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BioBank G R A Z

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Collections as base for knowledge



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Stift Melk



Meckel Sammlung
Institute of Anatomy, University Halle/Saale

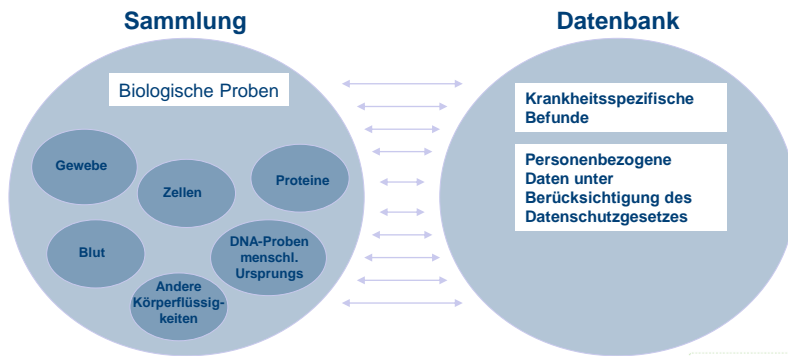
Philipp Friedrich Theodor Meckel (1755-1803), der Gründer dieser Sammlung, starb im Alter von 47 Jahren. Er ist noch immer Teil seiner Sammlung, da er bestimmte, dass sein Skelett zusammen gesetzt und ausgestellt wird.



Medizinische Universität Graz - Biobank Graz



- ▶ Structured collection of biological materials and associated medical data



“A collection of *biological material* and the associated *data and information* stored in an *organised system*, for a *population* or a *large subset of a population*.”

Organisation for Economic Co-operation and Development (OECD)



Types of Biobanks



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		+	-
Collections of individual researchers	→	Disease focused biobanks	High Quality? small, one entity
Setup of special study cohorts	→	Population based biobanks	High Quality, High numbers no tissue, high costs, long-term studies
Archives (Pathology)	IT, Stand.	Clinical biobanks	High numbers, tissue samples, all diseases, long-term follow up poor inconsistent quality

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History of law on biobanking in Austria



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Dekret der Studien-Hofkommission vom 18.10.1811, Z 1818 zur „Errichtung und Erhaltung anatomisch-pathologischer Cabinette“ [1] wurde zur Förderung des Unterrichtes in der Anatomie und pathologischen Anatomie die **Errichtung von anatomisch-pathologischen Sammlungen an allen medizinisch-chirurgischen Lehranstalten angeordnet** und Ärzte sogar ausdrücklich dazu verpflichtet, für die Bereicherung dieser Museen durch Anfertigung und Überlassung von Präparaten zu sorgen. [2] Diese Einsendungspflicht bezog sich sowohl auf interessante Präparate aus Leichenteilen, die im Zuge von Leichenöffnungen gewonnen wurden, [3] als auch – worauf hier schon hinzuweisen ist – auf sonstiges Material aus Kliniken [4] und aus der freien Praxis.

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Auszug aus Gutachten Prof. C. Kopetzki

Personalized Medicine



JAMA 2006

Why now?



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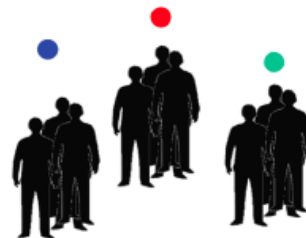
Actual practical
medicine



One size fits all

Trial and Error

Future perspective of
medicine



The **right** treatment for
the **right** person at the
right time

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Effectiveness of drugs Europe 2014:



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Hypertension Drugs 10-30%

ACE Inhibitors

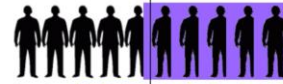


Heart Failure Drugs 15-25%

Beta Blockers



Anti Depressants 20-50%



Cholesterol Drugs 30-70%

Statins



Asthma Drugs 40-70%

Beta-2-agonists



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Danger of drugs:



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▶ **6.7% of patients *in hospitals* experience serious drug reactions in Europe**



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<http://www.pfizer.ch/de/health/personalisierte-medizin>

- Back programming of genetic and metabolomics pathways
- Identification of biomarker
- Personalised therapy



