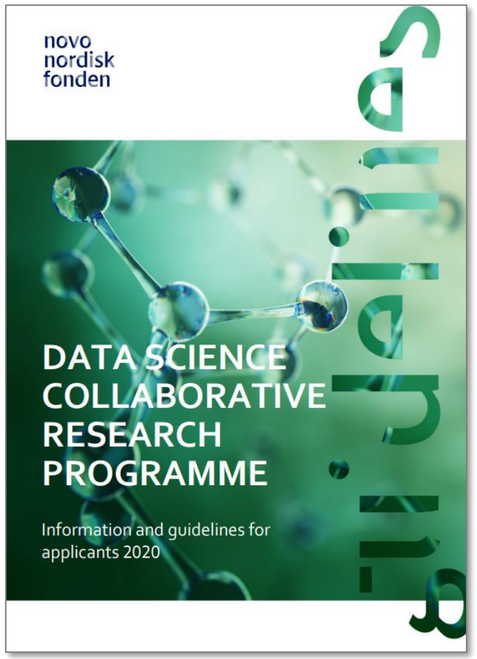
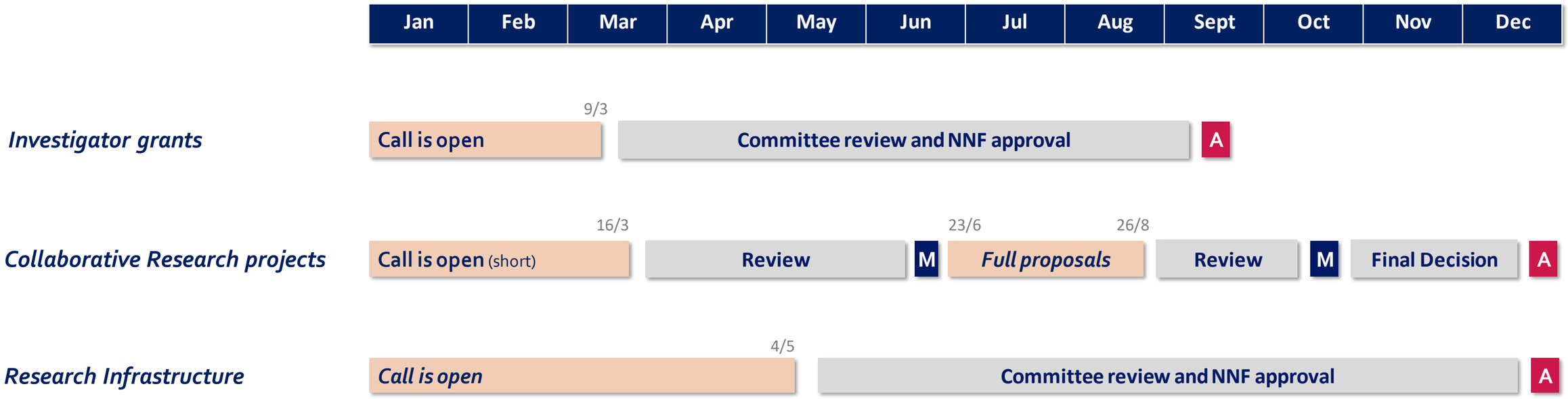
Guidelines for Applicants



https://novonordiskfonden.dk/en/projects-and-initiatives/data-science-initiative/

Timeline for 2021 open calls



M Committee meeting

A Announcement of grant recipients

Committee for Data Science (2021) – 50% of members are new

Member	Profile	Country	Title and affiliation
Gunnar von Heijne	Physics, chemistry, bioinformatics	Sweden	Professor in Biochemistry, Department of Biochemistry and Biophysics, Stockholm University, Sverige
Daniel Cremers*	Machine learning, computer vision	Germany	Professor in Informatics and Mathematics, Chair of Computer Vision and Artificial Intelligence, Center for Machine Learning, TU Munich, Germany
Fredrik Kahl*	Machine learning, medical imaging	Sweden	Professor in Computer Science, Computer Vision Group, Department of Electrical Engineering, Chalmers University of Technology, Sweden
Chris Holmes*	Biostatistics	United Kingdom	Professor in Biostatistics, Departments of Statistics & Nuffield Department of Medicine, University of Oxford, United Kingdom
Alfonso Valencia*	Bioinformatics, HPC	Spain	Professor, Director of Department, Computational Biology, Life Sciences Department, Barcelona Supercomputing Center, Spain
David T Jones	Bioinformatics, machine learning	United Kingdom	Professor in Bioinformatics, Department of Computer Science, University College London, United Kingdom
Nataša Pržulj*	Bioinformatics, network biology	Spain	Professor in Biomedical Data Science, Integrative Computational Network Biology, Life Sciences Department, Barcelona Supercomputing Center, Spain and Department of Computer Science, University College London, United Kingdom
Detlef Weigel*	Plant biology, molecular evolution	Germany	Professor in Molecular Biology, Director, Max Planck Institute for Developmental Biology, Tübingen, Germany
Markus Ralser	Microbiology, metabolism, bioinformatics	Germany	Professor of Biochemistry, Head of Department, Molecular Biology of Metabolism Laboratory, Francis Crick Institute, United Kingdom and Charité - Universitätsmedizin Berlin, Germany
Alexandre Tkatchenko	Theoretical physics	Luxemburg	Professor in Theoretical Condensed Matter Physics, Faculty of Science, Technology and Medicine, University of Luxemburg, Luxemburg
Olli-Pekka Kallioniemi	MD, Precision medicine, omcis, cancer	Sweden	Professor in Molecular Medicine, Director, SciLifeLab, Karolinska Institute, FIMM, Sweden
John Danesh*	Epidemiology, medicine, public health	United Kingdom	Professor in Epidemiology and Medicine, MD, Head of Department, Department of Public Health and Primary Care, University of Cambridge, United Kingdom
Isabel Rocha	Systems biology, metabolic models, innovation	Portugal	Pro-rector for Innovation and Entrepreneurship, Instituto de Tecnologia Química e Biológica António Xavier, NOVA University Lisbon, Portugal

