

STATENS
SERUM
INSTITUT



THE DANISH NATIONAL BIOBANK



DANMARKS
NATIONALE
BIOBANK



About me - Bart Wilkowski

- Danish National Biobank (2011-)
 - **2017** - : IT Manager (Danish National Biobank internal IT systems)
 - **2011** - : Project lead (System architect & developer) - Danish Biobank Register
- Technical University of Denmark (DTU) (2007-2011)
 - Research assistant & Ph.d. student
(Biomedical informatics, semantic text mining)
 - National Library of Medicine (NIH, Bethesda, MD, USA)
- Technical University of Lodz, Poland
 - MSc Engineer, International Faculty of Engineering, Telecommunications & Computer Science

Roadmap of my talk

- Background
 - Danish health registries
 - establishment of the Danish National Biobank (DNB)
- DNB – the **physical biobank**
- DNB – **Danish Biobank Register**
 - **National search system for rapid overview of preexisting biological samples**
- DNB – the **Coordinating Center** (access & outreach)
- Summary

“The Danish peninsula and its islands hold 0.08% of the world’s population, and yet we derive as much useful medical knowledge from Denmark as from anywhere else on earth. Such are the benefits of whole population data collection”

Richard Lehman (den mest læste blogger på BMJ)

The Danish registries are unique

- an investment worth billions of kroner
- follow the individual from birth to grave
- follow diseases through generations (gene/environment)
- millions of individuals
- results are robust



A newborn
viking

071215-0001
(CPR-number)

Birth characteristics

Diseases

All microbiological diagnoses

Prescribed medication

Vaccinations

Childcare facility history

School performance

Family, place of living

Education, employment

Biological specimens

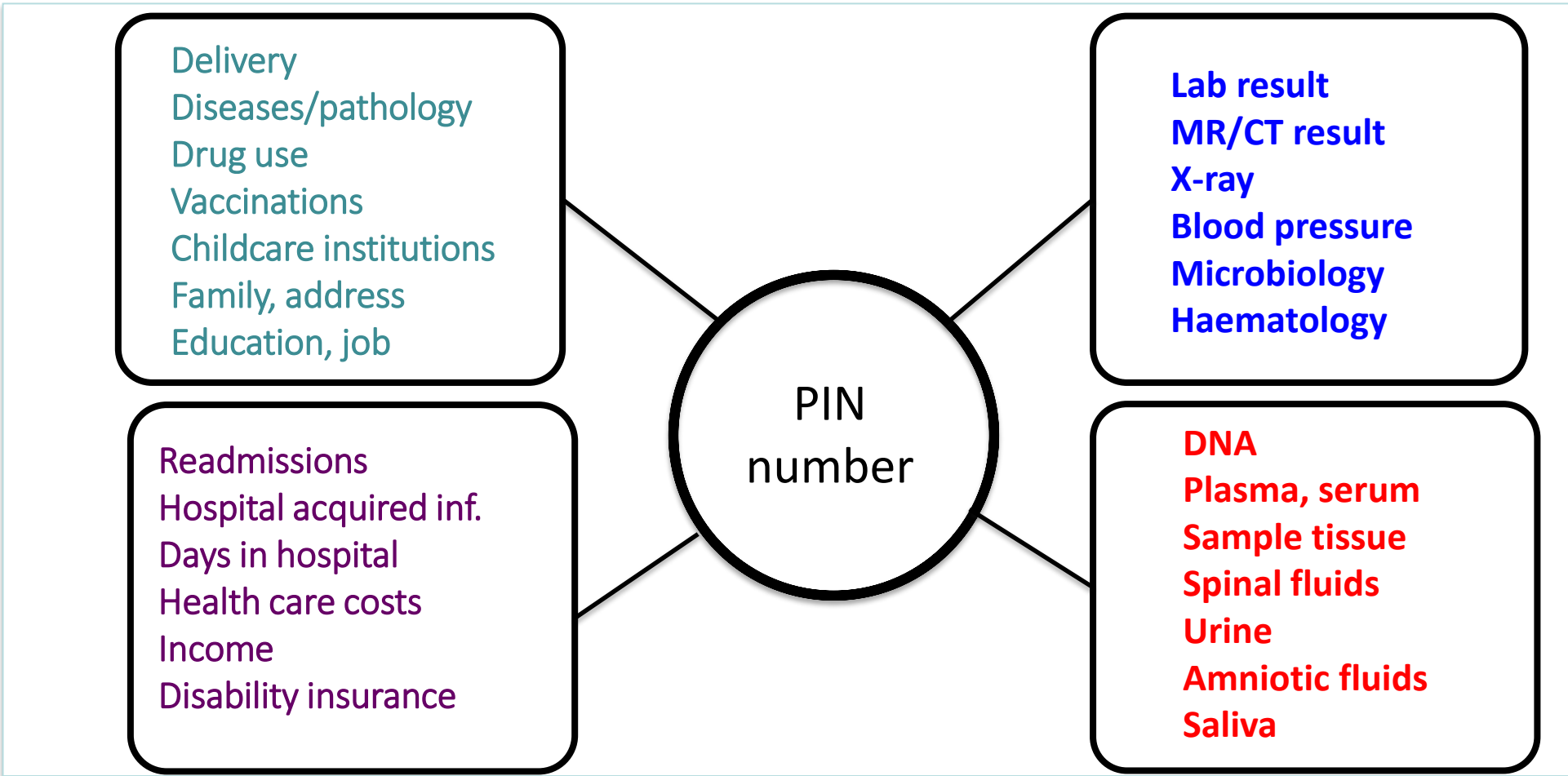
What is it that is so unique?

ALL subjects are included

Avoid the devastating selection bias in research

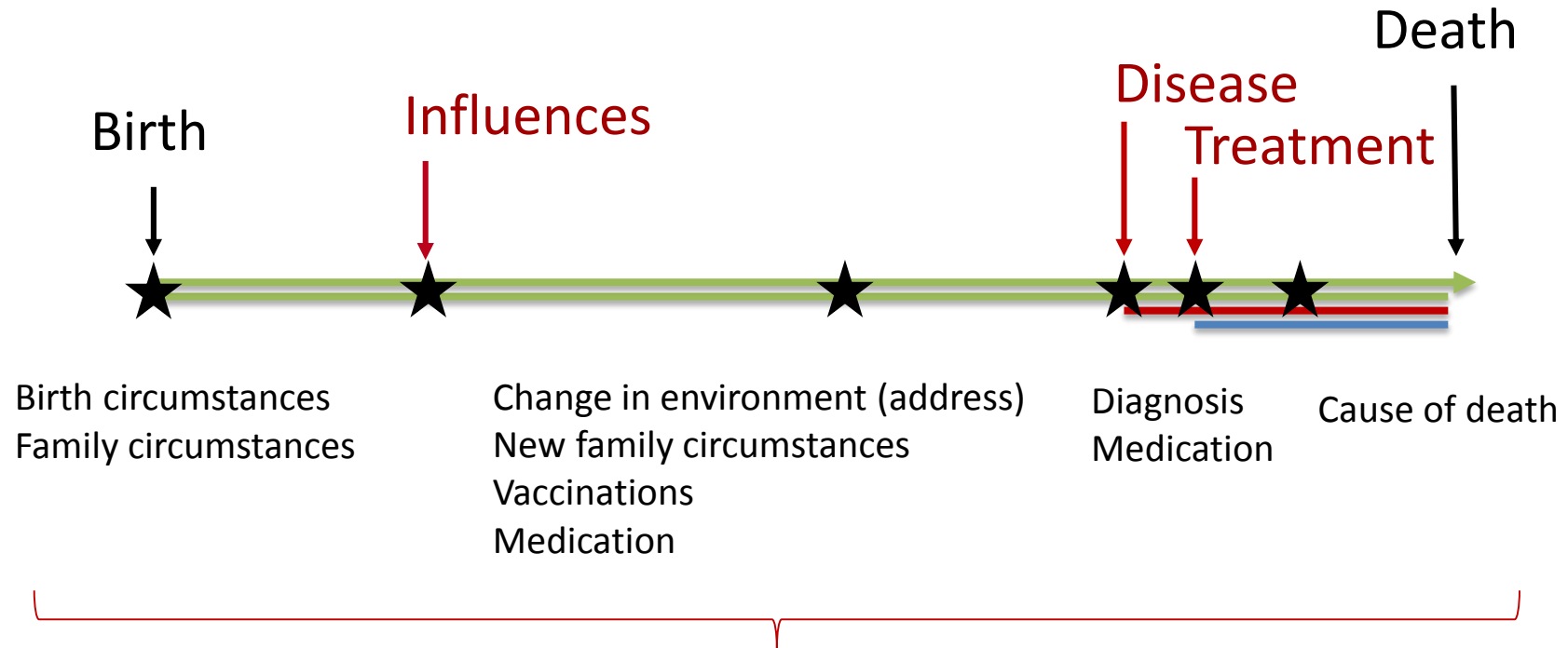
American case-control studies have a participation
rate of 16-20%

Research platform



The biobank research potential

From Cradle to Grave Disease migration through generations



★ Biological samples (biomarkers, genetics, functional studies)

The concept of the Danish National Biobank

Danish National Biobank

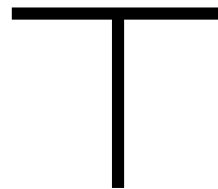


www.nationalbiobank.dk

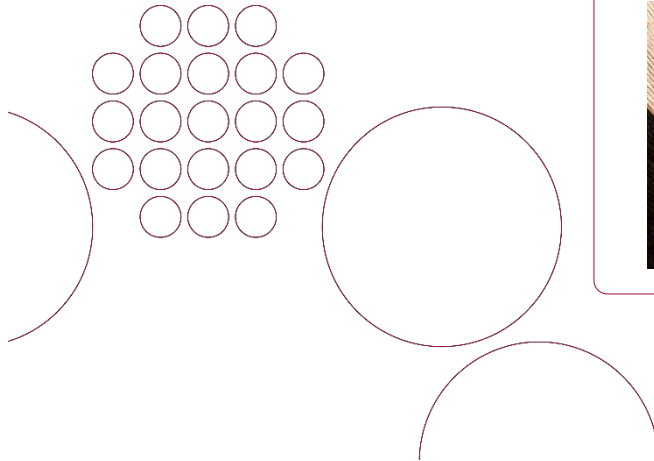
Danish Biobank Register



www.biobanks.dk



The Coordinating Centre



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Establishment of the Danish National Biobank (DNB)

- **2008** – submission of a joint application for funding (establishment of DNB)
 - Motivation:
 - Shared infrastructure for researchers: storage, processing, retrieval of biological specimens
 - Joint overview of available Danish biological specimens (national level)
 - Need for state-of-the-art infrastructure in order to establish top-class best practice on storage, handling, and delivery of biological specimens
 - Need for advisory role (for researchers and health authorities) on biobanking
 - Develop into a strong partner in international research collaboration
- **2010** – funding granted by Novo Nordisk Foundation / Ministry of Research and Innovation / Lundbeck Foundation
- **March 2012** – Grand Opening of the Danish National Biobank (physically located as a part of the Statens Serum Institut)

Before the Danish National Biobank (legacy samples)

- Statens Serum Institut (SSI) has served as a national laboratory for over 100 years
- Millions of biological samples were stored at SSI and in other labs/warehouses
- Researchers had to go through timeconsuming journal reviews at hospitals in order to recruit patients and to achieve biological samples
- Since 1990's regional laboratories has also build up collections of special biological samples stored at various places



These samples were not registered and not visible or obtainable for researchers

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The concept of the Danish National Biobank