The Path to Clinical Implementation from Translational Research



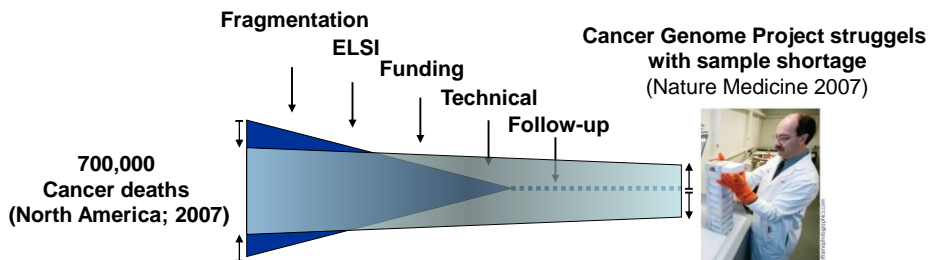
- ▶▶ **Analytical validity** - Technical feasibility and optimization – does the test measure what we say?
- ▶▶ **Clinical validity** – Diagnostic accuracy - does the test measure a value associated with a clinical condition?
 - Sensitivity (false negatives)
 - Specificity (false positives)
- ▶▶ **Clinical utility**
 - will the test improve making a healthcare decision?
 - Will the test be cost effective?



Biobanks in Medical Research



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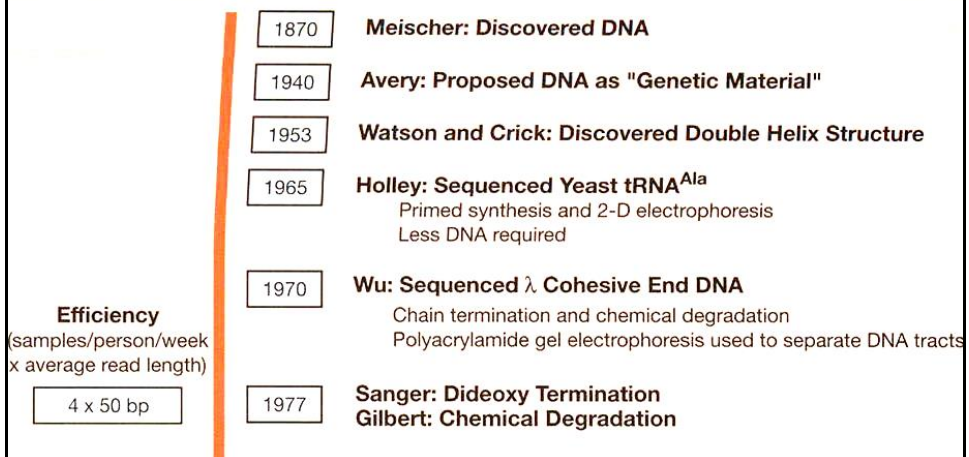
- NCI: Biological samples are #1 roadblock
- OECD: Global Biological Resource Centre Network
- WHO/IARC: Standards for biological resource centres
- ESF: Science Policy Briefing: Need for integration
- EU/ESFRI: Research infrastructure for Biobanks and Biomolecular Resources (BBMRI)



