

# Excellence and Competitive Niches in Nordic Research Collaborations

Leena Peltonen  
University of Helsinki &  
National Public Health Institute, Finland,  
The Broad Institute, MIT, Boston, MA, USA

# Nordic countries in Europe

Shared history

Shared culture

Shared values

Shared societal structure

Shared (free) educational system

# Nordic Countries: 24 million

National health care system

Accurate population registers

Reliable healthcare registers

Traditions in genetic research

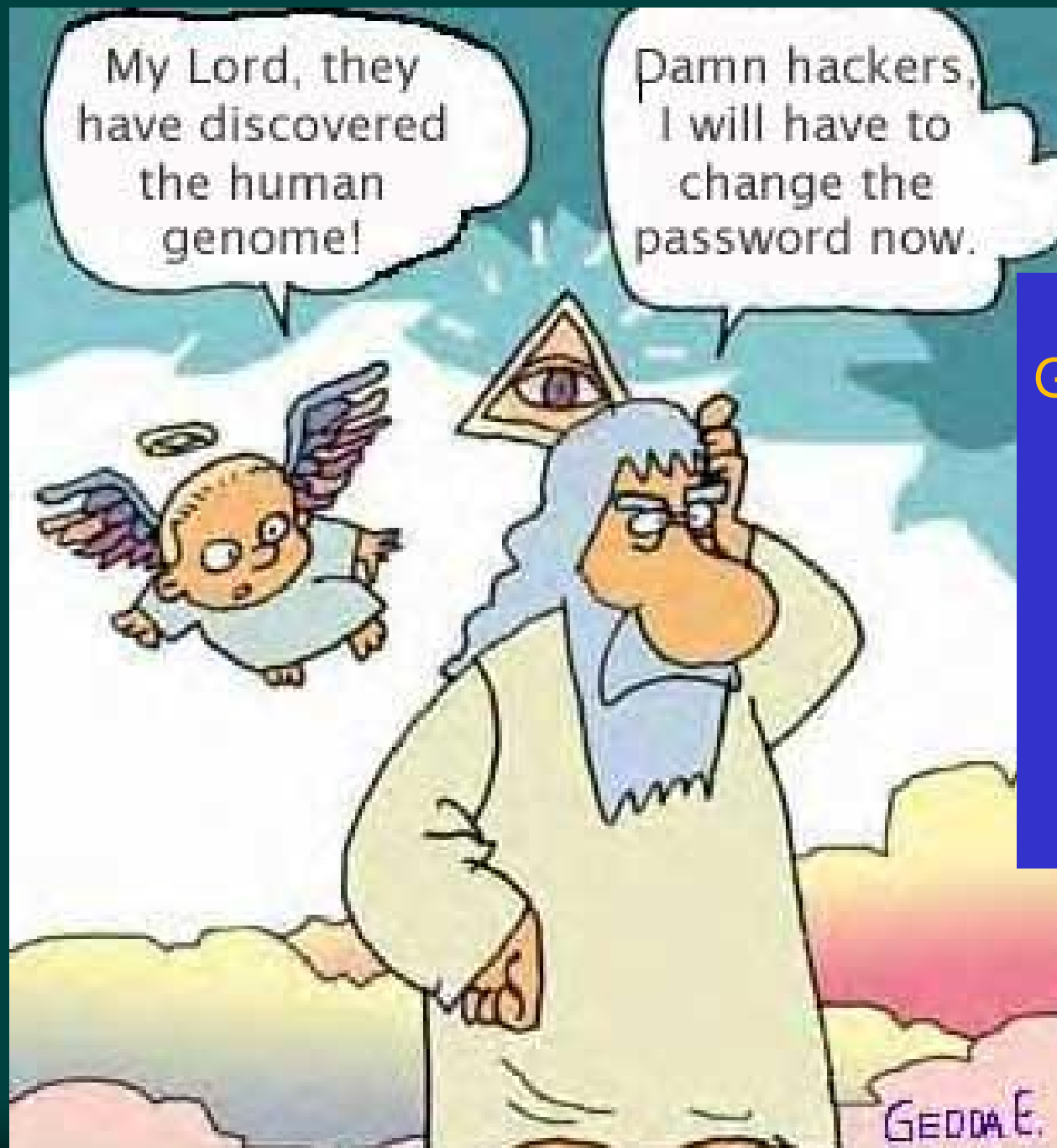
Some isolated populations

Traditions in epidemiology and mathematics

Expertise in information technology

Equal, high quality education





After Human Genome and Hapmap



Basic tools exist to characterize the biology behind human diseases

# Genomics era in Biomedicine

- n For the first time in human history we can produce a high-resolution picture of our individual genome
- n For the first time the role of genetic and life-style risk factors in diseases can be defined
- n Special European competitive advantage of in biomedical research can be utilized in this historical era

# Biotech bubble has burst and Nordic countries did not do very well

## WHY?

Investments not done on the areas of existing strengths

Thin and even distribution of funding: Limited expertise and lack of courage

Regional policy comes before science policy

Strategic decisions made slowly

Excellent science not translated to products

# What are we trying to accomplish?

Understanding the biological cause of any disease

- Improve diagnostics of common diseases
- Enable rational drug development to focus on causal genes

Personalizing medicine

- Understanding individual disease risk and response to therapies (positive and adverse)