Danish National Biobank



www.nationalbiobank.dk

Danish Biobank Register

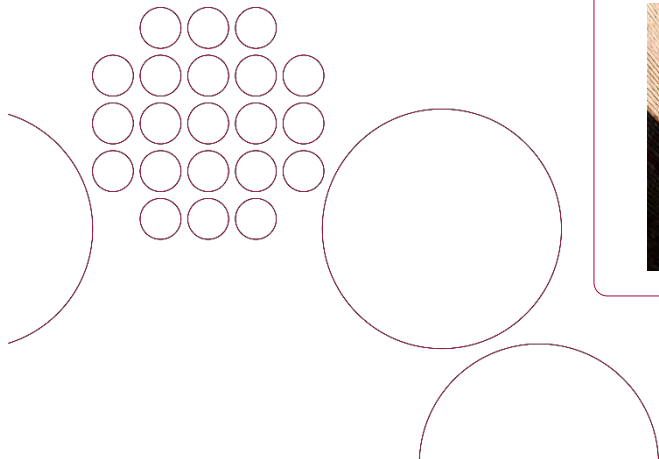


www.biobanks.dk

The Coordinating Centre



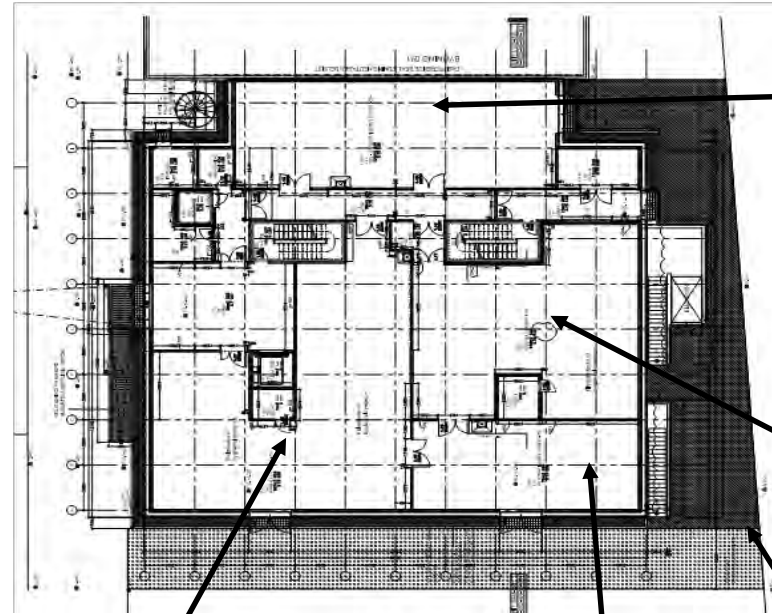
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Total storage capacity: over 30 mill tubes

Water cooled units

2D barcode tracking and LIMS system



-20 °C automated storage
(4 M tubes, 3 M PKU cards)



-196 °C storage
(7 M)



-80 °C manual storage
(10 M)



-80 °C automated storage
(6 M)



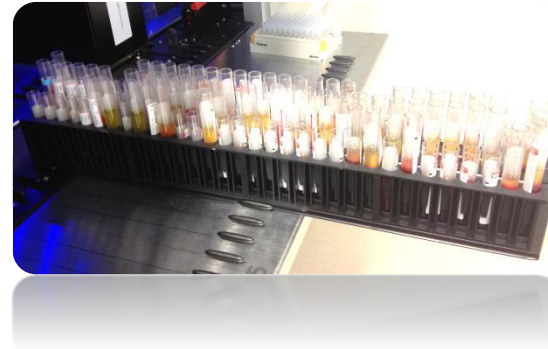
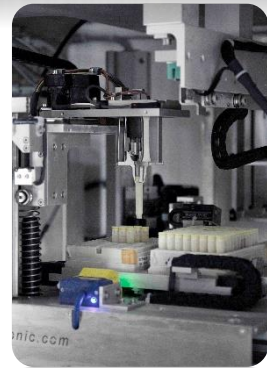
3 walk-in freezers, -20 °C
(basement, 4 M)



High throughput automated freezing

6 liquid handling robots and 2 DNA extraction robots

- handle daily intake of 2000 primary tubes
- 1200 DNA extractions per day and one-step conc./normalization



Automated storage

- -20°C storage 4M tubes, 3M PKU cards
Aliquot intake: 500 tubes per week, 1000 PKU cards per week
- -80°C storage 6M tubes
Aliquot intake: 3-4000 per day

Average project processing time, 13 days.



High throughput analyses

High throughput analyses



DNA extraction
1200 samples/day
One step conc./normalisation

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Genetic analysis

- NGS-500 sequencing
- Array genotyping
- Targeted sequencing
- Mutation analysis
- Methylation
- mRNA microRNA profiling



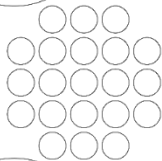
Metabolomics and proteomics

- Explorative and focused using mass spec.
- LC-tandem mass spec. for small analytes
- MALDI-TOF mass spec.

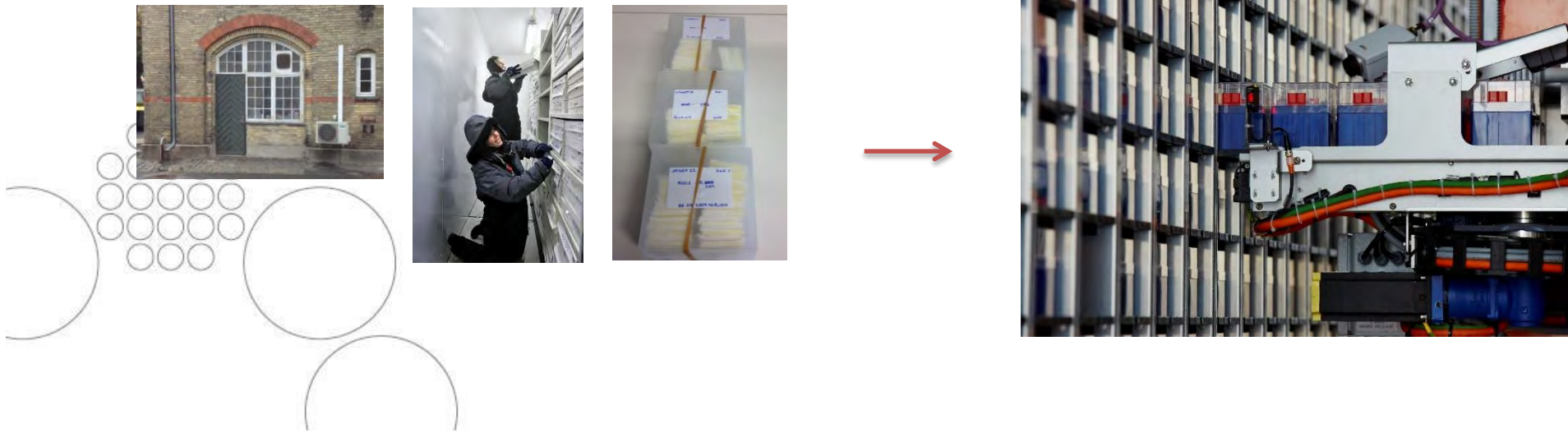


Immunoassays

- Autoimmune disease diagnostics and development
- Biacore interaction analysis
- Antibody development
- Protein purification, characterization, conjugation
- MesoScale platform 10 analytes/run
- Luminex platform 30-50 analytes/run



Manual collection of 1.8 million Guthrie cards (PKU) placed in automated -20°C robot systems



10,1 million biological samples in store

-and growing by 1 million per year

Biological samples in the Danish National Biobank	Samples	Individuals
Serum	3.317.536	951.521
Dried blood spot samples	2.565.821	2.091.587
Plasma	1.488.350	442.752
Whole blood	830.524	320.872
DNA	678.237	451.455
Buffy Coat	346.033	126.527
Urine	320.456	126.054
Saliva	90.407	42.554
Red blood cells	85.349	41.738
Amniotic fluid	66.407	56.505
Cord Blood Mononuclear Cells	65.032	65.032
Proteins extracted from DBS	39.168	38.979
Spinal fluid	28.596	16.498
Samples derived from swabs	25.856	20.745
DNA from feaces	18.900	18.900
Peripheral Blood Mononuclear Cells (PBMC)	12.980	1.023
Tape Stripping	6.301	629
Skin swab	4.066	688
Placenta Biopsy	3.026	820
Hair	2.851	1.088
RNA	1.746	620
Throat virus	1.415	1.004
Throat bacteria	1.413	1.003
Breast milk	1.223	607
Biopsy	1.008	558
EDTA Stem Cells	667	198
SAM (Synthetic Absorptive Matrix)	666	333
Faeces	568	280
Airway virus	426	227
Nasal Scrape	318	317

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The concept of the Danish National Biobank

Danish National Biobank



www.nationalbiobank.dk

Danish Biobank Register

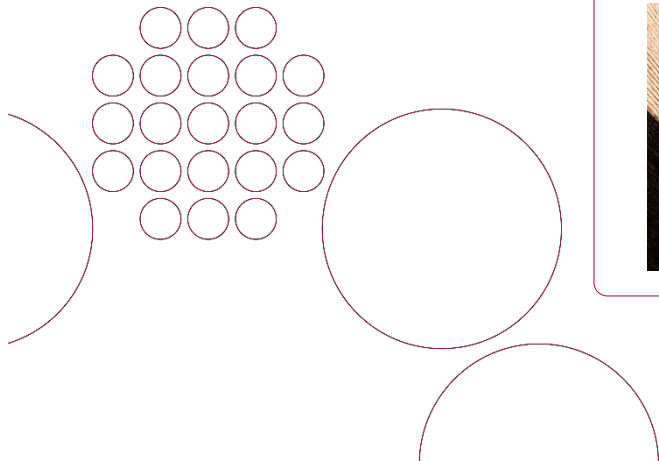


www.biobanks.dk

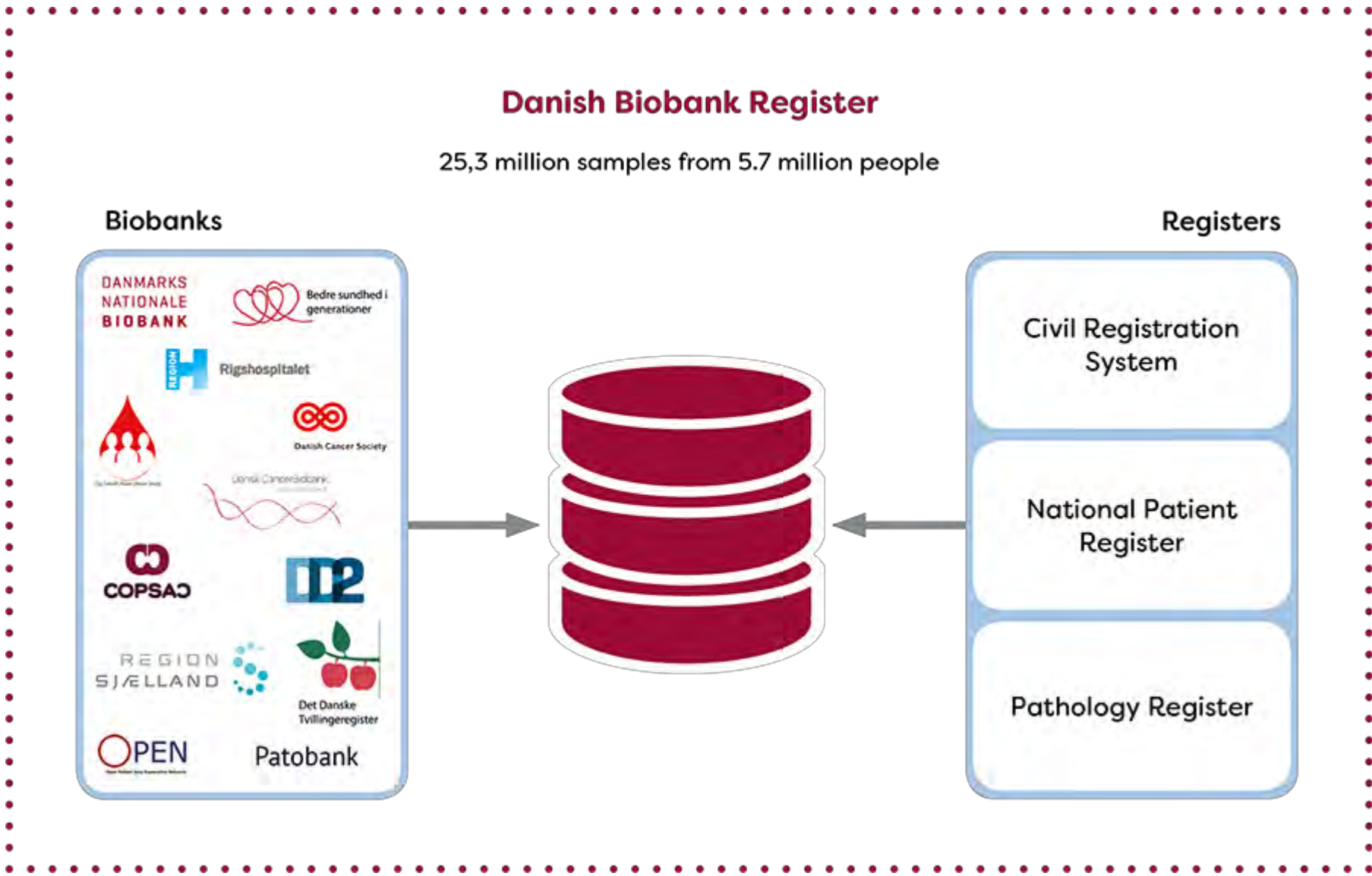
The Coordinating Centre



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The Danish Biobank Register



How the system works? Example - Ischemic heart disease (ICD8:410-414, ICD10:I20-I25)