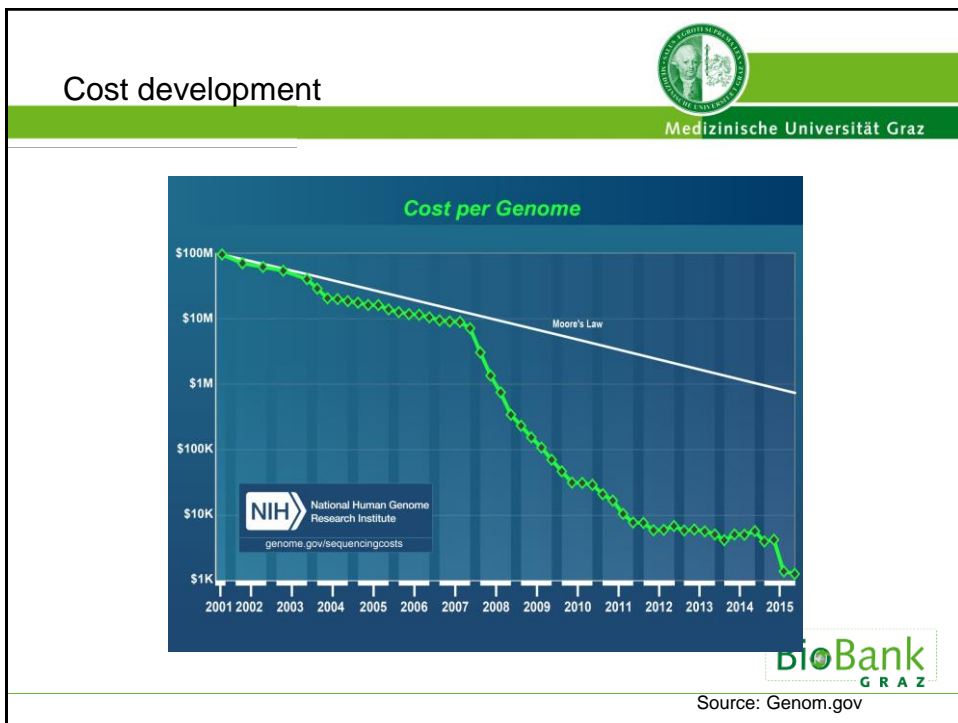
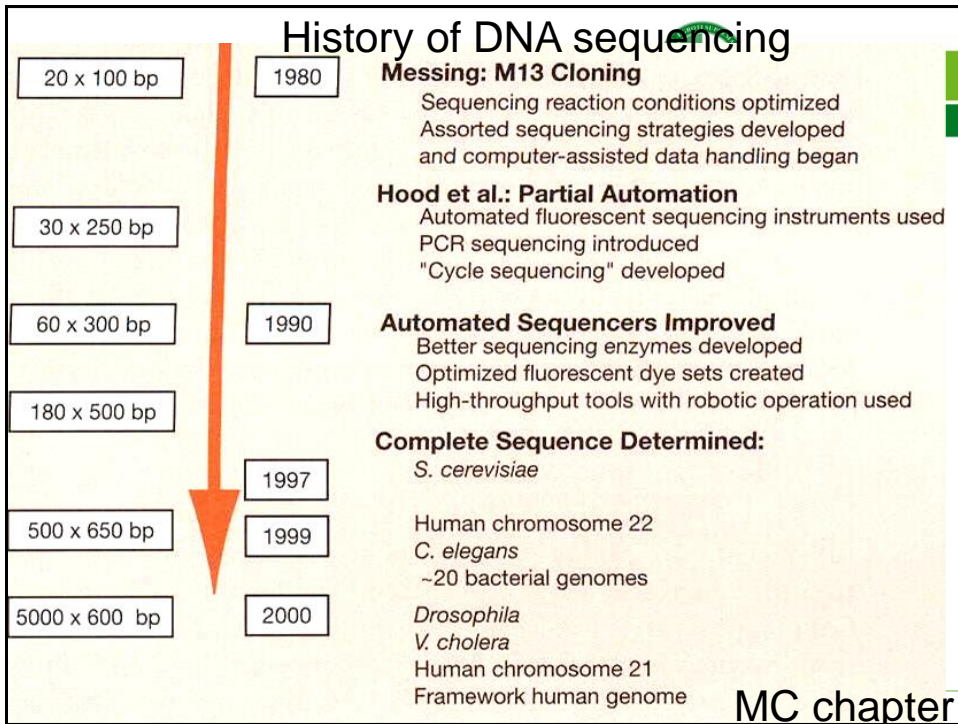
History of DNA sequencing



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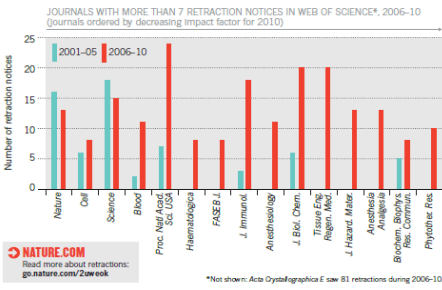
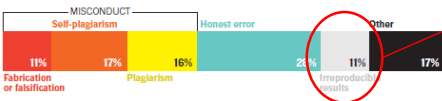
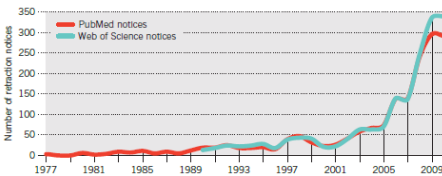


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RISE OF THE RETRACTIONS

In the past decade, the number of retraction notices has shot up 10-fold (top), even as the literature has expanded by only 44%. It is likely that only about half of all retractions are for researcher misconduct (middle). Higher-impact journals have logged more retraction notices over the past decade, but much of the increase during 2006–10 came from lower-impact journals (bottom).



