

# Building a shared national biobank infrastructure: the Swedish experience

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Karolinska Institutet & BBMRI.se

1. Nationales Biobanken-Symposium  
12. Dezember 2012

The background of the slide is a grayscale image of numerous laboratory test tubes. The tubes are arranged in a dense, overlapping pattern, with some in sharp focus and others blurred in the foreground and background, creating a sense of depth and a scientific atmosphere.

**BBMRI.se**

BioBanking and  
Molecular Resource  
Infrastructure of  
Sweden

# Overview

- Background
- The Swedish biobank landscape
- Why biobank (nationally)?... The value



Biobanks work hard to keep things cold!



But biobanks are cooking!





# Why is biobanking so hot?



- Huge potential
  - Transformative impact
- New technologies mapping the molecules of life
  - Genes, proteins, metabolites
- Controversial
- Money (cost)
- Real value already coming

- Growing impact on medical research
- Huge public health opportunity

# Yet we still need to keep cool!

*NCI discovered big quality problems*

FEATURES 18.06

## Libraries of Flesh: The Sorry State of Human Tissue Storage

By Steve Silberman [✉](#) May 24, 2010 | 12:00 pm | [Wired June 2010](#)



Photo: Andrew Tingle

See...

*Wired May 2010*

*Nature July 2011*

## *Quality hot-spots*

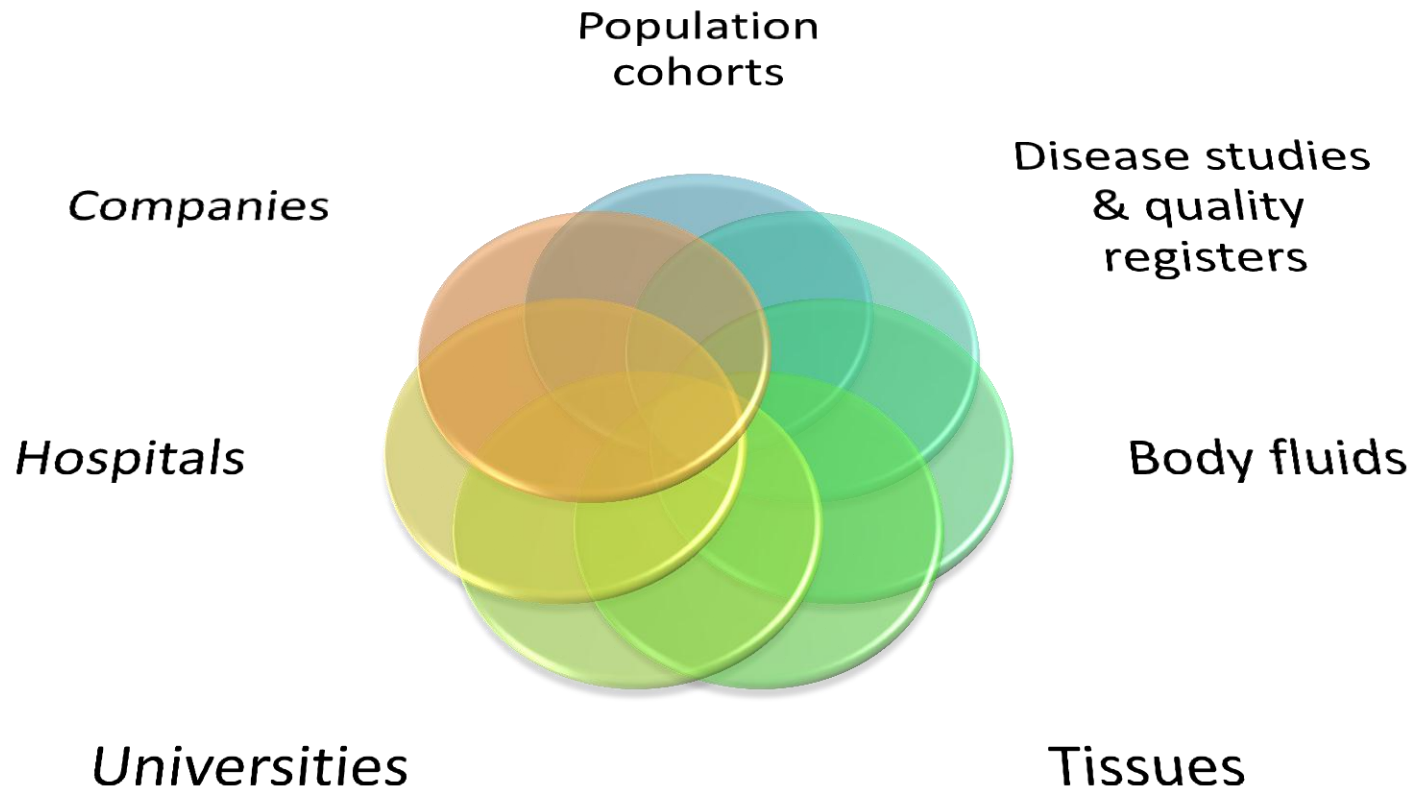
### *Samples*

- Collection
- Processing
- Storage
- Data
- Access

### *Donors*

- Selection
- Availability
- Informed consent

# Today we live in a very rich world of biobanks





# and explosions of genetic knowledge and technology

- Gene sequencing 1980s
- Human Genome Sequence 2002
- Single Nucleotide Polymorphisms
- Genome Wide Association Studies
- Epigenetics
- Next Generation Sequencing
- Genetic regulation – ENCODE 2012