## 2007: Genome-profiles of common traits

Age-related macular degeneration

Alzheimer's disease

ALS

Asthma

Atrial fibrillation

Bipolar disorder,

Breast cancer

Coronary artery disease,

Crohn's disease,

Diabetes, type 1

Diabetes, type 2

Hypertension

Celiac disease

Colorectal cancer

Diabetic nephropathy

Gallstone disease

Glaucoma

Inflammatory bowel disease

Ischemic stroke

Multiple sclerosis

Myocardial infarct

Nicotine dependence

Obesity

Prostate cancer

Rheumatoid arthritis,

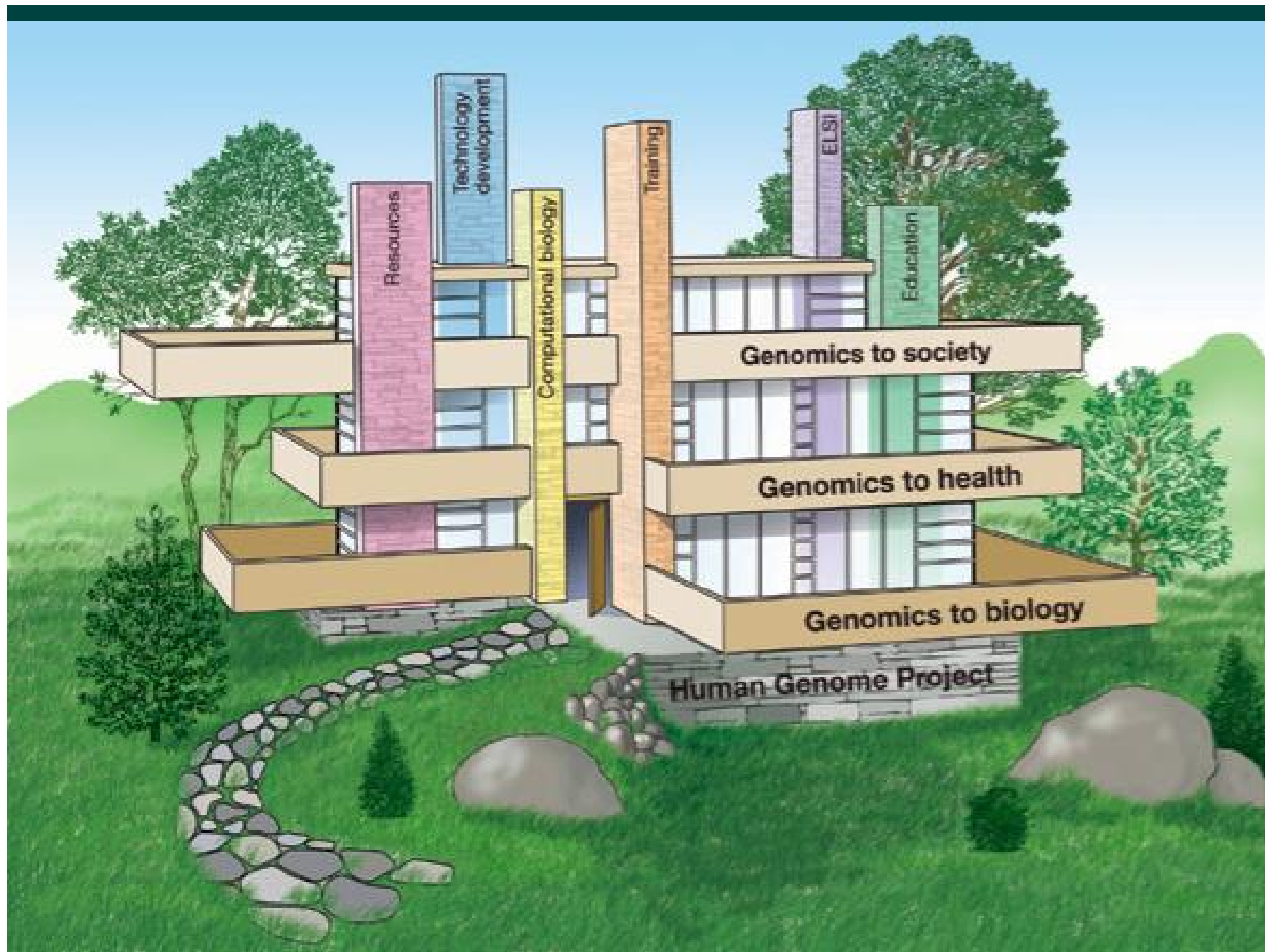
Restless legs syndrome

# Genetic information is not enough

For "personalized medicine" we have to be able to measure the role of genes and life style/environment for disease outcome

Genetic risk factors and life style risk factors represent a complex interplay

Understanding of this interplay and implementation this understanding to our health-related decisions is critical for future of our health care system



# Nordic competitive niche in this era: societal, not technical

- n Well characterized study samples and populations
- n Reliable health care infrastructure
- n High quality, equal education
- n Top level expertise in -omics, epidemiology, clinical medicine