NATURE.COM
Read more about retractions:
go.nature.com/2iweek

*Not shown: *Acta Otolaryngologica* & saw 81 retractions during 2006-10.



Pre-analytic Variables and their Effect on Science

More than 10% of those publications that have been retracted have presented irreproducible results.

Biomarker publications (PubMed): 2014: 44,574

How many of those with irreproducible results have not been retracted?

How many of those with irreproducible results are based on low quality samples?



Problems Arising from Today's Archives



Every year, around **seven billion samples** are tested in US laboratories alone. It is a critical part of the diagnostic process, contributing to 70% of all medical decisions that are made.

Alarming, it is estimated that up to **98,000 people die in US hospitals each year** from preventable medical errors, making misdiagnosis the 8th leading cause of death in the US, ahead of motor vehicle accidents, breast cancer and AIDS.

One of the most common and preventable causes leading to misdiagnosis comes from a surprisingly simple step in the process – the **labeling of tissue samples**.

Specimen tracking: Helping prevent misdiagnosis
Author: Mikko Rasanen, Leica Biosystems 01/2016

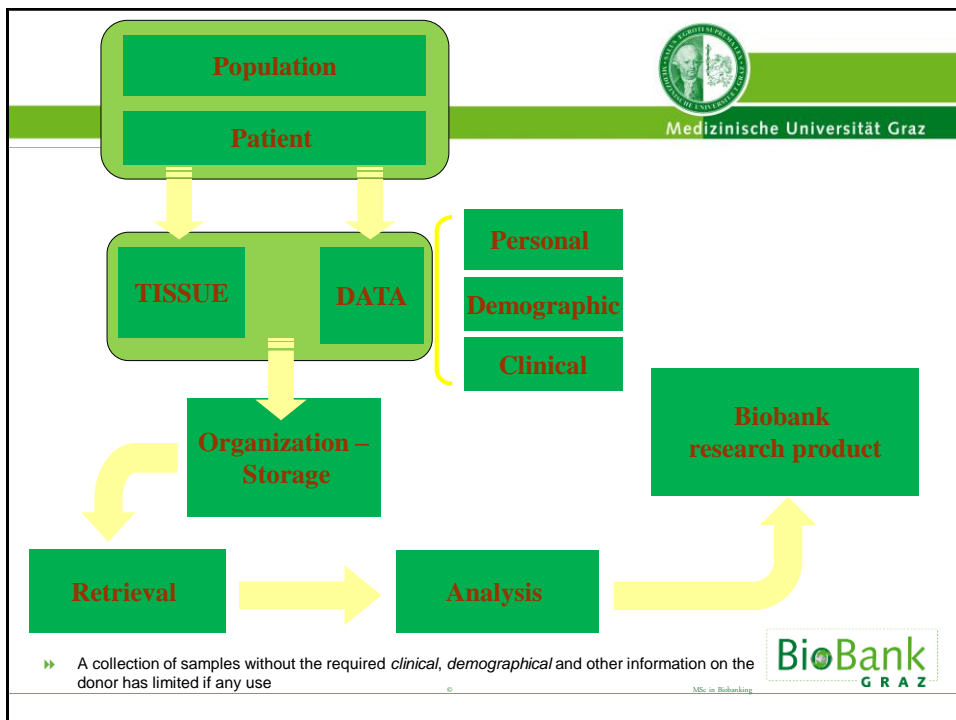
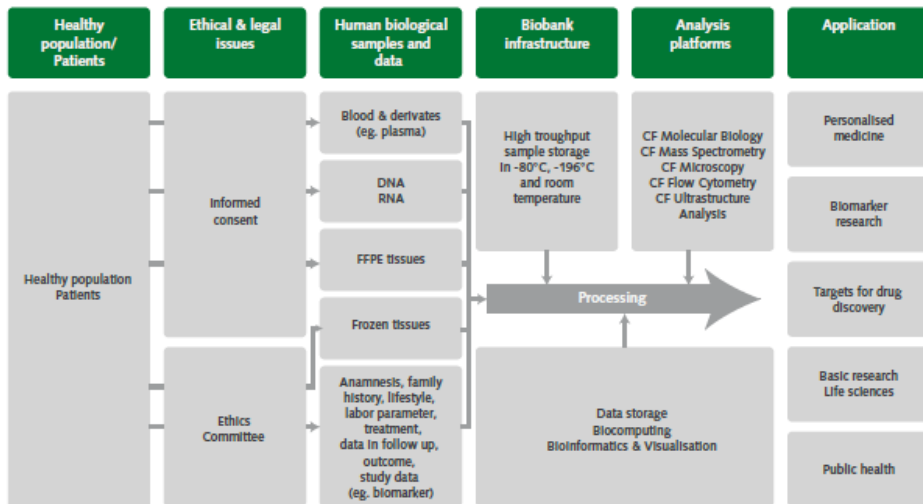