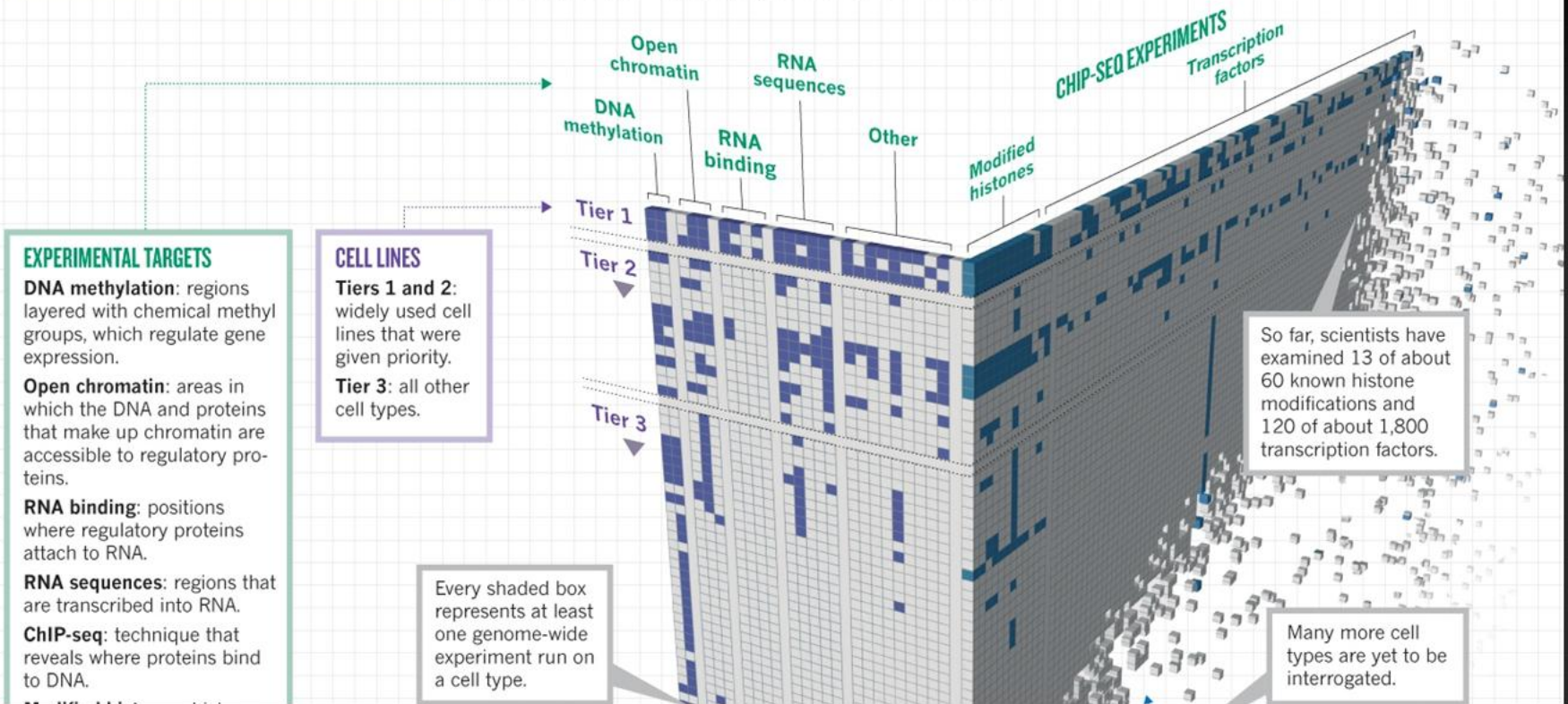
# ...eg the ENCODE initiative

## what does all that "non-coding" DNA do?



### MAKING A GENOME MANUAL

Scientists in the Encyclopedia of DNA Elements Consortium have applied 24 experiment types (across) to more than 150 cell lines (down) to assign functions to as many DNA regions as possible — but the project is still far from complete.





# Populations are now under the microscope

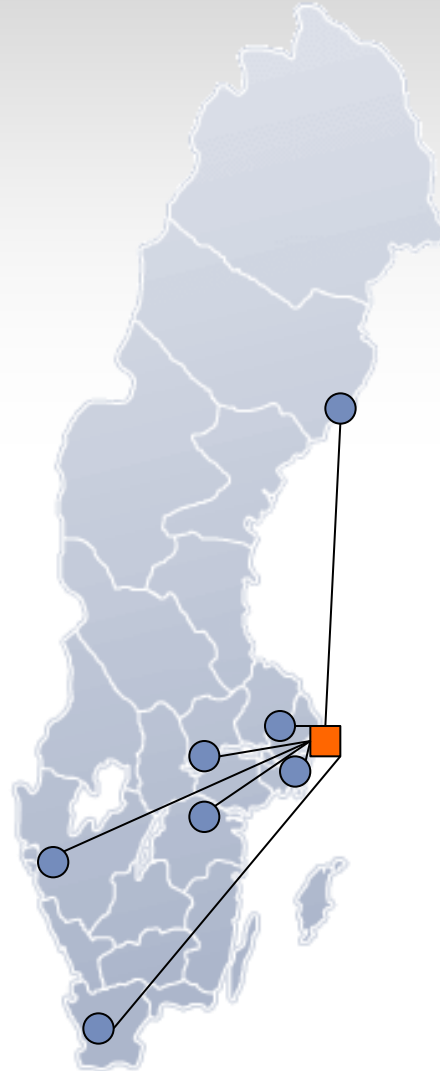
-  HUNT, Norway
-  UK Biobank
-  Kadoori, China
-  LifeLines, Netherlands
-  Helmholtz, Germany
-  LifeGene, Sweden
-  EpiHealth, Sweden
-  Saga, Iceland
-  PACT, Africa
-  Barshi, India
-  Es Maestras, Mexico



Millions of individuals helping us study interplay of genes and environment in health and disease