Unique possibilities in health care-related  
genome research

# Nordic Center of Excellence in Disease Genetics: Partners

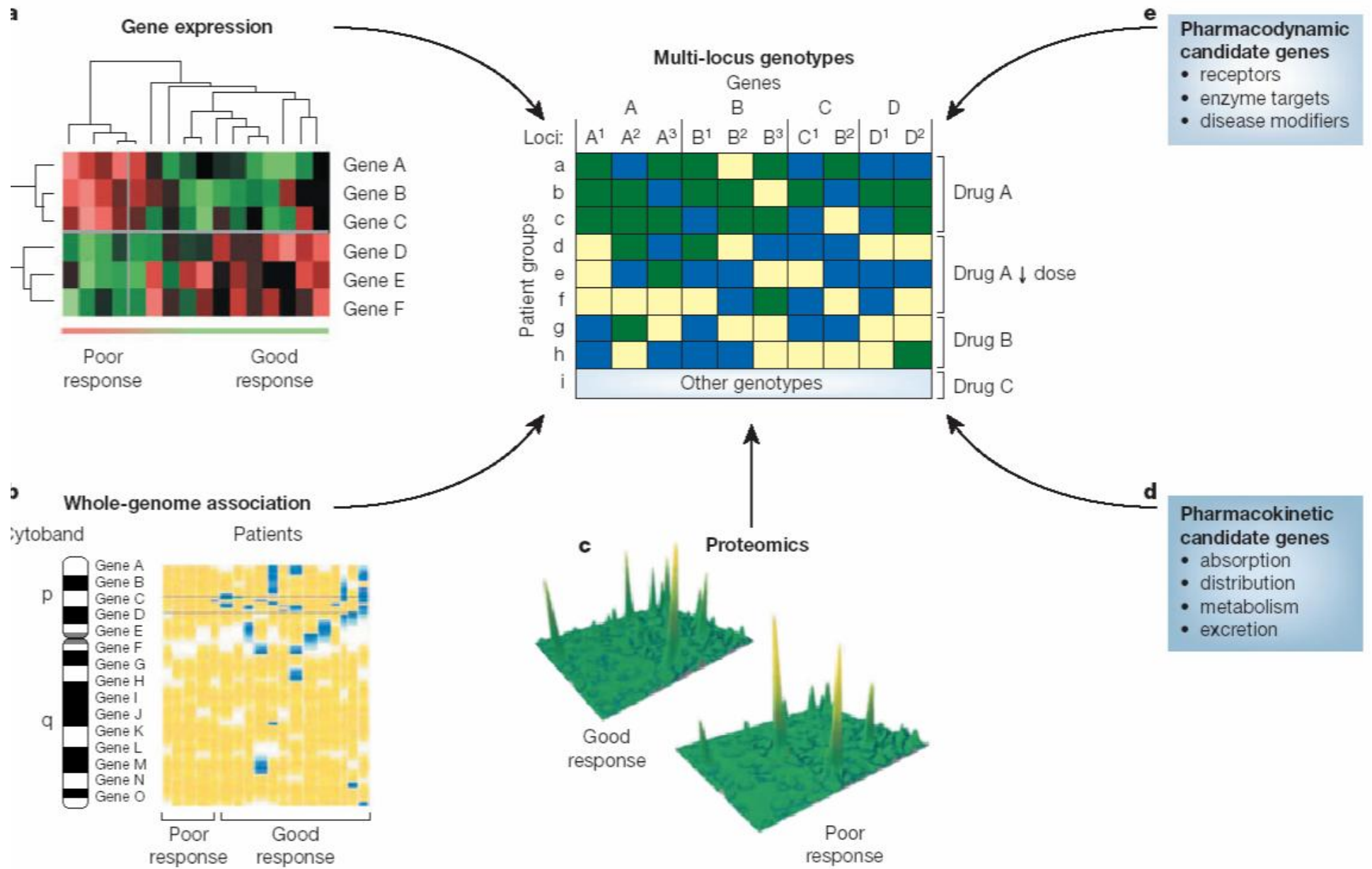
**Stockholm, Sweden**  
KI

**Helsinki, Finland**  
UH, NPFI, Folkhälsan

**Uppsala, Sweden**  
University of Uppsala

**Lund, Malmö, Sweden**  
Wallenberg Lab.,  
Univ. of Lund

**Århus, Denmark**  
Århus University Hosp.



DNA-analyses  
Biochemical analyses

New  
element

Epidemiological information

Free medication  
register

Health Care Records

Hospital discharge  
register

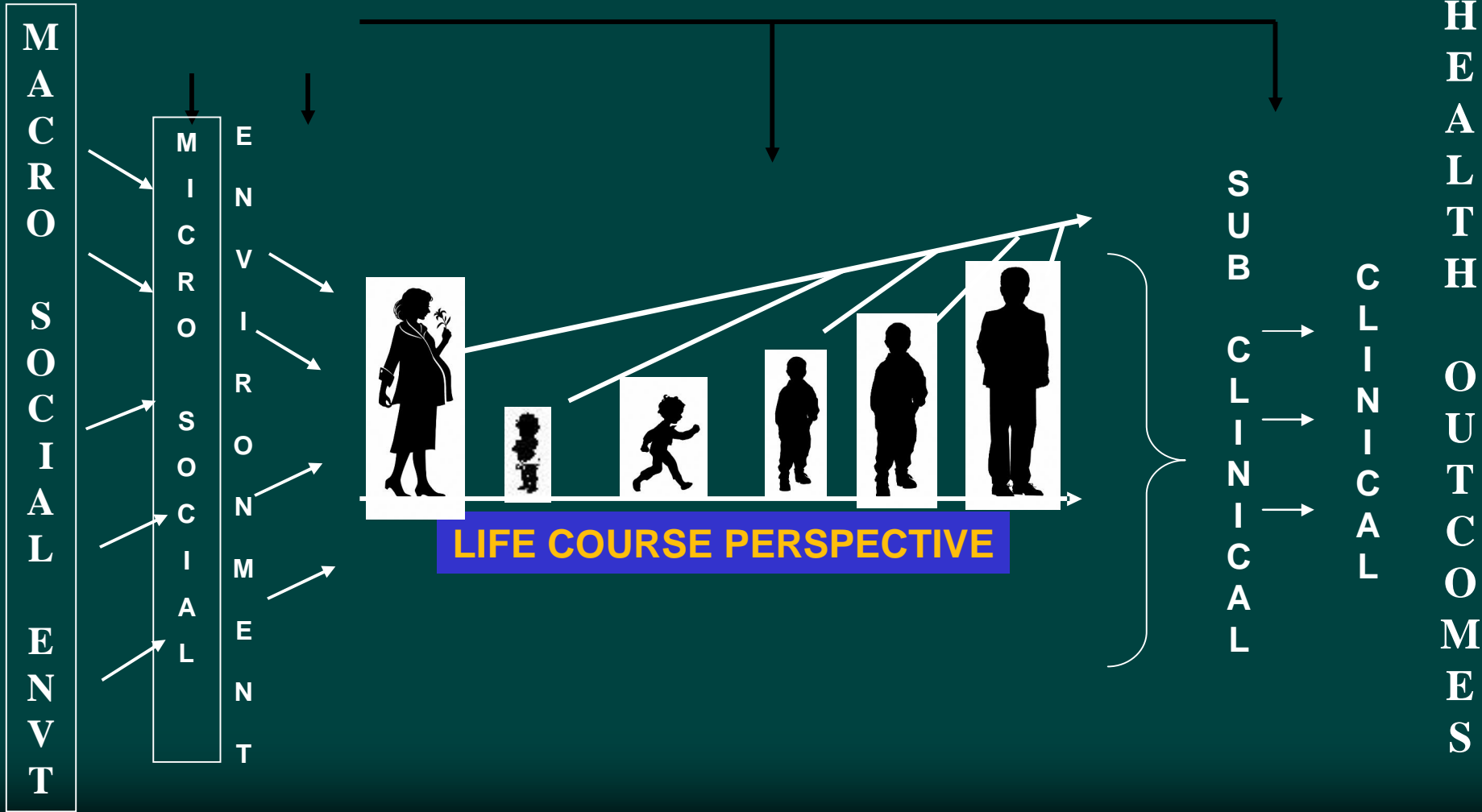
# Large epidemiological cohorts

Have provided the critical information guiding the actions of our health care system

Can now be used to studies of genetic and life style risk profiles

E.g. >200 000 Finns have contributed to these studies  
(4% of population!)

Risk factors to chronic diseases  
are numerous, complex and differ during the life span



# European and global effort is needed

In data harmonization: genetic profiles, phenotypes, epidemiological data

In pooling resources and expertise in genotyping metabolomics/ proteomics and statistical analyses

In data delivery to scientific community and public



Public Population Projects in Genomics ([www.p3g.org](http://www.p3g.org))

Europe could lead the way to harvest the potential of genome project in improvement of health of our societies