<https://www.danishnationalbiobank.com/danish-biobank-register>

How the system works? Example - Ischemic heart disease (ICD8:410-414, ICD10:I20-I25)



- Person
- Diagnosis
- Sample
- Report
- Finish
- General info

Gender

- Any
- Male
- Female

	Country of Birth	Country of Birth (mother)	Country of Birth (father)
	<input type="button" value="Deselect all"/>	<input type="button" value="Deselect all"/>	<input type="button" value="Deselect all"/>
Denmark	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Greenland	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Faroe Islands	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Norway	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Sweden	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Finland	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Iceland	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Other	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Unknown	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Year of birth

From 1850 To 2020

Age at sample taken (expressed in years)

From 0 To 150

How the system works? Example - Ischemic heart disease (ICD8:410-414, ICD10:I20-I25)



Person

- Person
- Diagnosis
- Sample
- Report
- Finish
- General info

Gender

Any

- Denmark
- Greenland
- Faro Islands
- Norway
- Sweden
- Finland
- Iceland
- Other
- Unknown

Year of birth

From 1850

Age at sample

From 0 To

Search for diagnosis codes

Choose code type

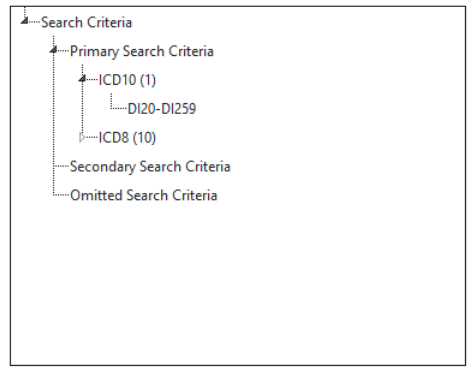
Search codes (e.g. DJ46, 493, asthma, KMAA-KMAD)

Select codes

- 41009 (INFARCTUS MYOCARDII ACUTUS CUM HYPERTENSIONE ARTERIALI)
- 41099 (INFARCTUS MYOCARDII ACUTUS (HYPERTENS. ARTERIALI))
- 41109 (MORBUS CORDIS ARTERIOSCL.AC.ET SUBAC.AL.CUM HYPER...
- 41199 (MORBUS CORDIS ARTERIOSCL.AC.ET SUBAC.AL.(HYP.AR...
- 41209 (MB.CORDIS ARTERIOSCLEROTICUS CUM HYPERTENSIONE...
- 41299 (MB.CORDIS ARTERIOSCLEROTICUS (HYPERTENS.ARTERIA...
- 41309 (ANGINA PECTORIS CUM HYPERTENSIONE ARTERIALI)
- 41399 (ANGINA PECTORIS(HYPERTENSIO ARTERIALIS NON INDIC...
- 41409 (MORBUS CORDIS ARTERIOSCL.ASYMPT. CUM HYPERTEN...
- 41499 (MORBUS CORDIS ARTERIOSCL.ASYMPT.(HYPERT.ART.NO...

Search criteria

- Add as primary
- Add as secondary
- Add as omitted



Select all Unselect all

Delete all Delete selected

Diagnosis period (applies only to the primary search criteria)

From 1850 To 2020

Age at diagnosis (applies only to the primary search criteria)

From 0 To 150

How the system works? Example - Ischemic heart disease (ICD8:410-414, ICD10:I20-I25)



- Person
- Person
- Person
- Diagnosis
- Sample
- Report
- Finish
- General info

Gender

Any

- Denmark
- Greenland
- Faroe Islands
- Norway
- Sweden
- Finland
- Iceland
- Other
- Unknown

Year of birth

From 1850 To

Age at sample

From 0 To

Search for diagn

Choose code ty

Search codes (e KMAA-KMAD)

Select codes

- 41009 (INFARCTUS MYOCARDII)
- 41099 (INFARCTUS MYOCARDII)
- 41109 (MORBUS CORDIS)
- 41199 (MORBUS CORDIS)
- 41209 (MB.CORDIS ARTERIOSCLEROSIS)
- 41299 (MB.CORDIS ARTERIOSCLEROSIS)
- 41309 (ANGINA PECTORIS)
- 41399 (ANGINA PECTORIS)
- 41409 (MORBUS CORDIS)
- 41499 (MORBUS CORDIS)

Select all

Diagnosis period

From 1850 To

Age at diagnosis

From 0 To

Biobanks
Danish National Biobank [All Projects selected]

Select all

<input checked="" type="checkbox"/> Danish National Biobank <ul style="list-style-type: none"><input checked="" type="checkbox"/> BSMB<input checked="" type="checkbox"/> PKU<input checked="" type="checkbox"/> Greenland samples<input checked="" type="checkbox"/> Diagnostic samples	<input type="checkbox"/> Copenhagen Hospital Biobank <ul style="list-style-type: none"><input type="checkbox"/> ALL SAMPLES	<input type="checkbox"/> Danish Cancer Society Biobank <ul style="list-style-type: none"><input type="checkbox"/> Diet, Cancer and Health Cohort
<input type="checkbox"/> Patobanken <ul style="list-style-type: none"><input type="checkbox"/> ALL SAMPLES	<input type="checkbox"/> The Danish Blood Donor Study <ul style="list-style-type: none"><input type="checkbox"/> ALL SAMPLES	<input type="checkbox"/> COPSAC <ul style="list-style-type: none"><input type="checkbox"/> ALL SAMPLES
<input type="checkbox"/> DD2 <ul style="list-style-type: none"><input type="checkbox"/> ALL SAMPLES	<input type="checkbox"/> Dansk CancerBiobank <ul style="list-style-type: none"><input type="checkbox"/> ALL SAMPLES	<input type="checkbox"/> Region Sjællands Biobank <ul style="list-style-type: none"><input type="checkbox"/> BEFUS<input type="checkbox"/> LOFUS
<input type="checkbox"/> Det Danske Tvillingeregister <ul style="list-style-type: none"><input type="checkbox"/> ALL SAMPLES	<input type="checkbox"/> OPEN biobank <ul style="list-style-type: none"><input type="checkbox"/> ALL SAMPLES	

+ Sample Types (All Sample types selected)

Advanced Filtering

How the system works? Example - Ischemic heart disease (ICD8:410-414, ICD10:I20-I25)



Person

Gender

Any

- Denmark
- Greenland
- Faroe Islands
- Norway
- Sweden
- Finland
- Iceland
- Other
- Unknown

Year of birth

From 1850 To

Age at sample

From 0 To

Person

Search for diagn

Choose code ty
Search codes (e
KMAA-KMAD)

Select codes

- 41009 (INFARCTUS MYO)
- 41099 (INFARCTUS MYO)
- 41109 (MORBUS CORDIS)
- 41199 (MORBUS CORDIS)
- 41209 (MB.CORDIS ARTE)
- 41299 (MB.CORDIS ARTE)
- 41309 (ANGINA PECTORI)
- 41399 (ANGINA PECTORI)
- 41409 (MORBUS CORDIS)
- 41499 (MORBUS CORDIS)

Select all

Diagnosis period

From 1850 To

Age at diagnosis

From 0 To

Person Diagnosis Sample Report Finish General info

+ Biobanks
Danish National Biobank [All Projects selected]

- Sample Types
Blood: All selected
Tissue: None selected
Other types: 2 selected (DNA, Spinal fluid)

Blood
Deselect all

<input checked="" type="checkbox"/> Buffycoat	<input checked="" type="checkbox"/> Serum	<input checked="" type="checkbox"/> Plasma	<input checked="" type="checkbox"/> Filter paper
<input checked="" type="checkbox"/> Whole blood	<input checked="" type="checkbox"/> Clot	<input checked="" type="checkbox"/> PBMC	

Tissue
Select all

<input type="checkbox"/> Dry frozen	<input type="checkbox"/> FFPE	<input type="checkbox"/> OCT embedded	<input type="checkbox"/> RNAlater treated
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Other types
Select all

<input checked="" type="checkbox"/> DNA	<input checked="" type="checkbox"/> Spinal fluid	<input type="checkbox"/> Amniotic fluid	<input type="checkbox"/> Urine
<input type="checkbox"/> Feces	<input type="checkbox"/> Nasopharyngeal swab	<input type="checkbox"/> Bone marrow	<input type="checkbox"/> Fine needle aspiration
<input type="checkbox"/> Cervical cytology	<input type="checkbox"/> Other cytologies	<input type="checkbox"/> Breast milk	<input type="checkbox"/> RNA

Advanced Filtering

Exclude umbilical cord samples Include umbilical cord samples Only umbilical cord samples

Sample taken period (in years)

From 1850 To 2020

How the system works? Example - Ischemic heart disease (ICD8:410-414, ICD10:I20-I25)

Gender

Any

Year of birth

From To

Age at sample

From To

Search for diagn

Choose code type

Search codes (e.g. KMAA-KMAD)

Select codes

- 41009 (INFARCTUS MYO)
- 41099 (INFARCTUS MYO)
- 41109 (MORBUS CORDIS)
- 41199 (MORBUS CORDIS)
- 41209 (MB.CORDIS ARTE)
- 41299 (MB.CORDIS ARTE)
- 41309 (ANGINA PECTORI)
- 41399 (ANGINA PECTORI)
- 41409 (MORBUS CORDIS)
- 41499 (MORBUS CORDIS)

Danish National Bio...

Blood: All selected
 Tissue: None selected
 Other types: 2 selected

Buffycoat
 Whole blo...

Dry frozen

DNA
 Feces
 Cervical cy...