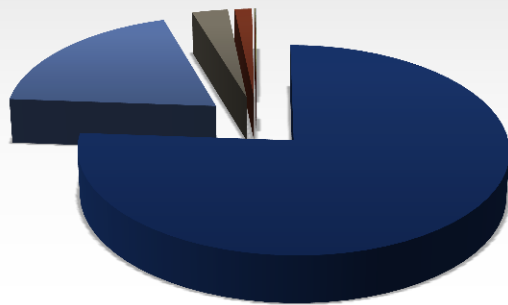
# Biobank landscape of Sweden

- **579 Biobanks**

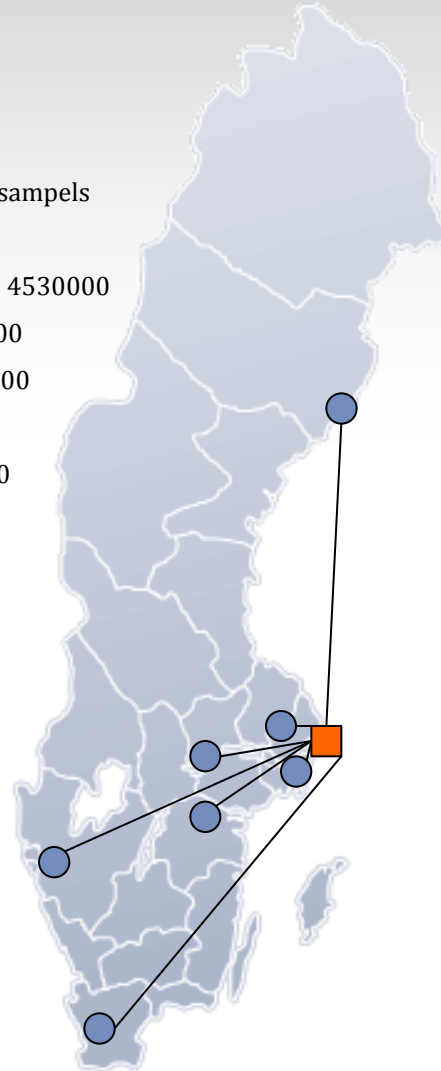


*With the courtesy of Prof Jan-Eric Litton, KI*

# Biobank landscape of Sweden – for healthcare



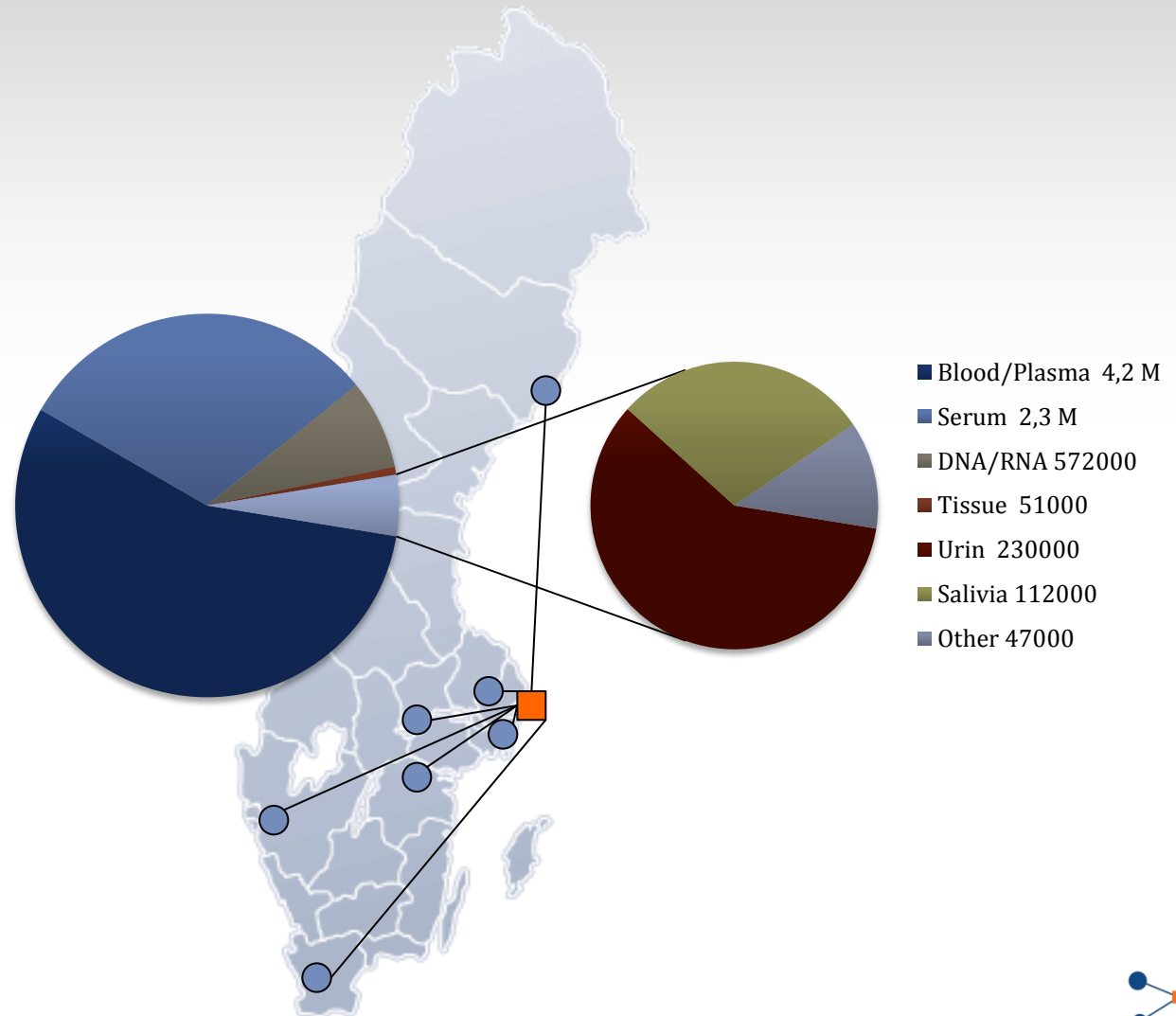
- Tissue 114 M sampels
- Cells 28,7 M
- Blood/plasma 4530000
- Serum 2200000
- DNA/RNA 69000
- Bone 110000
- Others 106000