# GENOME EU TWIN

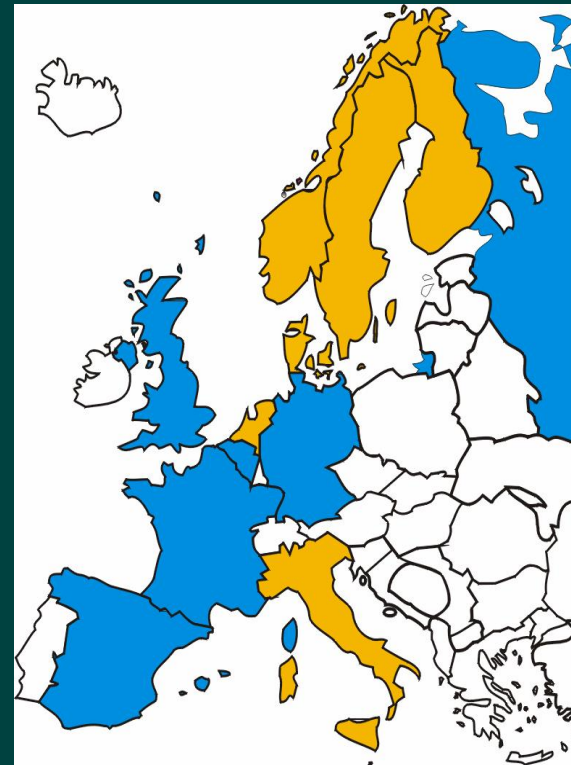
[www.genomeutwin.org](http://www.genomeutwin.org)

Funded by EU to study genetic and life style risk factors of common traits

14 countries: cohorts with 400 000 twin pairs and 320000 Morgam participants

Over 90 000 DNAs collected

Stature, BMI, CHD, stroke, migraine,



# Nordic model for Federated Database (Karolinska and Helsinki)

PhenNET

Virtual Private Network

Analysis units

Web

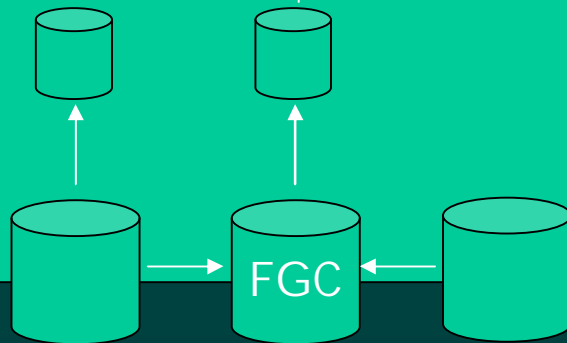
↑  
SQL

↑

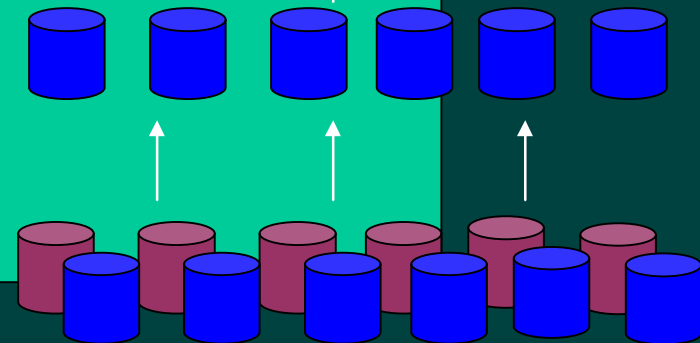
Genomedata – Federated Database

*Genotypes*

*Phenotypes*



*Genotyping laboratories*



*clinical-centres*

# Critical bottlenecks of Nordic countries (Europe):

Relative lack of experts: We must build attractive centers to be able to recruit globally

Lack of the concept of recruitment

Lack of tenure track for young experts

Underdeveloped infrastructure investments in expensive technologies: Platforms with high running costs and constant updating of large databases require intensified collaboration between academic institutes (and industry)

# 35 ESFRI structures identified: 6 in life sciences/biology

European Advanced Translational Research Infrastructure in  
Medicine **EATRIS**: 50 M/year

**Biobanking** and Biomolecular Resources: 15 M/year

**Infrafrontier** (mouse): Phenomefrontier, Archivefrontier  
(mouse): 36M/year

**Infrastructure for clinical trials**&biotherapy facilities: 5M/year

Integrated **Structural Biology** Infrastructure: 25M/year:

Protein production, NMR, crystallography, different forms of  
microscopy

Upgrade of **EBI**: 7M/year: Shared biological data collection,  
storage, annotation, validation, dissemination