Primary variable:
 Secondary variable:
 Counting unit:

(Optional) Classify samples into 3 categories:

Sample taken date

- 365 days before the "incident diagnosis" date and earlier
- at the "incident diagnosis" date and earlier
- 14 days after the "incident diagnosis" date and earlier

#	X-value	Y-value	Counting unit	Before interval in days	After interval in days
1	Biobank	Sample type	Number of samples		<input type="button" value="trash"/>
2	Biobank	Sample type	Number of individuals		<input type="button" value="trash"/>
3	Biobank	Sample type	Number of individuals	365	14 <input type="button" value="trash"/>

Advanced Filtering

Exclude umbilical cord samples
 Include umbilical cord samples
 Only umbilical cord samples

Sample taken period (in years)

From To

How the system works? Example - Ischemic heart disease (ICD8:410-414, ICD10:I20-I25)

Person Person Person Person Person Diagnosis Sample Report Finish General info

Gender: Any

Denmark Greenland Faroe Islands Norway Sweden Finland Iceland Other Unknown

Year of birth: From 1850 To

Age at sample: From 0 To

Search for diagn: Choose code type Search codes (e KMAA-KMAD)

Select codes: 41009 (INFARCTUS MYO) 41099 (INFARCTUS MYO) 41109 (MORBUS CORDIS) 41199 (MORBUS CORDIS) 41209 (MB.CORDIS ARTE) 41299 (MB.CORDIS ARTE) 41309 (ANGINA PECTORI) 41399 (ANGINA PECTORI) 41409 (MORBUS CORDIS) 41499 (MORBUS CORDIS)

Select all

Diagnosis period: From 1850 To

Age at diagnosis: From 0 To

+ Biobanks: Danish National Bio

- Sample Types: Blood: All selected Tissue: None selected Other types: 2 selected

Blood: Deselect all

Buffycoat Whole blo

Tissue: Select all

Dry frozen

Other types: Select all

DNA Feces Cervical cy

Primary variable: Biobank

(Optional) Sample taken: - 365 da - at the "incid - 14 da

Add report

#	X-value	Y-value	Counting unit	Before interval in days	After interval in days
1	Biobank	Sample type	Number of samples		
2	Biobank	Sample type	Number of individuals		
3	Biobank	Sample type	Number of individuals	365	14

Name: John Doe
Title *: PhD
Affiliation *: Public institution
Position: PhD
Country *: USA
Email *: johndoe@univ.gov
Name your search: ischemic heart @ DNB

Submit

Advanced Filtering: Exclude umbilical cord samples Include umbilical cord samples Only umbilical cord samples

Sample taken period (in years): From 1850 To 2020

How the system works? Example - Ischemic heart disease (ICD8:410-414, ICD10:I20-I25)

Gender

Any

Denmark

Greenland

Faroe Islands

Norway

Sweden

Finland

Iceland

Other

Unknown

Year of birth

From

Age at sample

From To

Search for diagn

Choose code ty

Search codes (e KMAA-KMAD)

Select codes

- 41009 (INFARCTUS MYO)
- 41099 (INFARCTUS MYO)
- 41109 (MORBUS CORDIS)
- 41199 (MORBUS CORDIS)
- 41209 (MB.CORDIS ARTE)
- 41299 (MB.CORDIS ARTE)
- 41309 (ANGINA PECTORI)
- 41399 (ANGINA PECTORI)
- 41409 (MORBUS CORDIS)
- 41499 (MORBUS CORDIS)

Select all

Diagnosis period

From To

Age at diagnosis

From To

+ Biobanks

Danish National Bio

- Sample Types

Blood: All selected

Tissue: None selecte

Other types: 2 select

Blood

Buffycoat

Whole blo

Tissue

Dry frozen

Other types

DNA

Feces

Cervical cy

Primary varia

Biobank

(Optional)

Sample taken

- 365 da

- at the "incid

- 14 da

#	X-value	Y-value	Counting unit	Before inter
1	Biobank	Sample type	Number of samples	
2	Biobank	Sample type	Number of individuals	
3	Biobank	Sample type	Number of individuals	365

Name: John Doe

Title *: PhD

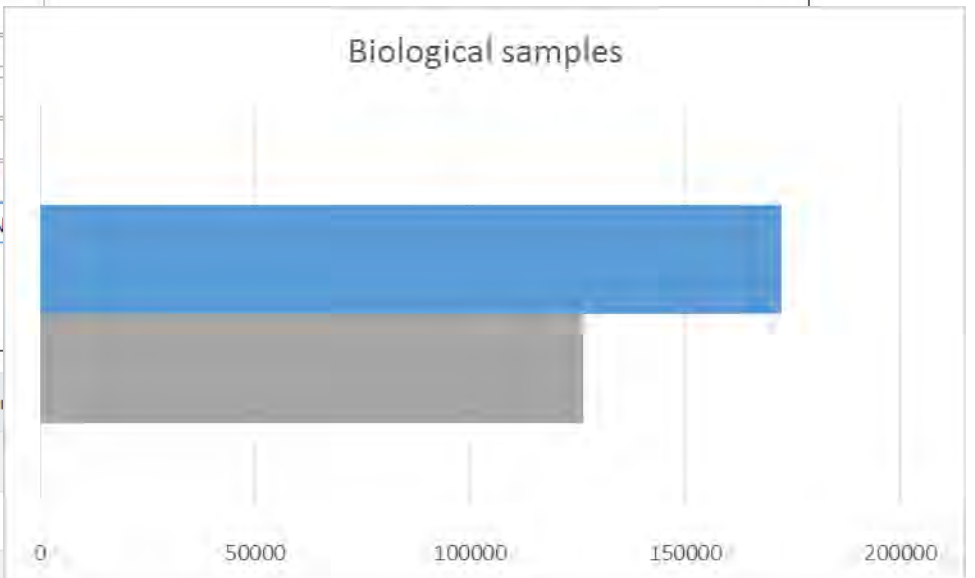
Affiliation *: Public institution

Position: PhD

Country *: USA

Email *: johndoe@univ.gov

Name your search: ischemic heart @ DN




Advanced Filtering





Exclude umbilical cord samples
 Include umbilical cord samples
 Only umbilical cord samples

Sample taken period (in years)

From To

Til  Bartłomiej Wilkowski

Meddelelse

 biobank-sample_type-number_of_samples-1.csv (771 B) biobank-sample_type biobank-sample_type-number_of_individuals-3.csv (2 KB) 20200211160756_isch**3. [Biobank] - [Sample Type] - [Number Of Individuals]**

With before/at/after - ("at diagnosis" range: -365 days, +14 days)

			Biobank
			Danish National Biobank
Sample Type	Buffycoat	before	754
		at	11
		after	40
	Clot	before	453
		at	594
		after	8084
	DNA	before	856
		at	1844
		after	23379
	Filter paper	before	2057
		at	69
		after	47
	PBMC	before	
		at	
		after	
	Plasma	before	1847
		at	1894
		after	22664
	Serum	before	16488
		at	6093
		after	43117
Spinal fluid	before	812	
	at	288	
	after	1933	

Selected diseases and corresponding biological samples in DNB



Alzheimer's disease

(ICD8: 29010, ICD10: DF00, DG30)

Spinal fluids from >800 patients 200 before diagnosis, 200 at diagnosis and 400 after diagnosis. Serum from >2.000 patients 1200 before diagnosis, 400 at diagnosis and 600 after diagnosis.



Testicular cancer

(ICD8:186, ICD10:DC62)

Serum from 3.000 patients 600 before diagnosis, 300 at diagnosis and 3.500 after diagnosis. DNA from 25.000 patients 23.000 before diagnosis, 3.000 at diagnosis and 1.000 after diagnose. In addition 100 plasma samples and 200 spinal fluids.



Inflammatory bowel disease

(ICD8:563.00-563.09, 563.19, ICD10:DK50-51)

DNA from 10.000 patients 8.000 before diagnosis, 300 at diagnosis and 1.600 after diagnosis. Serum from 14.000 patients 3.000 before diagnosis, 2500 at diagnosis and 18.000 after diagnosis. In addition 400 plasma samples and 500 spinal fluids.



Diabetes

(ICD8: 249-250, ICD10: DE10-11)

Serum from 40.000 patients 11.000 before diagnosis, 8000 at diagnosis and 40.000 after diagnosis. DNA from 12.000 patients 10.000 before diagnosis, 400 at diagnosis and 4000 after diagnosis. In addition 2000 plasma samples and 2000 spinal fluids.



Colon cancer

(ICD8:153, ICD10:DC18)

Serum from 6.000 patients 2.500 before diagnosis, 1700 at diagnosis and 8.000 after diagnosis. In addition 400 DNA samples, 150 plasma samples and 250 spinal fluids.



Epilepsy

(ICD8: 293.29, 309.4, 331.2, 345, ICD10: DF80.3, DG40-41)

Spinalvæsker from 2.600 patients 400 before diagnosis, 1000 at diagnosis and 1.300 after diagnosis. Serum from 16.000 patients 3.000 before diagnose, 2.000 at diagnosis and 12.000 after diagnosis. In addition DNA from >30.000 patients.



Febrile seizures

(ICD8: 780.21, ICD10:DR56.0)

Serum from 7.000 patients 200 before diagnosis, 400 at diagnosis and 6.400 after diagnosis. Spinal fluids from 500 patients 50 before diagnose, 200 at diagnosis and 300 after diagnosis. In addition DNA from 75.000 patients.



Ischemic heart disease

(ICD8:410-414, ICD10:D120-D125)

DNA from 4.500 patients. Serum from 50.000 patients 17.000 before diagnosis, 6.000 at diagnosis and 50.000 after diagnosis. In addition 2.000 plasma samples and 2.800 spinal fluids.



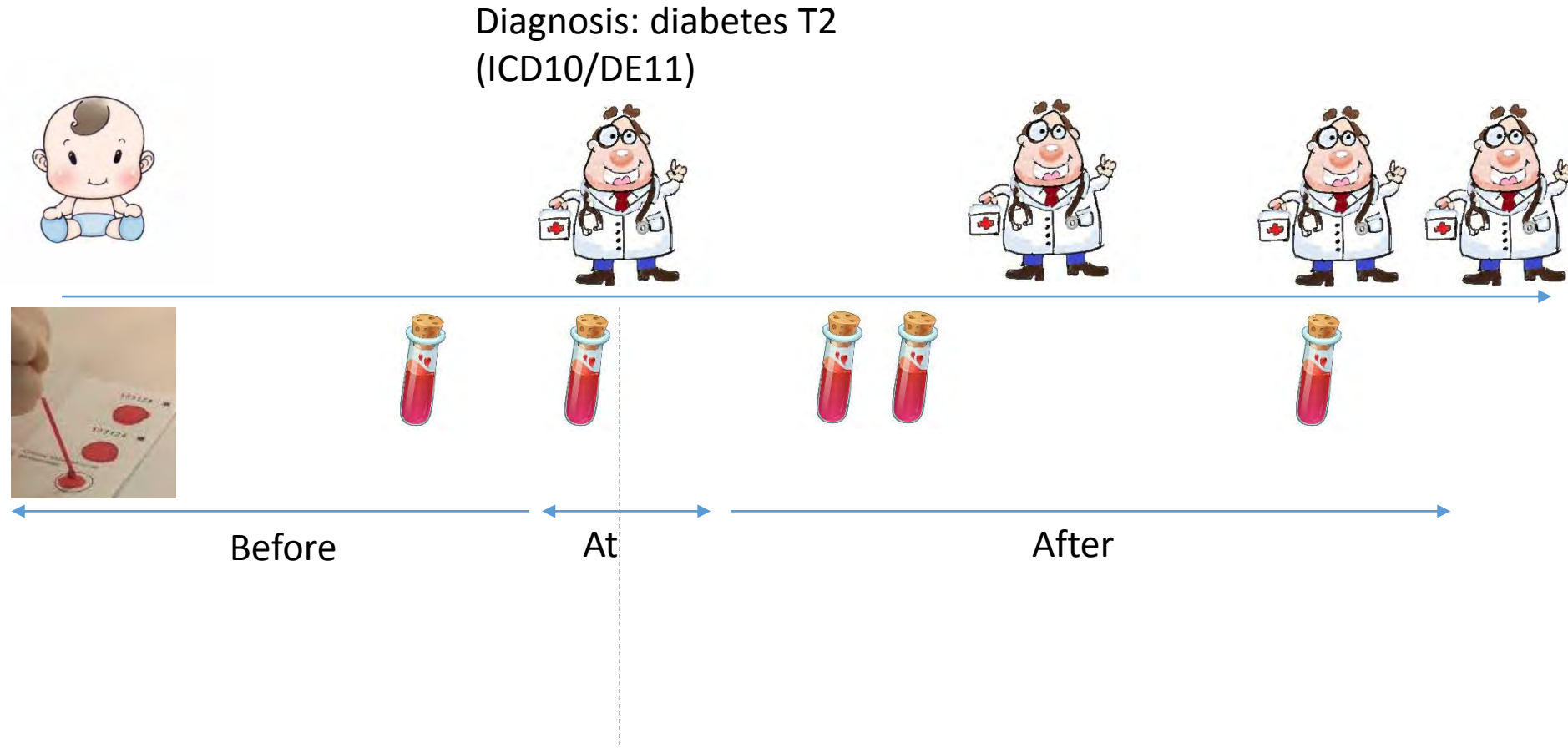
Breast Cancer

(ICD8: 174, ICD10: DC50)

Serum from 10.000 patients 5.000 before diagnosis, 1.000 at diagnosis and 12.000 after diagnosis. In addition 250 plasma samples, 500 spinal fluids and 750 DNA samples.