*With the courtesy of Prof Jan-Eric Litton, KI*



# Biobank landscape of Sweden – for research

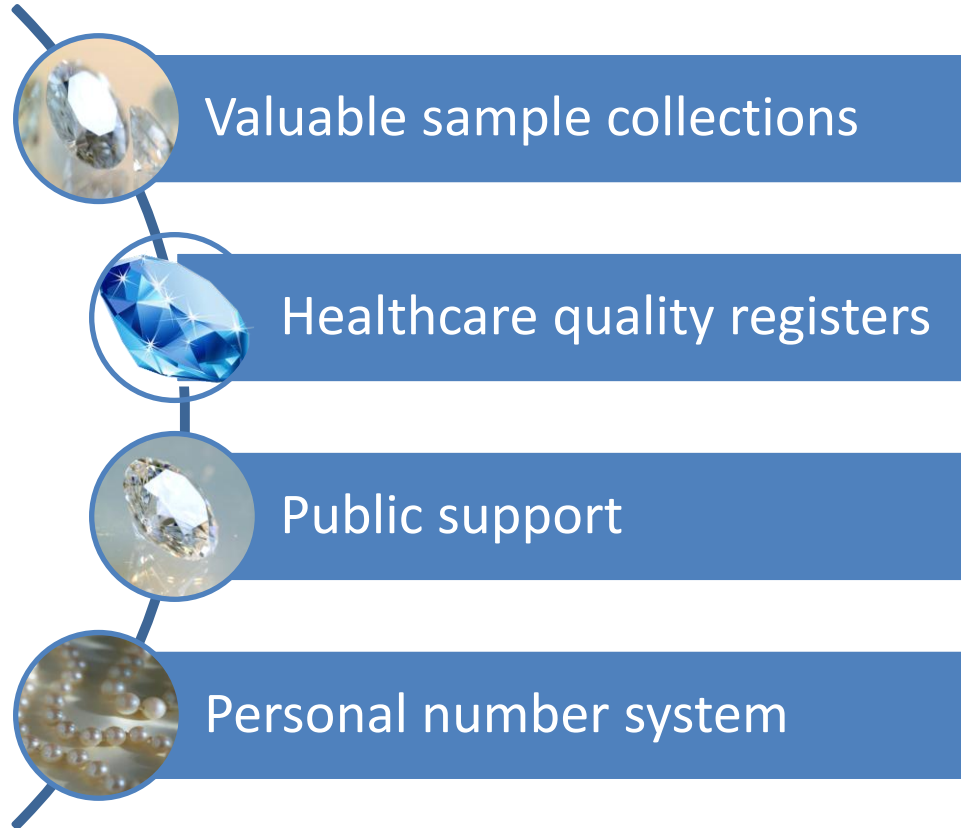


*With the courtesy of Prof Jan-Eric Litton, KI*



# A good climate for biobank-based research in Nordic countries

## *The Scandinavian gold-mine*



# But sometimes buried deep!



- *Complex ethico-legal landscape*
- *Fragmented infrastructure*
- *Trust and ownership fears*
- *Bureaucracy*
- ...

- *Many oysters*
- *But few pearls*



# BBMRI.se is a national initiative to make biobanking better for Swedish medical research

- Funded by Swedish Research Council (VR) and KI
- Based on the EU concept of research infrastructure
- Becoming a reality in Sweden
- 2010-2014



# A short history of KI Biobank...

## *Progressive growth*

- Capacity
- Competence
- Quality
- Study diversity

### ● 2003/4 kick-off!

- Lab, data systems, processes
- Ethics and legal compliance addressed
- 1st studies, incl. Twingene

### ● 2006

- 1st withdrawals
- Quality System and ISO accreditation
- Data support to external collections

### ● 2010

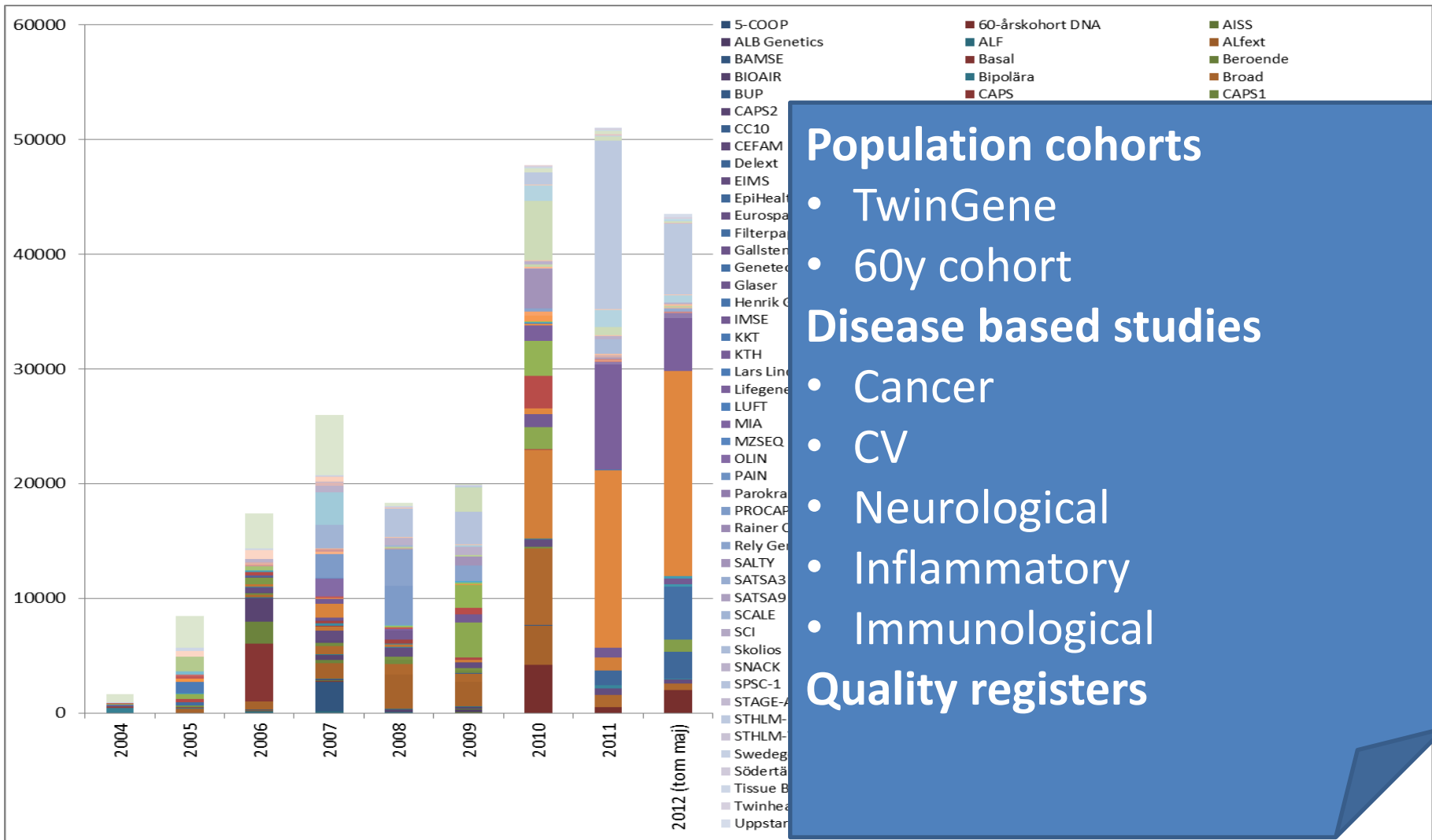
- BBMRI.se
- Technical re-development
- Large-scale studies start