# FP7 BMS Research Infrastructures

## *Biological and Life sciences*

- **INFRA-2007-2.2.1.15:** EATRIS (European Advanced Translational Research Infrastructure for medicine)
- **INFRA-2007-2.2.1.16:** European Bio-Banking and Biomolecular Resources
- **INFRA-2007-2.2.1.17:** INFRAFRONTIER (Infrastructure for Phenomefrontier and Archivefrontier)
- **INFRA-2007-2.2.1.18:** Infrastructure for Clinical Trials and Biotherapy
- **INFRA-2007-2.2.1.19:** Integrated Structural Biology Infrastructure
- **INFRA-2007-2.2.1.20:** Upgrade of European Bio-Informatics Infrastructure

EUROPEAN ROADMAP  
FOR RESEARCH  
INFRASTRUCTURES

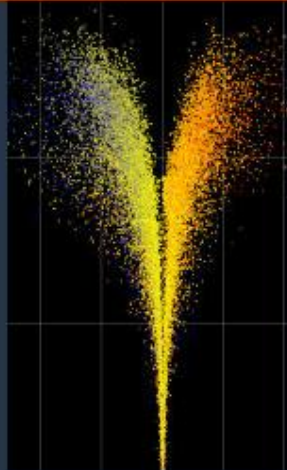
Report 2006

### **The facility**

**A pan-European and broadly accessible network of existing and de novo biobanks and biomolecular resources. The infrastructure will include samples from patients and healthy persons, molecular genomic resources and bioinformatics tools to optimally exploit this resource for global biomedical research.**



## THE FACILITY



### Website launched >

Biobanks website has been opened 01.10.2007



## PARTNERS

### Partners supportive of a European Biobank Research Infrastructure:

- GenomEUtwin ([www.genomeutwin.org](http://www.genomeutwin.org))
- Finnish biobank ([www.nationalbiobanks.fi](http://www.nationalbiobanks.fi))
- Swedish biobank (<http://www.biobanks.se/>)
- German biobank, KORA ([http://epi.gsf.de/kora-gen/index\\_e.html](http://epi.gsf.de/kora-gen/index_e.html))
- British biobank (<http://www.alspac.bris.ac.uk/welcome/index.shtml>)
- Estonian biobank: ([www.geenivaramu.ee](http://www.geenivaramu.ee))
- UK biobank ([www.ukbiobank.ac.uk](http://www.ukbiobank.ac.uk))
- A Nordic Center of Excellence linking family-based collections from Nordic countries ([www.ncoedg.org](http://www.ncoedg.org))
- Generation Scotland ([www.generationscotland.org](http://www.generationscotland.org))
- HUNT, a Norwegian biobank targeted to cardiovascular health ([www.hunt.ntnu.no](http://www.hunt.ntnu.no))
- EPIC, (<http://www.iarc.fr/epic/>) European prospective study of

# Biobanks and Biomolecular Resources

## **Biobanks (blood, DNA, tissue, cells, body fluids, and data)**

- Population-based biobanks
- Clinical case-control biobanks
- Population isolates biobanks
- Twin registries

## **Biomolecular resources / analysis tools (examples)**

- Antibodies
- Full-length ORF clone collections
- siRNA libraries
- Tools to decipher gene and protein functions
- Tools to study protein-protein interaction

# Biobanks in Nordic Countries

Biobank can be a trash bank without detailed clinical and epidemiological data, DNA:s are worth of nothing

Most biobanks will be useful 10-20 years from now

Nordic countries could start from "the other end", not from biobanks but from epidemiological data collections

Benefits from epidemiological samples for society materialize relatively soon

# The strength of Nordic epidemiological cohorts

Solid epidemiological criteria have been used to collect the study samples

Excessive amount of life style and health-related data has been collected

Possibility for longitudinal studies



All these features do not exist in current biobanks

# Guiding Principles

Scientific excellence

Pan-European relevance

Long-term perspective

Openness and transparency

Well organized but flexible

Build on existing resources and expertise

# Co-applicants: OVER 50

Existing Biobanks and Collections (members)