Danish Biobank Register – current status

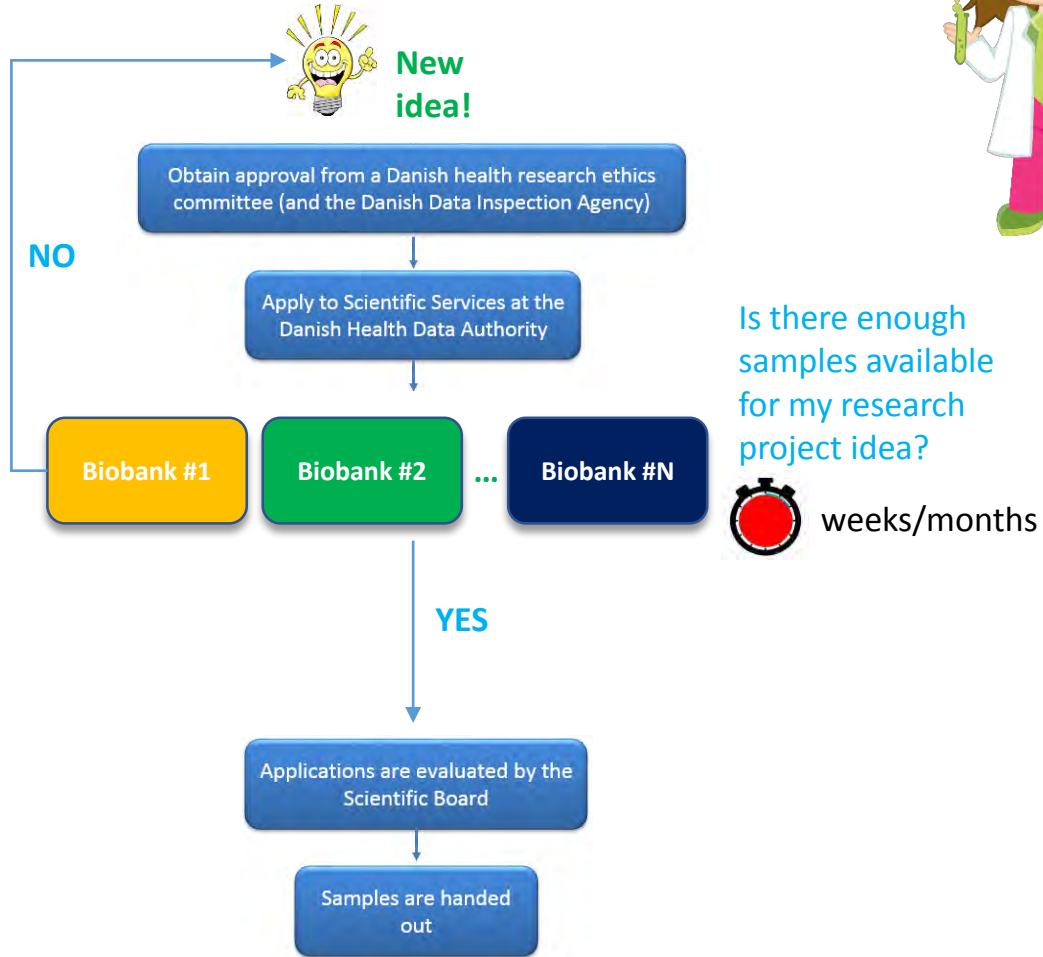
The system helps to find pre-existing biological samples, available for research, and links them to the patients diagnoses and hospital procedures.



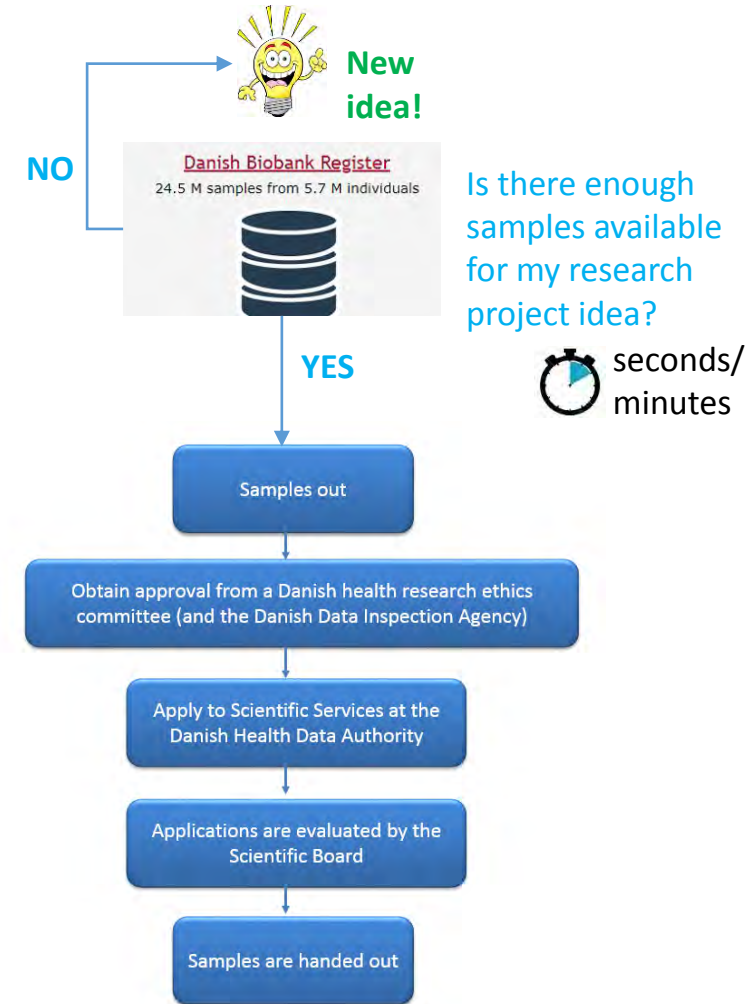
Danish Biobank Register (how it helped the researchers)



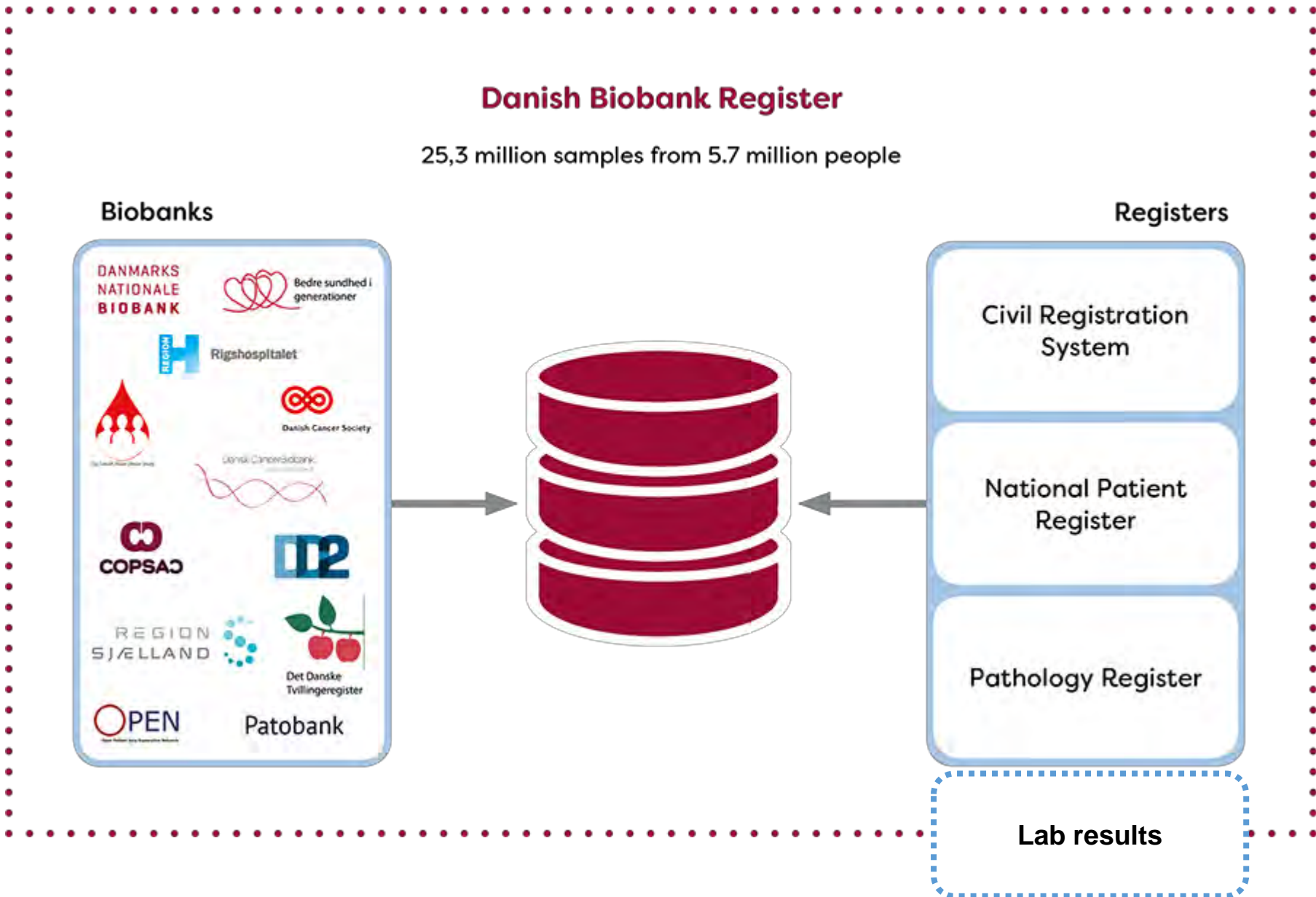
BEFORE:



NOW:

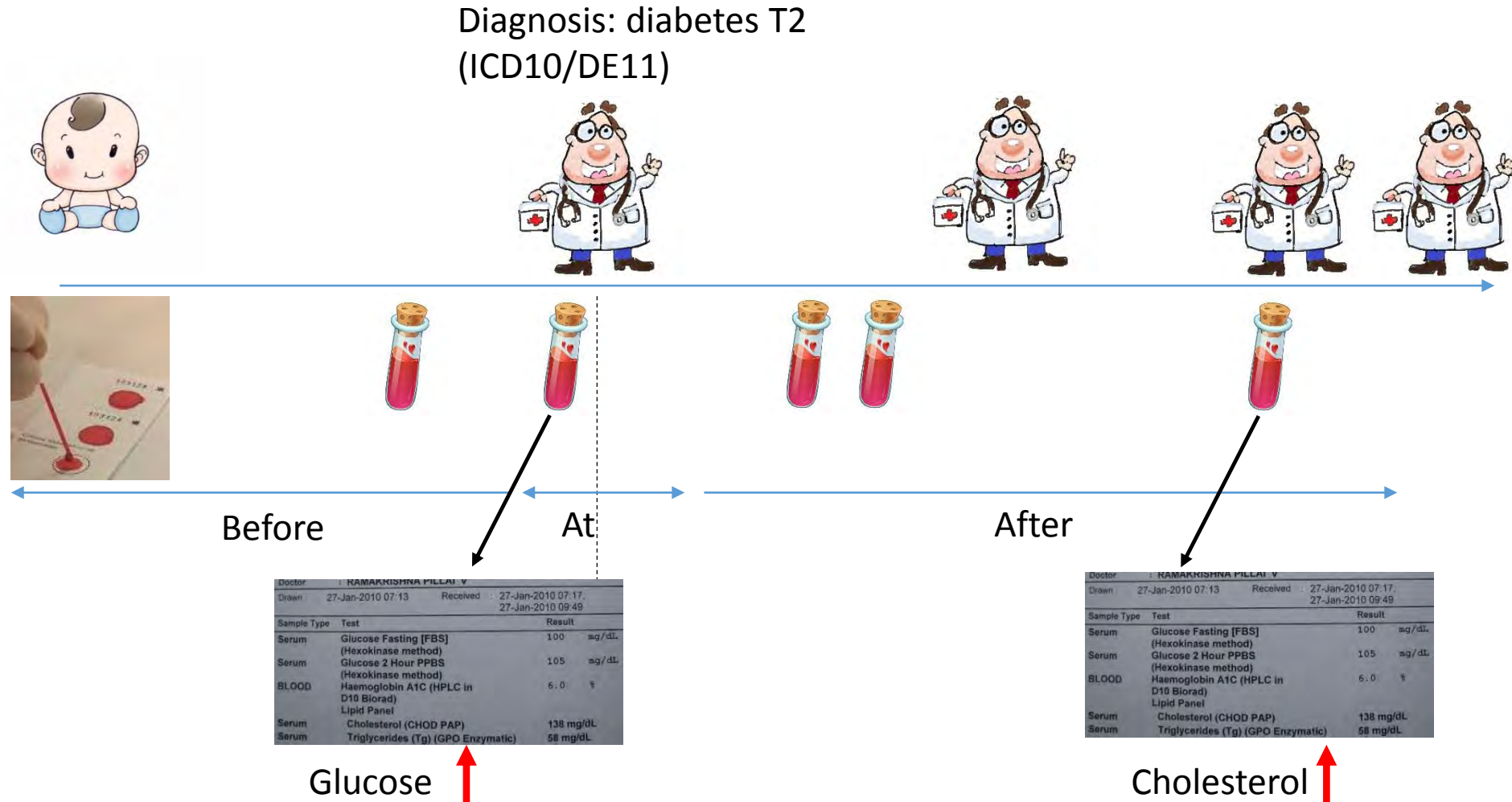


The Danish Biobank Register – new initiative 2020



Danish Biobank Register – laboratory data

Extend the current functionality and link the biological to the **laboratory test results** database.



Lab Results Register

STATENS
SERUM
INSTITUT



SSI LIMS
76 M test results 1993-now



Department of Public Health

CopLab-database (KPLL data)
176 M test results as well as pulmonary function and Ecg
2000-2015

Lab Results Register

The Laboratory Results Database

Nationwide 89 labs

Estimated > 1,000,000,000 results



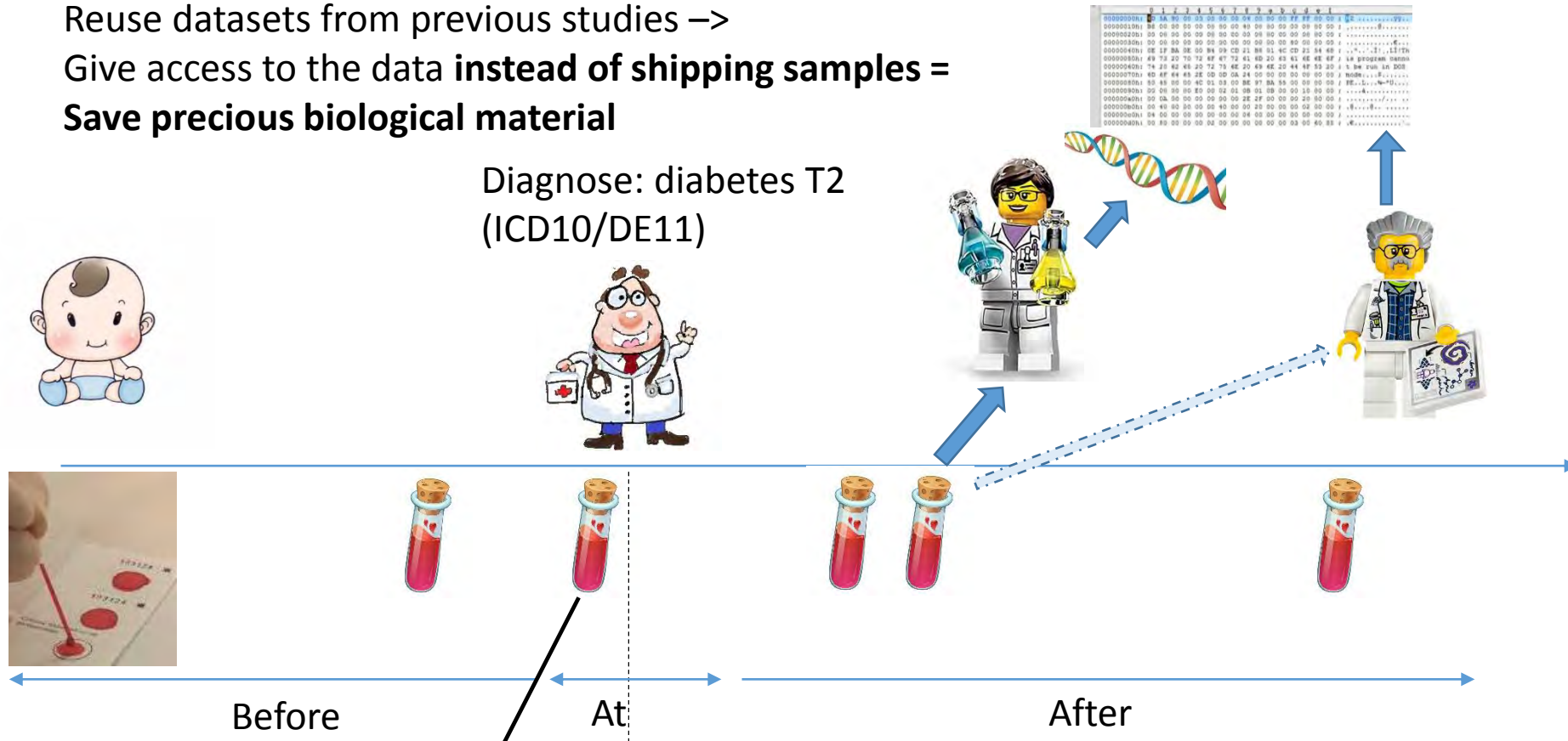
code name count

NPU03230	P—Kalium-ion; stofk. = ? mmol/L	45,361,842
NPU03429	P—Natrium-ion; stofk. = ? mmol/L	44,974,530
NPU02319	B—Hæmoglobin(Fe); stofk. = ? mmol/L	44,039,825
NPU02593	B—Leukocytter; antalk. = ? × 10 ⁹ /L	39,190,374
NPU19651	P—Alanintransaminase; kat.k.(IFCC 2002) = ? U/L	38,719,016
NPU19748	P—C-reaktivt protein; massek. = ? mg/L	35,995,222
NPU18016	P—Creatininium; stofk. = ? µmol/L	34,493,035
NPU27783	P—Basisk phosphatase; kat.k.(37 °C; proc.) = ? U/L	33,726,472
NPU03568	B—Thrombocytter; antalk. = ? × 10 ⁹ /L	33,279,989
NPU19673	P—Albumin; massek.(proc.) = ? g/L	28,724,226
NPU03577	P—Thyrotropin; arb.stofk.= ? × 10 ⁻³ IU/L	23,545,661
NPU01370	P—Bilirubiner; stofk. = ? µmol/L	23,414,712

Danish Biobank Register – databank

Reuse datasets from previous studies →
 Give access to the data **instead of shipping samples** =
Save precious biological material

Diagnose: diabetes T2
 (ICD10/DE11)



Doctor: NAMAKKISHNA PILLAI V		
Sample Type	Test	Result
Serum	Glucose Fasting (FBS) (Hexokinase method)	100 mg/dL
Serum	Glucose 2 Hour PPBS (Hexokinase method)	105 mg/dL
BLOOD	Haemoglobin A1C (HPLC in D10 Biocod)	6.0 %
Serum	Lipid Panel	
Serum	Cholesterol (CHOD PAP)	138 mg/dL
Serum	Triglycerides (Tg) (GPO Enzymatic)	58 mg/dL

Glucose ↑

Danish Biobank Register - metadata

Name	Description	Who provides data?
PIN	<i>Personal Identification Number</i>	Biobank
Taken_date	<i>Date of sample taken</i>	Biobank
Sample_type	<i>Type of the biological specimen</i>	Biobank
Umbilical_cord_blood	<i>Sample originates from umbilical cord (Yes/No)</i>	Biobank
Biobank_name	<i>Name of the biobank</i>	Biobank
Project_name	<i>Name of the collection within a biobank</i>	Biobank
PIN	<i>Personal Identification Number</i>	auto: in-patient national hospital register
DIAGNOSIS_CODE_TYPE	<i>Type of the classification (ICD8/ICD10/SNOMED)</i>	auto: in-patient national hospital register
DIAGNOSIS_CODE	<i>Diagnosis code for a given diagnosis</i>	auto: in-patient national hospital register
DIAGNOSIS_NAME	<i>Description (label) for a diagnosis code</i>	auto: in-patient national hospital register
ADM_DATE	<i>Diagnosis date = Hospital admission date for a patient</i>	auto: in-patient national hospital register
PIN	<i>Personal Identification Number</i>	auto: civil registration system
Gender	<i>Male/Female</i>	auto: civil registration system
COB	<i>Country of birth</i>	auto: civil registration system
MCOB	<i>Mother's country of birth</i>	auto: civil registration system
FCOB	<i>Father's country of birth</i>	auto: civil registration system
Date_of_birth	<i>Date of birth</i>	auto: civil registration system
Age_at_sample	<i>Person's age at sample taken</i>	auto calculated
Age_at_diagnosis	<i>Person's age at diagnosis</i>	auto calculated

Roadmap of my talk

- Background
 - establishment of the Danish National Biobank (DNB)
- DNB – the physical biobank
- DNB – Danish Biobank Register
 - National search system for rapid overview of preexisting biological samples
- DNB – the Coordinating Center (access & outreach)
- Summary

The concept of the Danish National Biobank

Danish National Biobank



www.nationalbiobank.dk

Danish Biobank Register

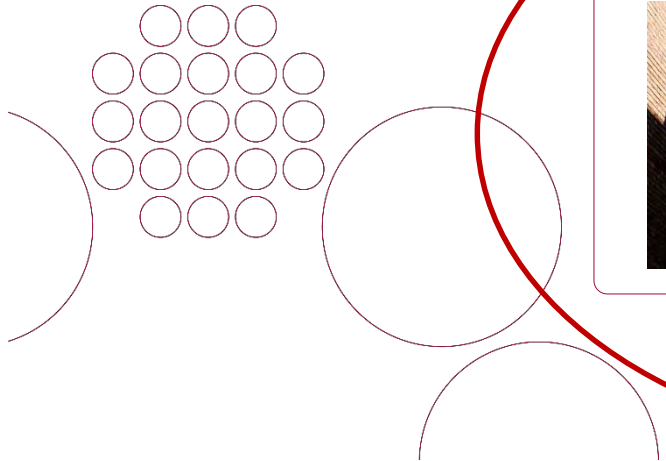


www.biobanks.dk

The Coordinating Centre



DANMARKS
NATIONALE
BIOBANK



Biobank access

DANMARKS
NATIONALE
BIOBANK

Guidelines on access to biological material and
data from The Danish National Biobank, Statens
Serum Institut