### ● 2012

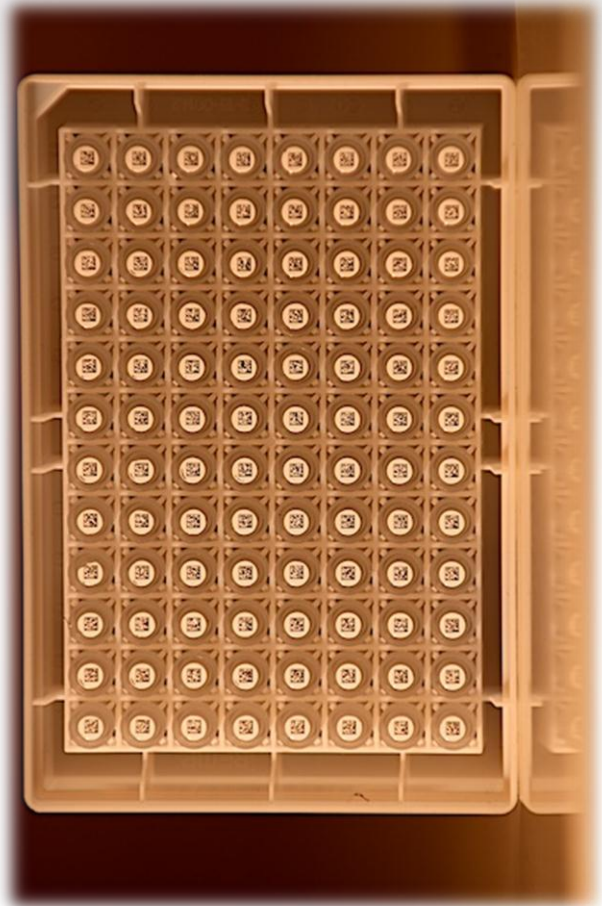
- 2.5M samples
- 210K donors
- Impact!



# The biobanks of KI and BBMRI.se are a rich source of samples: 150 studies, 3M samples



# BBMRI.se is transforming sample handling



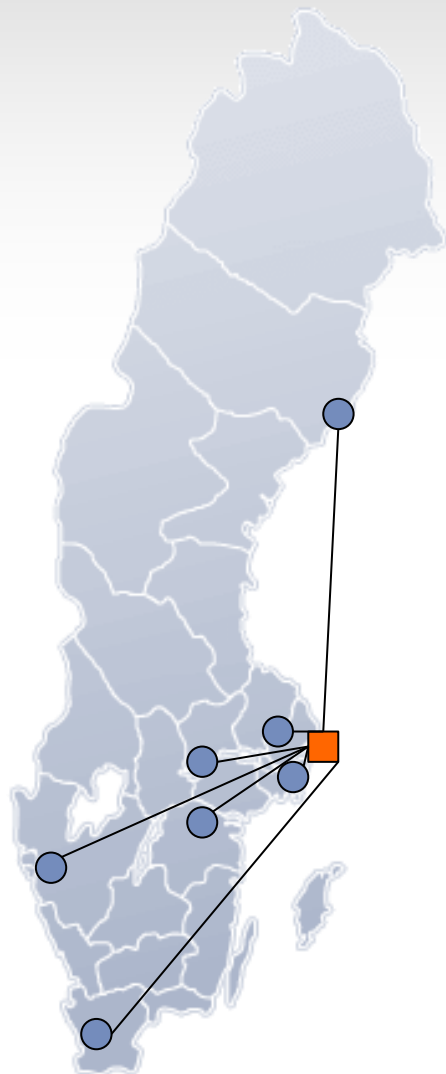
- **Modern sample format**
- **Highly automated**
  - Fast in – Fast out
- **Highly traceable, secures integrity**
  - For donor, sample, data
- **Higher quality**
- **Lower cost**
- **Continuous improvement**
  - Plenty of improvements to come!

# Some sample statistics, Nov 2012

	Total	KIBB	BBMRI.se
# studies	155	145	10
# samples	3 400 000	700 000	2 700 000
# donors	275 000	160 000	115 000
# DNA samples	240 000	145 000	95 000
# withdrawals	>335 000	>270 000	>65 000

# National prospective cohorts growing within **BBMRI.se**

Large-scale cohorts	# donors planned (now)	Collection region
LifeGene	200K (20K)	Stockholm +
EpiHealth North	150K (5K)	Uppsala
EpiHealth South	150K (0.5K)	Skåne
Karma breast cancer	100K (50K)	Stockholm (+Skåne)
Sthm-2 prostate cancer	100K (25K)	Stockholm
Scapis CV	30K (2K)	Göteborg + national
Malmö Diet & Cancer	18K, complete	Malmö
Malmö Preventive Med	22K, complete	Malmö
Sthm-3 prostate cancer	200K pilot test	Stockholm



BBMRI.se standards :

- *Unified sample and data format*
- *Open Access Program*



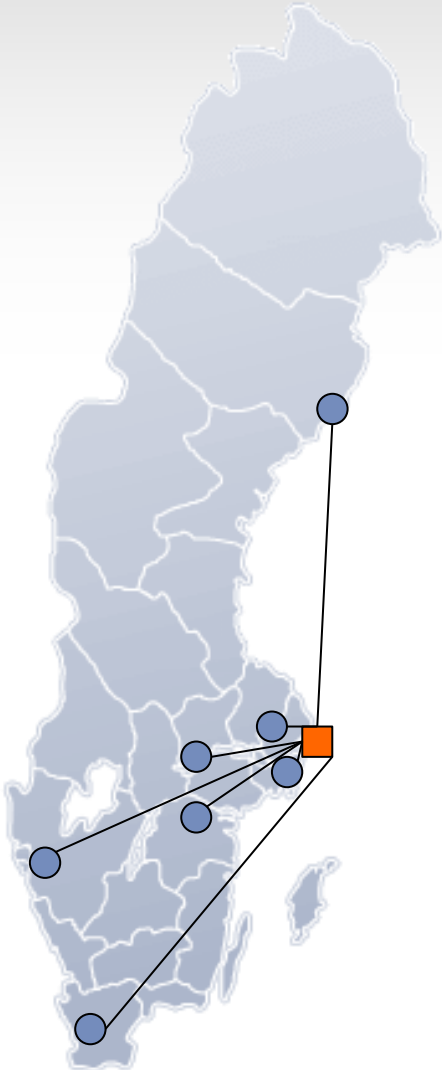
But it's not all just about populations...  
...squeezed into the biobank



We have space for others too!...