WP leaders and partners

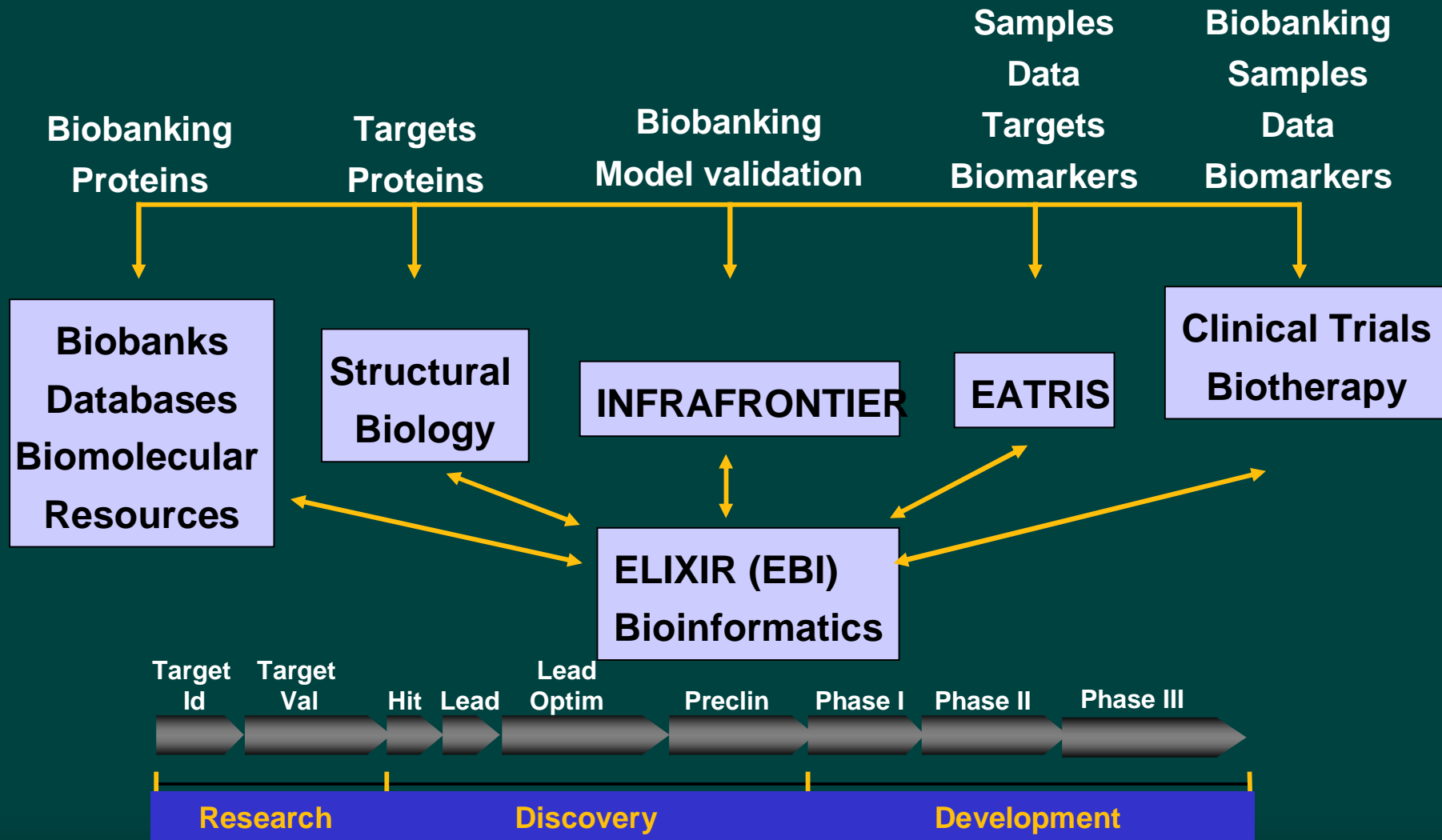
Funding agencies/organizations

Research and health ministries

International organizations

**Nordic countries have no shared strategy!**

# Synergies with Other Research Infrastructures



# Nordic countries need a shared research policy and a strategic roadmap

*"It is not enough that we do our best, sometimes  
we have to do what is required"*

*Winston Churchill*