Governance model created in collaboration with important Danish stakeholders

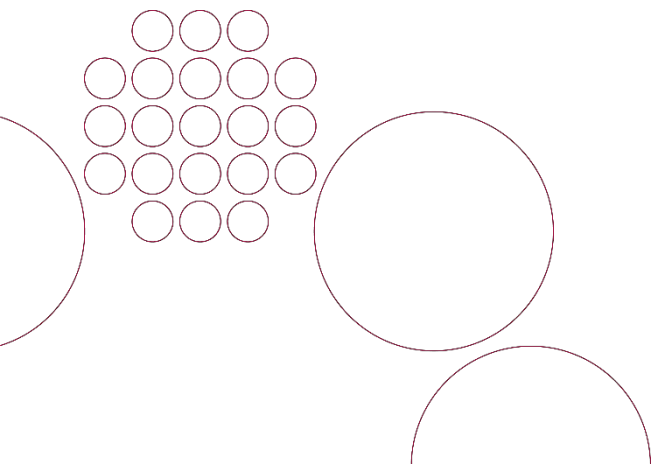
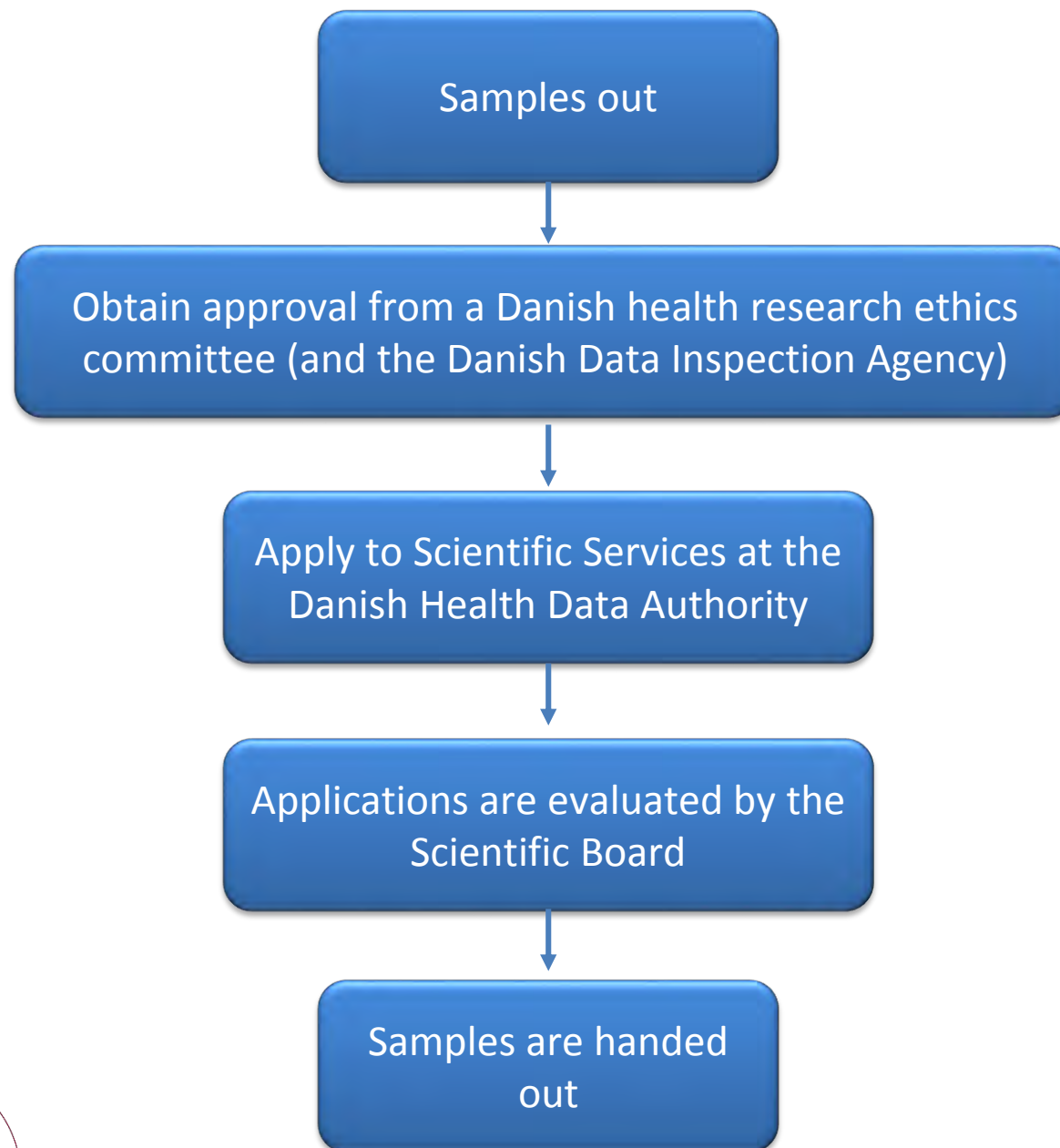
DANMARKS
NATIONALE
BIOBANK



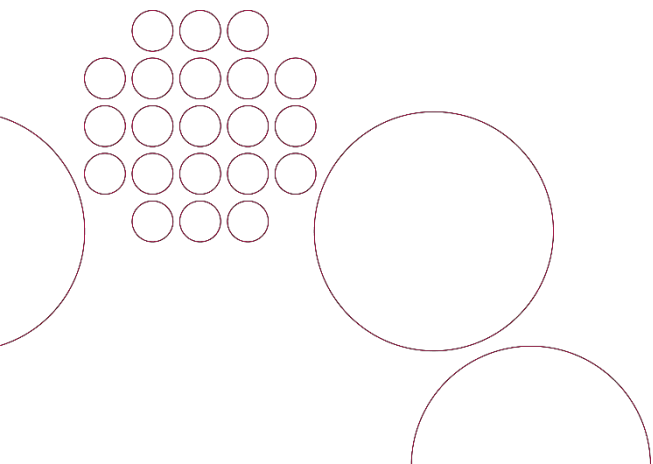
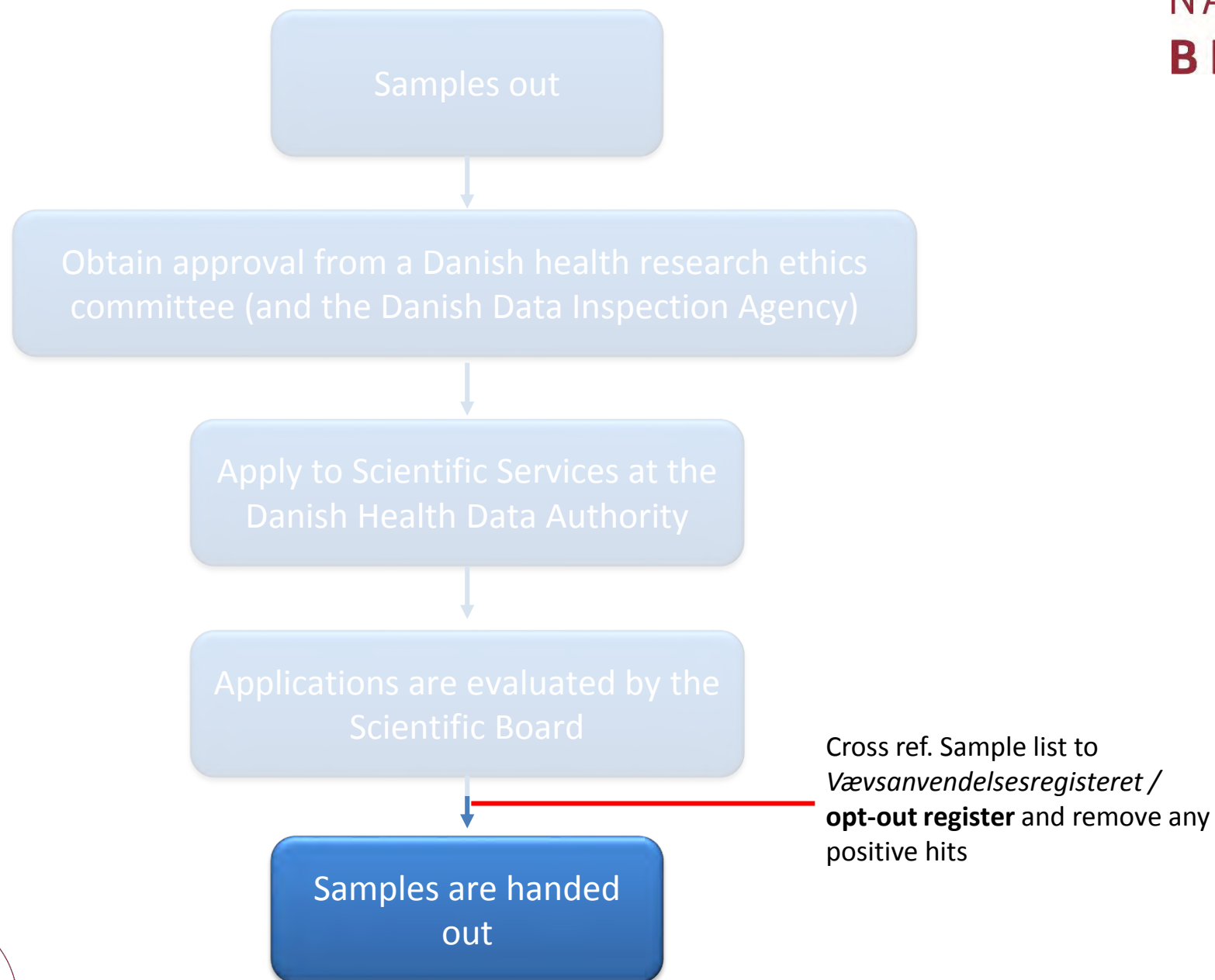
Styrelsen for Forskning og Uddannelse