# National patient-based sample collections growing within BBMRI.se



National Quality Register collections	Status
Multiple Sclerosis (IMSEII)	Running; clinical trial
Bipolar Disease	Running
Rheumatoid Arthritis	Advanced planning
Myelo Dysplastic Syndrome	Started
Chronic Lymphoid Leukemia	Planning
Other studies	Status
Pre-Rheumatoid Arthritis	Planning; gather pre-existing clinical samples

BBMRI.se standards :

- *Unified sample and data format*
- *Open Access Program*

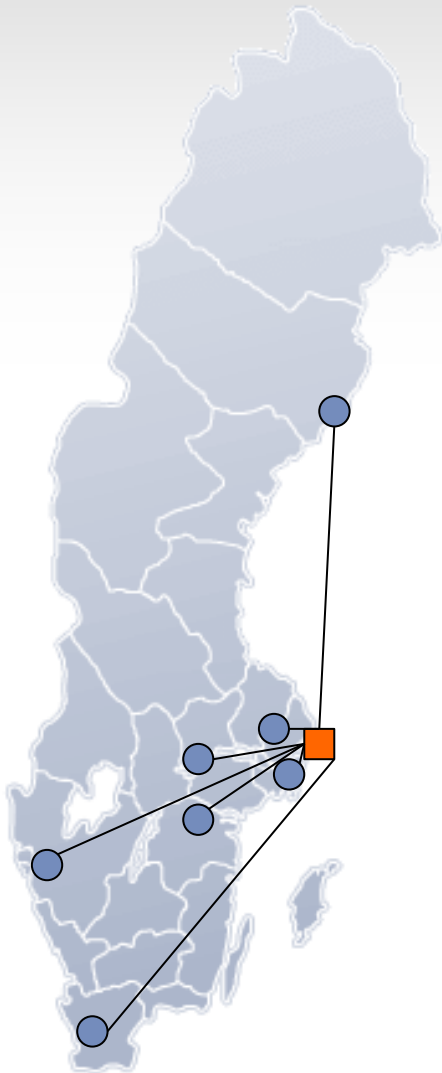


# We can't do this alone!

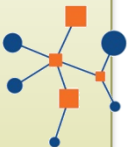


# An emerging national network for BBMRI.se sample handling

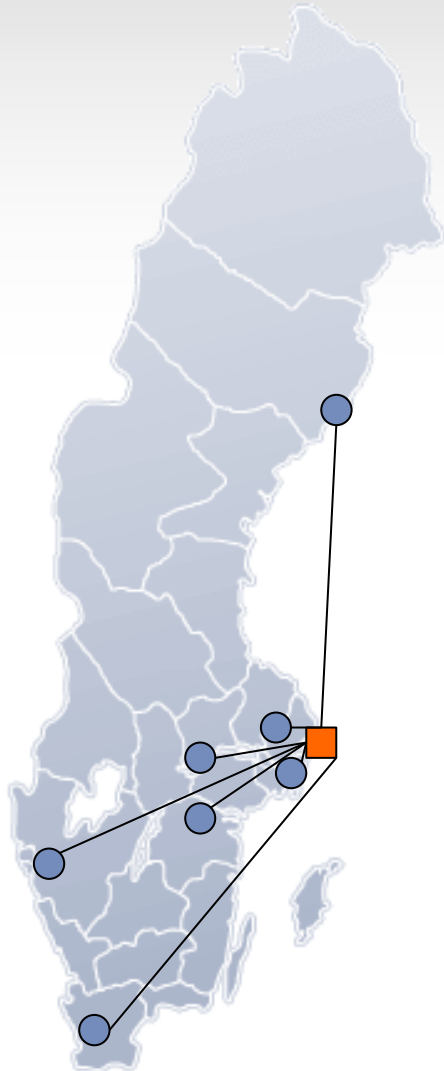
Node	Status	Launch
Stockholm, SSB hub	Major facility production & development	Nov 2010
Göteborg	New facility	Feb 2012
Skåne	Reformat existing samples, co-develop with new RS Biobank	Nov 2011
Umeå	Rebuild existing facility	1Q2013
Örebro	New facility	2Q2013
Linköping	New facility	3Q2013



- BBMRI.se finances defined sample handling equipment
- Node adopts BBMRI.se sample & data format
- Node provides staff & facilities
- Node participates in BBMRI.se development
- ***Node brings new sample collections to BBMRI.se***



# BBMRI.se sample network can bring even more collection enrichment



Node	Sample collection opportunity
Skåne +	Scapis
Örebro	Swedeheart UCAN
Umeå	Northpop cohort Västerbotten cohort Monica Marma UCAN
Linköping	Lifestyle & stress cohort

With built-in BBMRI.se benefits:

- *Unified sample and data format*
- *Open Access Program*



# Why are we biobanking?...

*... to advance medical research!*

- Combine with modern bio-analysis
  - Systematic
  - Statistical power
- Huge potential for public health

Study	publications
GALLSTEN	4
PAIN	2
BAMSE	8
SCALE	15
Ekonomiskt beteende	2
TwinGene & Euroclot	13
HARMONY & SATSA	12
KTS	1
CAPS	40
Totalt	97

## Emerging highlights

- Multiple Sclerosis
- TwinGene
- Broad
- Influenza Like Illnesses
- Prostate Cancer



# Some great examples



# Examples of research progress, 2011

- Bipolar disease (SBP) Mikael Landén
  - New susceptibility gene, calcium channel (GWAS)
- Multiple sclerosis (IMSE, EIMS) Tomas Olsson, Lars Alfredsson
  - Genetic susceptibility (GWAS)
- Lymphoma (SCALE) Karin Ekström-Smedby
  - Hodgkins lymphoma genetic susceptibility (GWAS)
- Prostate cancer (SPSC-1) Henrik Grönberg
  - Genotyping for better diagnosis (SNP)

# International biobank-based collaboration



## Main findings of the iCOGS chip, Spring 2012

Approximate number of new disease associated loci 75:

Breast	42
Prostate	23
Ovary	5
<i>BRCA1/2 carriers breast</i>	3
<i>BRCA1/2 carriers ovary</i>	2