Key Components of a Biobank

Base Biobank Graz



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Change of Infrastructure



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Library at Monastery Melk, Austria

Past

Present



Library at the Free University Berlin, Germany

Future



SOCIEDAD DE BIBLIÓFILOS CHILENOS



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Biobank Graz: Labeling



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Cryo vials (-150°C)



Tubes for fluids (-80°C)



2D data matrix codes



FFPE blocks →

← Tissue slides (room temp.)



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PAST: Paraffin Sample Storage



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Manual Storage System



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PRESENT: Paraffin Sample Storage



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Semi-Automated Storage System



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FUTURE: Paraffin Archive, Outlook

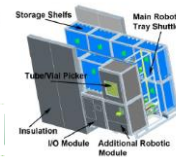
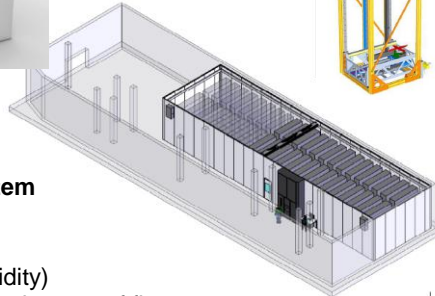


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Outlook to large new system

- (Semi-) Automated system
- Dry air system (<20% humidity)
- Integrated oxyreduct system in case of fire
- Capacity: >10 million paraffin blocks



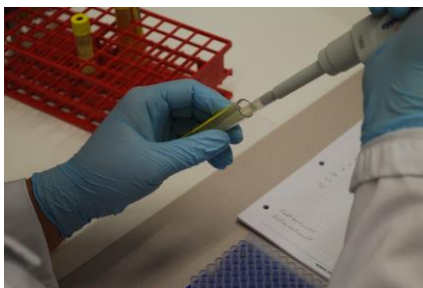
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PAST: Handling of Fluid Samples



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Manual Handling



manual pipetting
 ▶ hand written report files

Old robot

- ▶ simple pipetting robot
- ▶ hand written report files



- time between filling of primary tube and aliquoting
- accuracy of aliquoting
- errors in report files
- identification of stored tubes



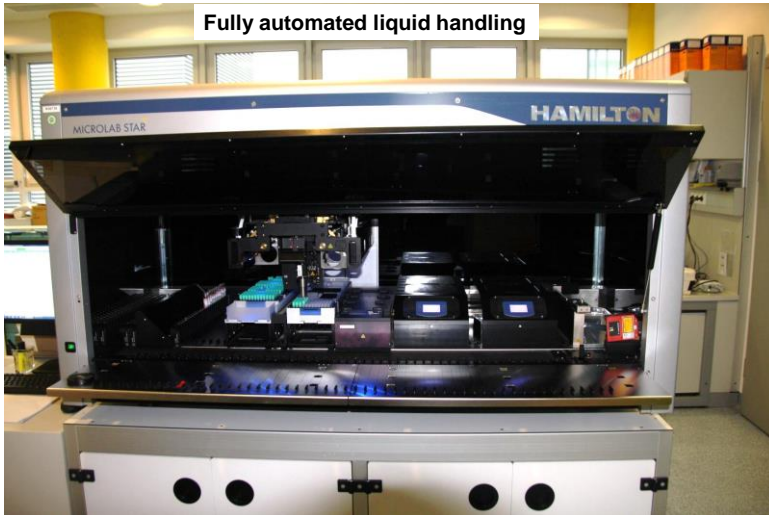
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PRESENT: Handling of Fluid Samples



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Fully automated liquid handling



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PAST: Liquid Storage at -80°C



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Storage in Manual Freezers



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PAST & PRESENT: Liquid Storage at -80°C



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- ▶ Fully automated storage system
- ▶ Capacity: 0.7 million tubes
- ▶ Scanning and storage of 1D and 2D barcoded tubes and racks
- ▶ Chaotic storage