Kammeradvokaten

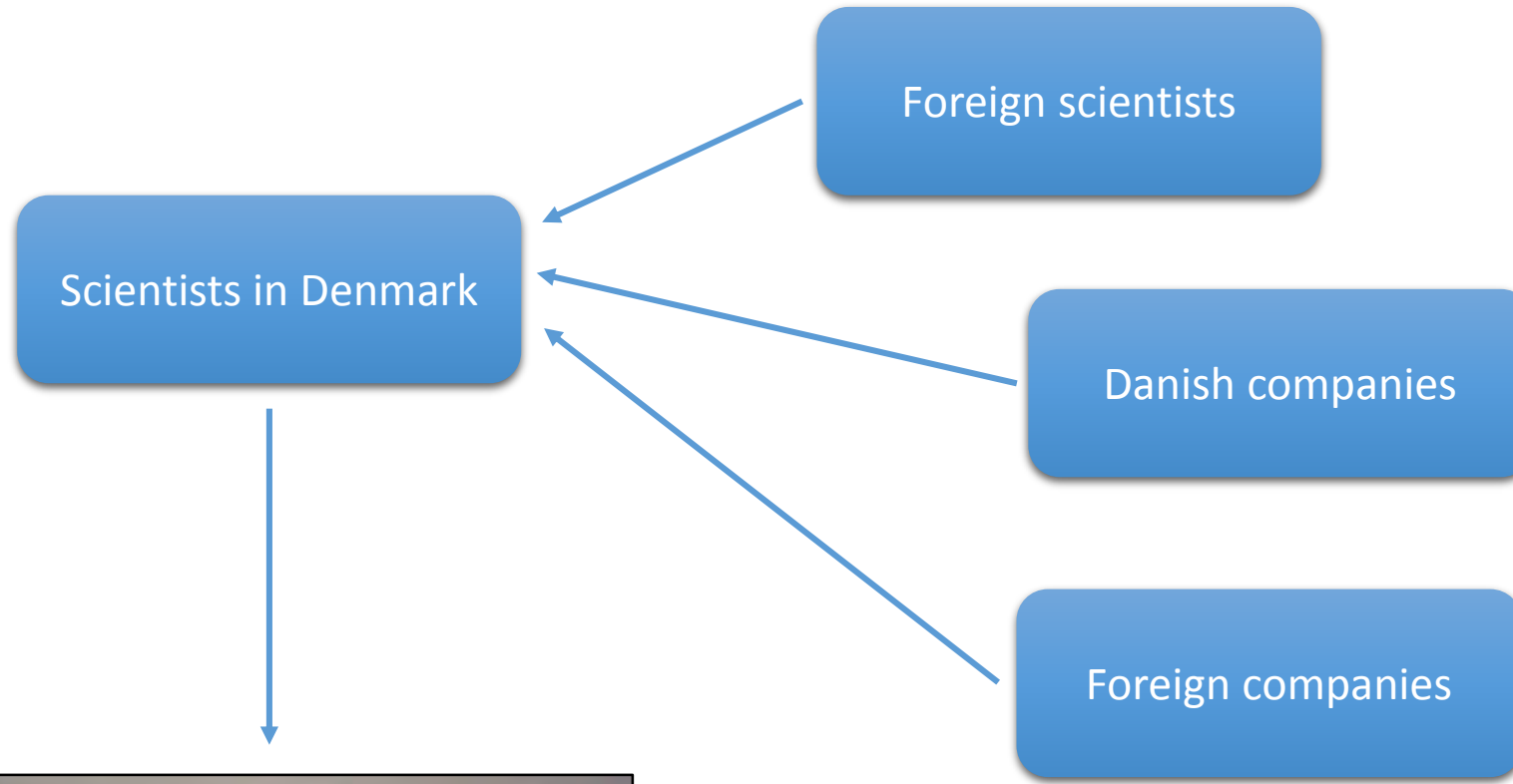
Flow samples out



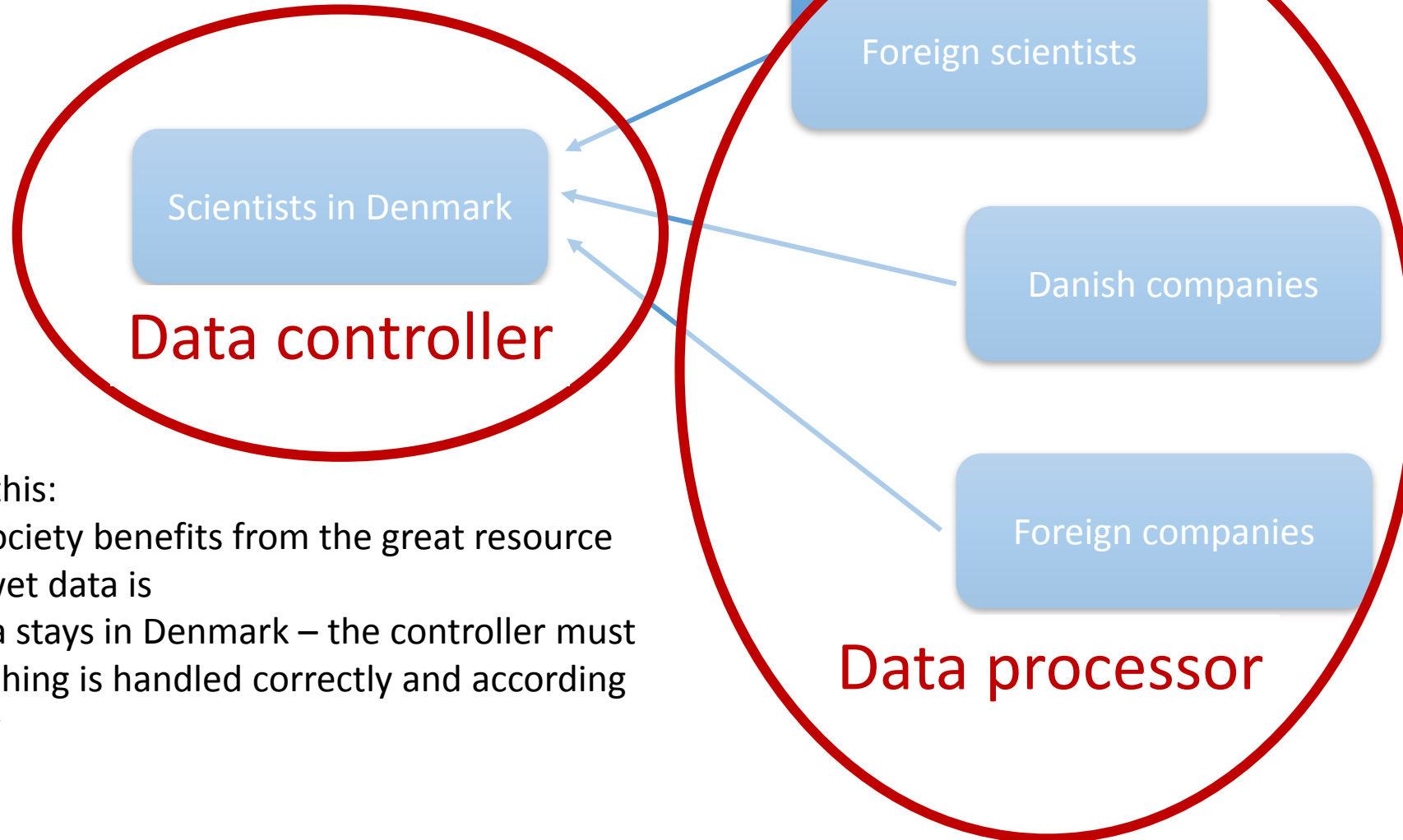
Flow samples out



Who can gain access?



Who can gain access?



Two reasons for this:

- 1) The Danish society benefits from the great resource the dry and wet data is
- 2) Sensitive data stays in Denmark – the controller must secure everything is handled correctly and according to Danish law

Financial model:

- 1) Revenue-covered business, prices based on actual expenses, no profit.
- 2) No intellectual property rights

Outreach: Guests from all over the world (>500 yearly)



Outreach: Guests, meetings and events



Unleash talents (150) Aug. 17



Open House events



Forskningens Døgn April 17+19
Danish Science Festival




Videos



Folkemødet 2018+19
DNA workshop

Outreach: New podcast for researchers




Mar 4th, 2019

mtDNA in a population of immigrants

0:00 — 0:00

The first episode looks at Mitochondrial DNA research into mental disorders, and how it has helped scientists understand the origin and biological anc...[View Details](#)

♡ Like ↗ Share ⬇ Download(112)



Apr 4th, 2019

Power over Cancer

0:00 — 0:00

In the second episode we visit the Danish Cancer Society, and speak with Professor Anne Tjønneland about the studies Diet, Cancer and Health and it's...[View Details](#)

♡ Like ↗ Share ⬇ Download(125)



Jun 7th, 2019

Giving Software It's Due

0:00 — 0:00

In episode 3 we sat down with the three research software engineers trying to put focus on quality and sustainability in research software, as well as...[View Details](#)

♡ Like ↗ Share ⬇ Download(57)

Jun 7th, 2019

Software Special: Carole Goble Keynote

0:00 — 0:00

The unedited keynote of Carole Goble of the Software Sustainability Institut the Life Sciences - Development, Usa...[View Details](#)

♡ Like ↗ Share ⬇ Download(39)

Jun 7th, 2019

Software Special: Tim Gardner Keynote

0:00 — 0:00

The unedited keynote of Tim Gardner, CEO of Riffyn at the un-conference, "Development, Usability, Sustainability"

♡ Like ↗ Share ⬇ Download(39)

Outreach: Twitter with highlights and video teasers



@NationalBiobank

DANMARKS NATIONALE BIOBANK

National Biobank DK @NationalBiobank · 29. mar.
Highlighting the important role of software engineers and software sustainability in modern bioresearch, DNB head of IT: @Bartwilkows @kaiblin and @phantomas1234 of @DTUbiosustain hosted an un- this week. #givesoftwareitsdue

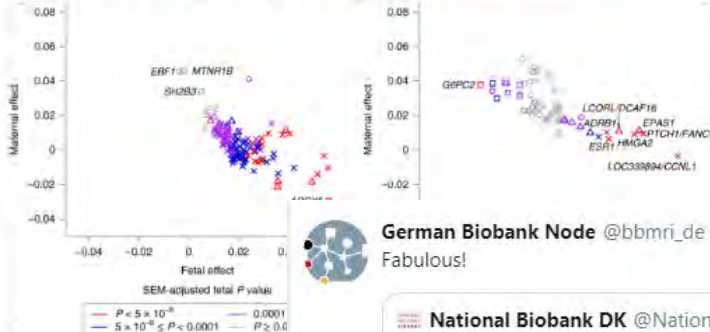


420 visninger | Welcome | 0:04 / 1:59

6 | 13

National Biobank DK retweetede

Nature Genetics @NatureGenet · 1. maj
Maternal and fetal genetic effects on birth weight and their relevance to cardio-metabolic risk factors (Warrington et al.) go.nature.com/2ITFTCE



SEM-adjusted fetal P value
P < 5 × 10⁻⁸ | 5 × 10⁻⁸ ≤ P < 0.0001 | P ≥ 0.0001

3 | 7

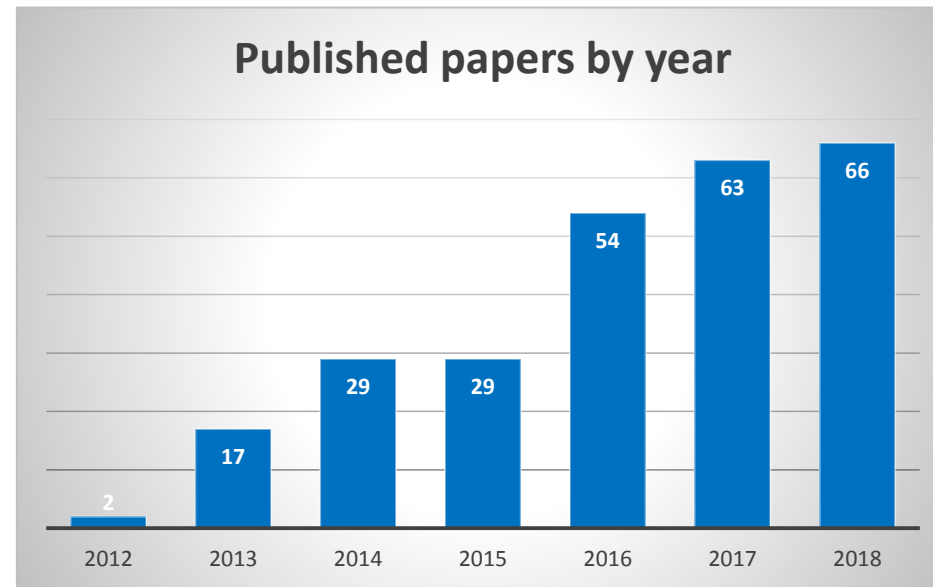
German Biobank Node @bbmri_de · 8. feb.
Fabulous!

National Biobank DK @NationalBiobank · 8. feb.
Our new information brochure about the unique research opportunities in the DNB is out today. Read and share, researchers!
Find it here: bit.ly/2MSCTFN
#biobanking #research #health #genetics

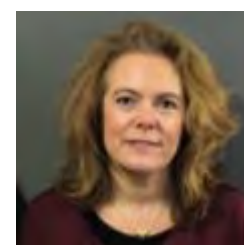
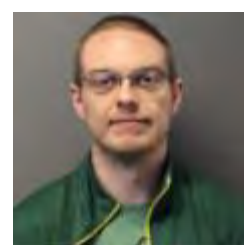
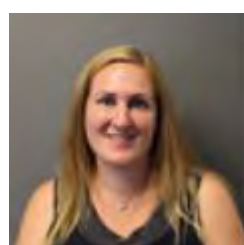
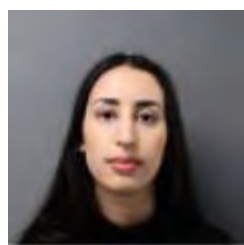
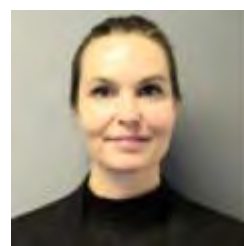
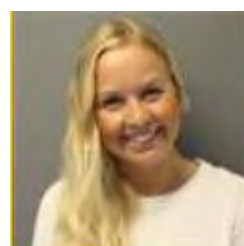
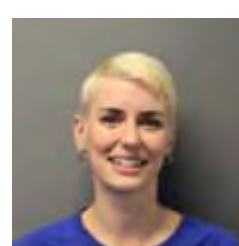


3

260 publications (2018) average impact factor 10,1



Danish National Biobank Team





www.danishnationalbiobank.com

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Forskningsministeriet

novo nordisk fonden

LUNDBECKFONDEN