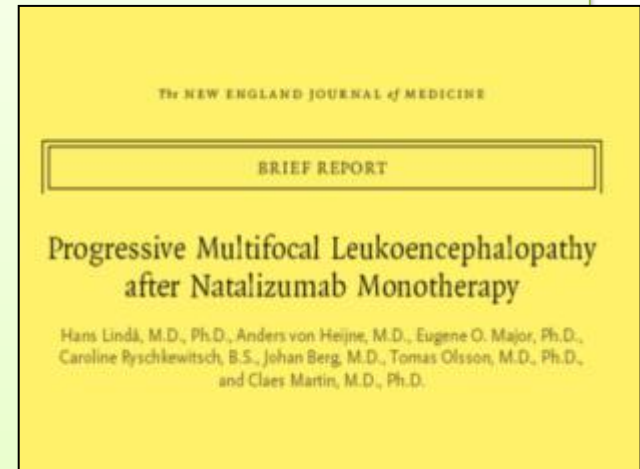
- *The results roughly doubles number of known loci for these cancers*
- *Several surprising overlaps between cancers have been identified*
- *13 papers about to be submitted*

*With the courtesy of Prof Per Hall, KI*

# What is the real value of biobanking?...

Multiple Sclerosis research gives a great example\*

- ~17K MS cases in Sweden
- Many represented in KI Biobank
- New therapy, Tysabri™
  - Monoclonal antibody
  - Very effective, very expensive
  - Serious side effects for some (polyoma viral cross-reacton)
- Screen MS biobank for polyoma virus
  - Save big drug cost (200Kkr/patient/yr)
  - Save some lives, improve others
  - Match a good drug to the right patients



\*T Olsson et al

[http://www.pharmatimes.com/Article/12-01-23/New\\_Tysabri\\_label\\_to\\_personalise\\_treatment.aspx](http://www.pharmatimes.com/Article/12-01-23/New_Tysabri_label_to_personalise_treatment.aspx)

# New Tysabri label to personalise treatment

WORLD NEWS | JANUARY 23, 2012

PHARMATIMES

Elan and Biogen have been given a green light from the US Food and Drug Administration to update the product labelling for their multiple sclerosis drug Tysabri (natalizumab) to help identify those at most risk of developing the rare but potentially fatal viral infection PML (progressive multifocal leukoencephalopathy).

### Related Links

[Tysabri once again drives Biogen figures](#)

The labelling now suggests patients should be tested to see whether or not they have previously been exposed to the JC virus – prior infection and a corresponding anti-JCV antibody positive status means a multiple sclerosis patient runs a greater risk of developing PML, particularly if they have also received

immunosuppressant therapy and have been on Tysabri for more than two years.

In analyses, patients who were anti-JCV antibody positive had a greater chance of developing PML to varying degrees depending on prior IS use and duration of Tysabri treatment. Irrespective of treatment, around 55% of MS patients are anti-JCV positive, the companies note.

These attempts to personalise medicines means that a product that a few years ago might have been taken off the market because of the small but possible risk of PML, can now be used effectively in a targeted group of patients. "Our development of the risk stratification algorithm and subsequent efforts to support the commercial availability of anti-JCV antibody testing reflect our commitment to providing patients and their physicians with additional guidance to help them make more personalised treatment decisions," notes George Scangos, chief executive of Biogen.

Tysabri is one of the key drivers of growth at Biogen, bringing \$277.3 million into its coffers, up 26%, in the third quarter of last year. Overall its profits were up 38% to \$351.8 million for the period.

Subscribe to PharmaTimes Magazine here

## 24<sup>TH</sup> ANNUAL EUROMEETING

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Copenhagen, Denmark

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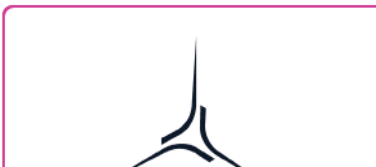
e.g. Director, Medical Sales

e.g. London e.g. last 2 days

**FIND A JOB**

### POPULAR TAGS

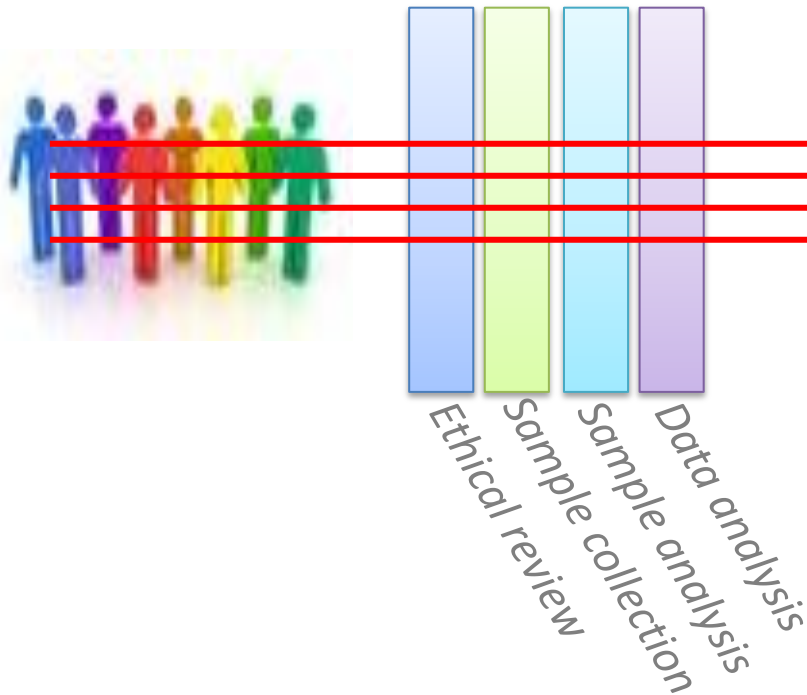
Pfizer **Sandwich** FDA Inlyta  
Third OKs **Amylin** Bydureon  
**Murdoch** GSK Pharma Servier  
European