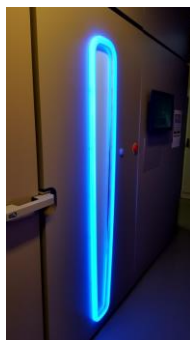
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PRESENT & FUTURE: Liquid Storage at -80°C



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- ▶ -80°C fully automated storage system
- ▶ Storage of tubes at -80°C
- ▶ Single tube picking at -80°C



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32

Cryo-Storage in Liquid N₂



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Past and Present



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Biobank Graz: Features



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- ▶▶ Europe's largest clinical biobank
- ▶▶ Central service facility of Medical University of Graz
 - ▶ Not based at a clinic or institute
 - ▶ Directly linked to Vice Rector of Research
- ▶▶ Collection work processes are embedded into the clinical routine system of University Hospital Graz

- ▶▶ About 20 million samples from 1.2 million donors
 - ▶ FFPE blocks and slides at RT (6 mill + 13 mill)
 - ▶ Body fluids at -80°C (1.5 mill)
 - ▶ Cryo tissue samples in vapor phase of liquid N₂ (-150°C) (0.1 mill)

- ▶▶ Collection of FFPE samples since 1984 (33 years)
- ▶▶ Collection of oncological serum samples since 1992 (25 years)
 - ▶ Both with longitudinal clinical data



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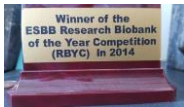
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Biobank Graz: Features



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- » Certified according to ISO 9001:2008
- » Broad informed consent (open for biomedical research academic and non-academic research institutions)
- » **“Research Biobank of the Year” 2014**
- » **“Best European Academic Biobank” 2016**
in the “International Life Sciences Awards 2016”
- » **“Most Outstanding Academic Biobank” 2016**
in the “Healthcare & Life Sciences Awards 2016”



International Life Sciences Awards
2016
Best European Academic Biobank

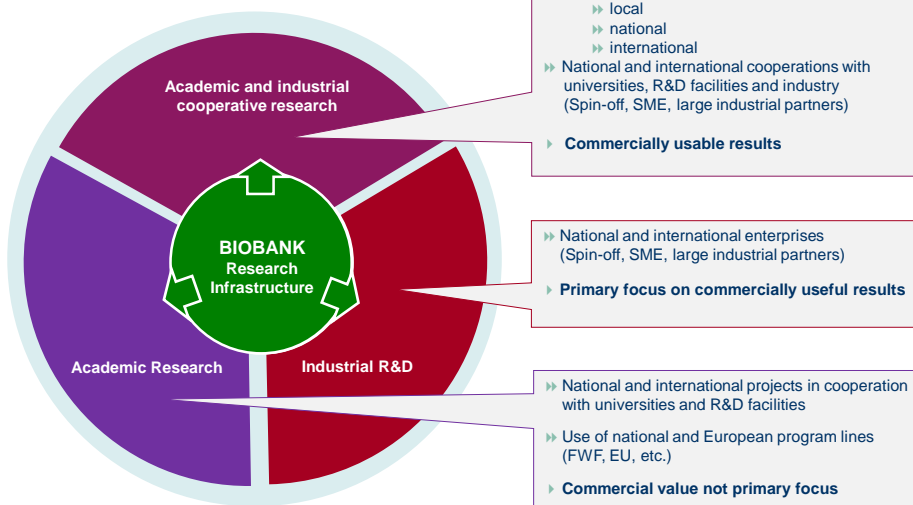


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Biobank Graz: Project Service