* New member in 2021

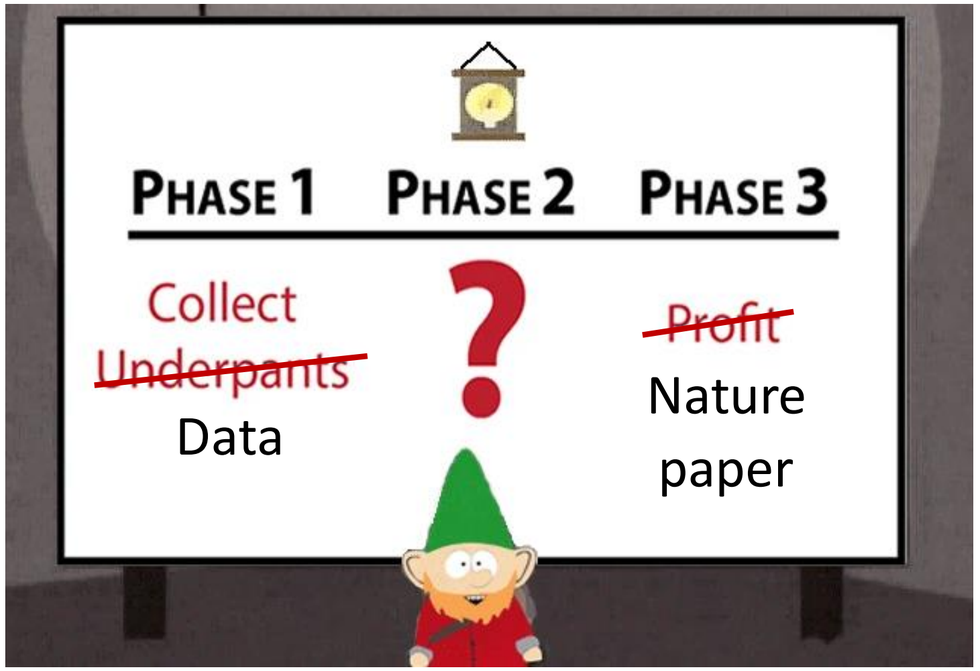
https://novonordiskfonden.dk/en/committees/committee-for-data-science-2021-2/

Good Advice from us

- Read the guidelines carefully ☺
- Familiarize yourself with the Foundations application system “NORMA”
- Do not submit your application on the last day…2 minutes before deadline ☺
- Explain
  - ✓ How your project/idea/methods are new/different/better than the current state-of-the-art
  - ✓ How your project/idea fits into the national landscape (particularly infrastructure)
  - ✓ What methods you will use? What you mean by “Machine learning”?
  - ✓ The wider impact of your work on the Danish data science community
  - ✓ Your contribution to teaching and sharing of data, code, tools, etc.

A final word of advice or causion about your project application ☺

Avoid the ”Underpant Gnome” business model

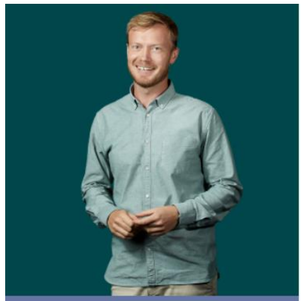


Questions about the Data Science open calls?

Signe Rømer Holm
Grant Manager

NAT-TECH (admin)

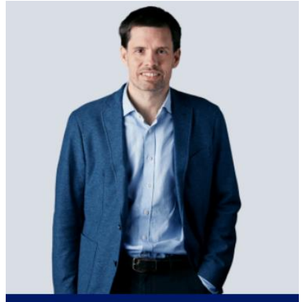
Natural and technical science research and interdisciplinarity



Thomas de Bang
Scientific Manager, PhD

BIO-TECH

Life science research and industrial applications promoting sustainability



Morten Bache
Senior Scientific Lead, PhD, Dr. Techn.

NAT-TECH

Natural and technical science research and interdisciplinarity

Ulrik Nicolai de Lichtenberg
Senior Scientific Manager, PhD

BIO-MED

Biomedical and health science research and applications

Questions?