# Conclusion:

## Biobank-based research adds big value



### Clinical practice

*Better screening, diagnosis and treatment match; eg HPV*

### Health economy

*Better public health for lower cost eg HPV, MS, RA*

### Drug development

*Matching patients to treatments eg MS, HIV, HPV*

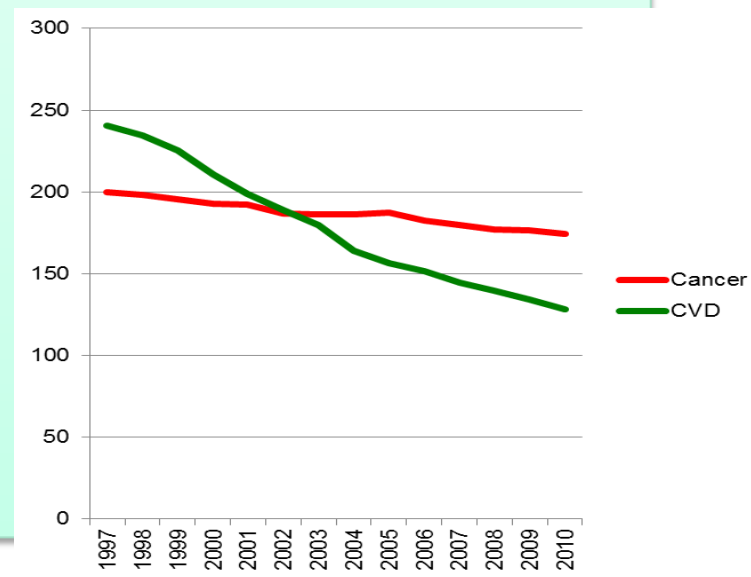
### Ethical credibility

*Increased trust and support eg all of the above*

# A new wave of biobank studies



- Power of large numbers and...
- ...Sharp focus on specific disease areas
  - Prostate cancer
  - Breast cancer
  - Cardio-vascular disease
- Plus healthcare quality registers
- Big opportunity for early impact
  - Clinical practice
  - Health economics

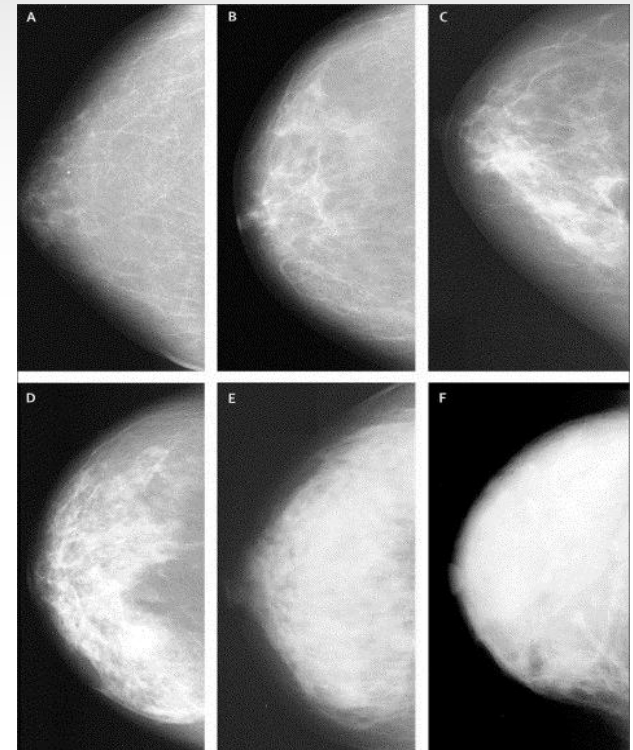


Karolinska Mammography  
Project for Risk Prediction  
of Breast Cancer

**Karma**

Thanks for joining  
celebrating Karma at  
**50,000**  
participants

# Karma



**Karma** Några minuter idag. Många liv i morgon.

### Enkätöversikten - TEST

Här ställer vi frågor om din livsstil, din hälsa och vad som hänt dig tidigare i livet. Frågorna handlar både om kända riskfaktorer och om områden som behöver belysas närmare. Klicka på en ikon för att sätta igång.

- Graviditet och barn
- Mediciner
- Levnadsvanor
- Hälsohistoria
- Familj och släkt
- Livskvalitet
- Fysisk aktivitet
- Mätvanor
- Bakgrund

Klicka här för att fortsätta där du slutade

# STHLM 3

---

Stora studien inom  
prostatacancer

**Start 2013-01-01**  
**PI prof Henrik Grönberg**  
**Karolinska Institutet**

**250 000 individuals**

Biobanking to support big decisions:

- Diagnosis
- Treat or not treat localised cancer
- Which treatment for advanced disease
- Is patient cured



## Costs of prostate cancer care in Sweden today

- 2003 estimated direct cost of 1,5 billion SEK
- 1100 MSEK direct care
- 400 MSEK drugs

## Prostate cancer diagnosis: Today

Insensitive  
diagnosis  
based on 1  
biomarker,  
PSA

- 2 of 3 positive diagnoses are incorrect
- 15-20% of all severe cancers are missed

## Screening for Prostate Cancer: U.S. Preventive Services Task Force Recommendation Statement

Virginia A. Moyer, MD, PhD, on behalf of the U.S. Preventive Services Task Force\*

**Recommendation:** The USPSTF recommends against PSA-based screening for prostate cancer (grade D recommendation).

## What the U.S. Preventive Services Task Force Missed in Its Prostate Cancer Screening Recommendation

William J. Catalona, MD; Anthony V. D'Amico, MD; William F. Fitzgibbons, MD; Omofolasade Kosoko-Lasaki, MD; Stephen W. Leslie, MD; Henry T. Lynch, MD; Judd W. Moul, MD; Marc S. Rendell, MD; and Patrick C. Walsh, MD

## Prostate Cancer Screening: What We Know, Don't Know, and Believe


Otis W. Brawley, MD

**CONTROVERSIAL !!!!**

*With the courtesy of Prof Henrik Grönberg, KI*

## Prostate cancer diagnosis: Tomorrow

Improved  
diagnosis  
based on  
combination of  
100+ markers



- Enables exclusion of 50%
- Differentiate severe from non-severe tumors
- Significant reduction in unnecessary biopsies
- Reduce anxiety – improved quality of life

# So what about the future?

## Bad?...

- Ethical fears take over
- Legal constraints increase
- Abuses of integrity
- Technology fails to deliver
- Cost pressure
- More fragmentation

➤ Banking crises spread to biobanks

## Good?

- More research progress
- Healthcare quality increases
- Public faith grows
- Samples and data shared
- Technology delivers

➤ Public health improves





The future can never be fully predicted...



...but we must look forward!

# A wise investment...

... biobanks help health

**If you think research is expensive,  
try disease**

*Mary Lasker (1901-94)*



What do you think?



Bright or gloomy future?

# Acknowledgements



# More info on KI Biobank and BBMRI.se services...

[www.ki.se/kibiobank](http://www.ki.se/kibiobank)

[www.ki.se/scarab](http://www.ki.se/scarab)

[www.bbmri.se](http://www.bbmri.se)