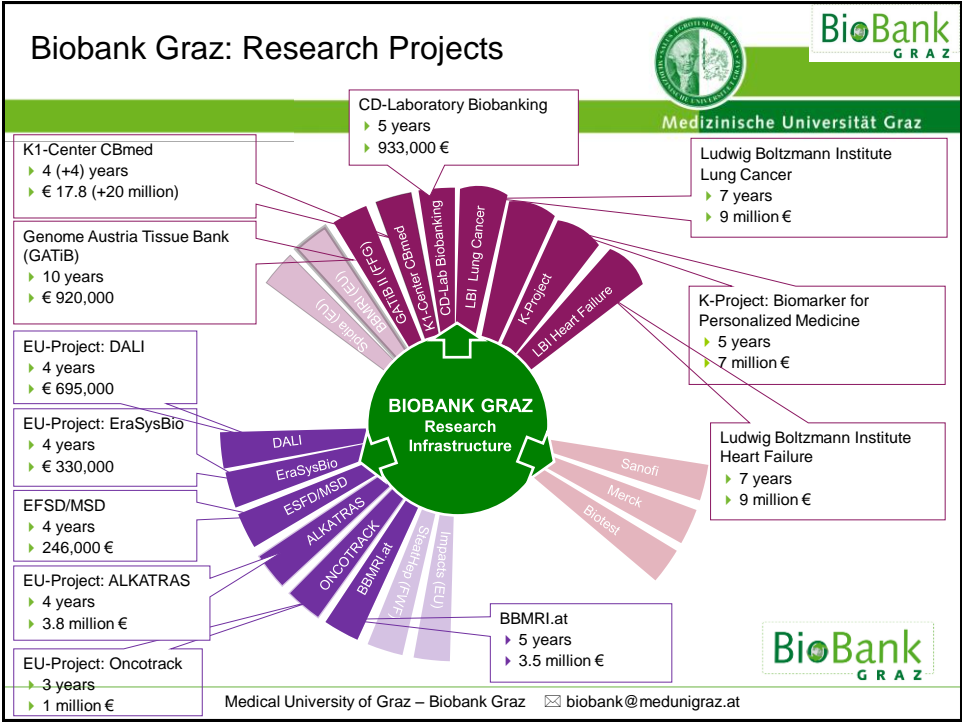


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Focus in Different Stages of Biobanking



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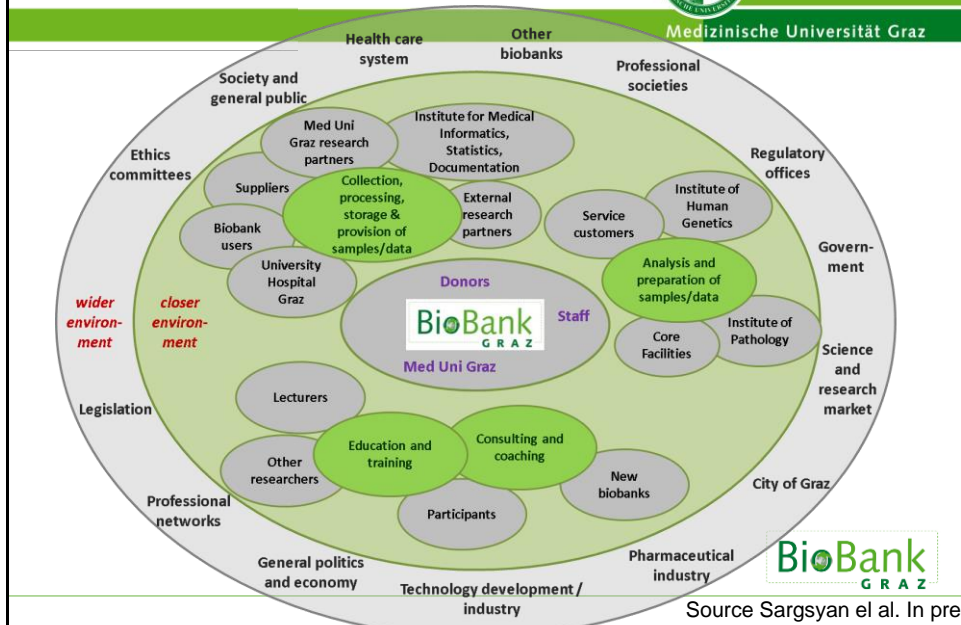
	Biobanking 1.0	Biobanking 2.0	Biobanking 3.0
Main Focus	Quantity	Quality	External Stakeholders
Number of Biospecimens	+++++	+++	++
Person Related Data	++	+++	++++
Biospecimen Data	+	+++++	++++
Stakeholder's Needs	+	+	+++++
Sustainability	+	+	+++++



Stakeholder Analysis



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Service and role of biobanks – biotechnology – DALI



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Diabetes and Pregnancy Vitamin D And Lifestyle Intervention for Gestational Diabetes Mellitus Prevention

- Diabetes mellitus during pregnancy is a very serious disease with dire consequences for both mother and baby. As a result, babies can be born with growth disturbances, breathing problems or low blood sugar. In the long run, diabetes mellitus during pregnancy - also called Gestational Diabetes Mellitus (GDM) - constitutes insofar a problem for mother and baby as it might lead to overweight (obesity) and diabetes in the future. Due to the lack of typical symptoms and Europe-wide standards in diagnosis and treatment it is very difficult to diagnose GDM. The number of affected people rises constantly; in some countries, almost 20% of pregnant women have GDM.
- The EU-project DALI is the framework for 13 partners from 11 countries to cooperate in a Europe-wide and large-scale study with the aim to develop effective preventive measures for GDM.
- During the next four and a half years, DALI will investigate the actual spreading of the disease by using standardized diagnostic methods. Furthermore, possible preventive measures will be tested.
- <http://www.dali-project.eu/>



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Misc in Biobanking

40

Service and role of biobanks – biotechnology - DALI



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Blood and cryo sample logistics



MSc in Biobanking

41

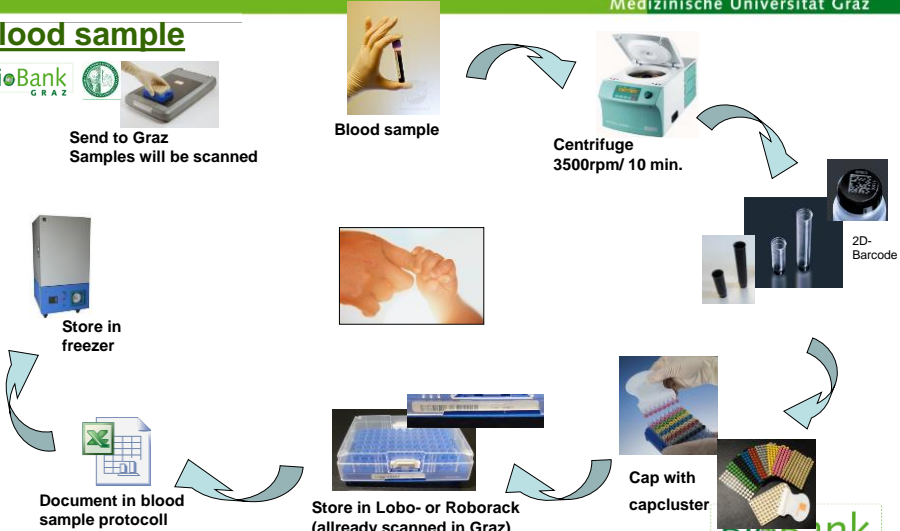
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Service and role of biobanks – biotechnology – DALI



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Blood sample



MSc in Biobanking

42

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Service and role of biobanks – biotechnology – EXAMPLE DALI



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Example for blood sample protocol

RackBarcode	Y	Z	request number	blood sample ID	material	sender	patient ID	date of blood collection
x	1	A	50000084-04	123456789	Serum	Gynäkologie Graz	2010009	15.03.2010
x	1	B						
x	1	C						
x	1	D						
x	1	E						
x	1	F						
x	1	G						
x	1	H						



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MSc in Biobanking

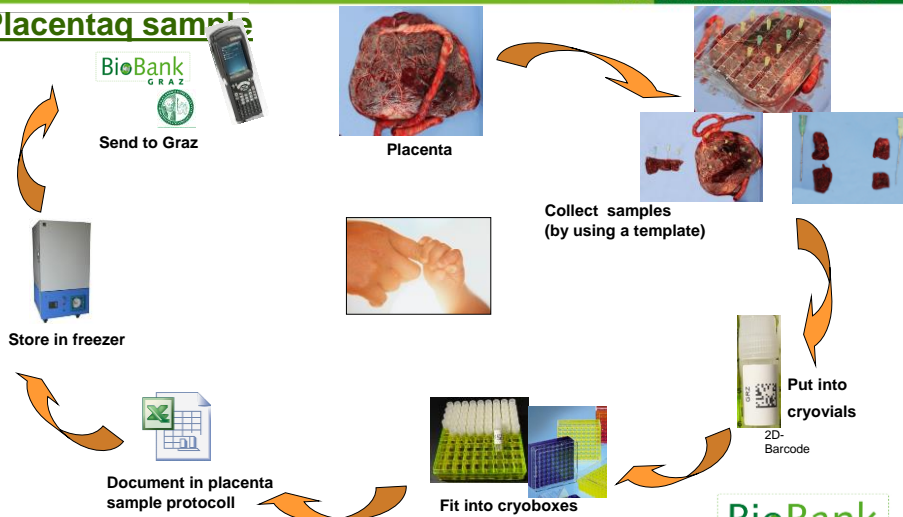
43

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Placenta sample



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44

