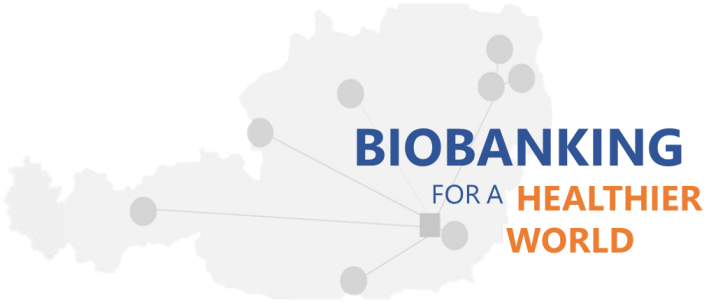

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LEARNINGS FROM THE GREEN BIOBANKING SURVEY OF BBMRI.AT BIOBANKS

SABRINA KRAL

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BBMRI.AT BIOBANKS

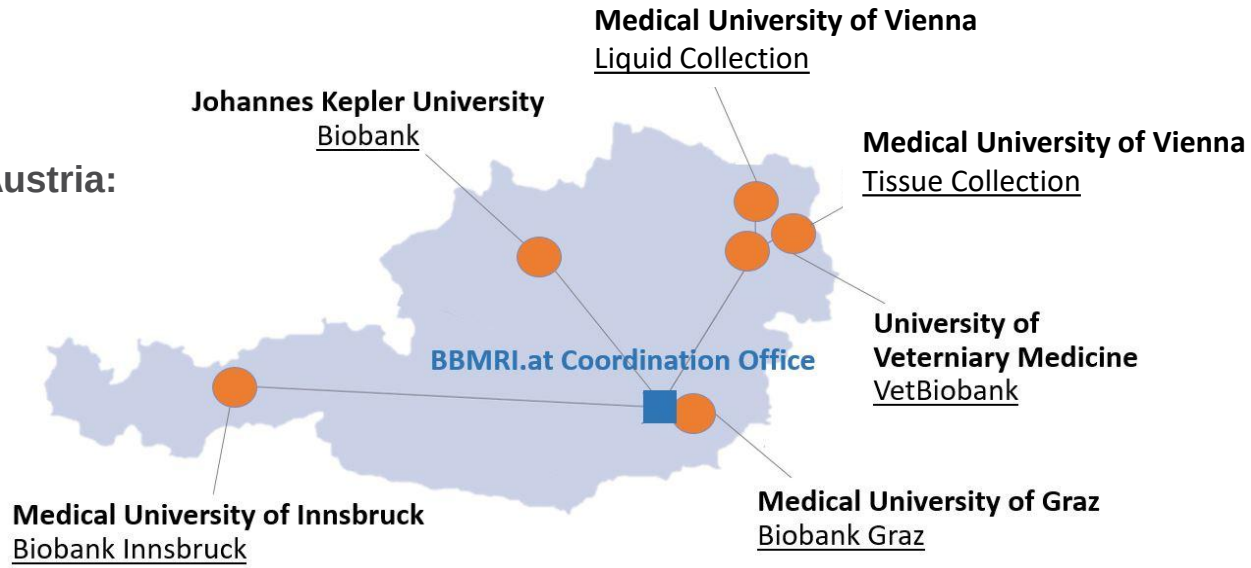
ALL BBMRI.AT PARTNER BIOBANKS PARTICIPATED IN THE GREEN BIOBANKING SURVEY

1 animal biobank located at University of Veterinary Medicine Vienna:

- VetBiobank (Domestic and wildlife)

5 human biobanks located at Medical Universities all over Austria:

- Projekt Zentrale Biobank Innsbruck
- Biobank Linz
- Med Uni Wien Biobank KIP (Tissue Collections)
- Med Uni Wien Biobank (Liquid Collections)
- Biobank Graz of the Medical University of Graz



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BBMRI.AT BIOBANKS

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AUSTRIAN BIOBANKING LANDSCAPE

BBMRI.at partner biobanks are in charge of:

- Sample processing of different types of liquid and tissue samples including e.g. PBMC, DNA, fresh frozen tissue, FFPE tissue
- Sample storage
- Provision of specimens and data for research
- Maintainance of biobanking infrastructure e.g.
  - Freezers and automated storage systems
  - Cryotanks
  - Pipetting robots
  - Lab equipment

Each Biobank contains multiple defined collections

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BBMRI.AT BIOBANKS DEEP DIVE

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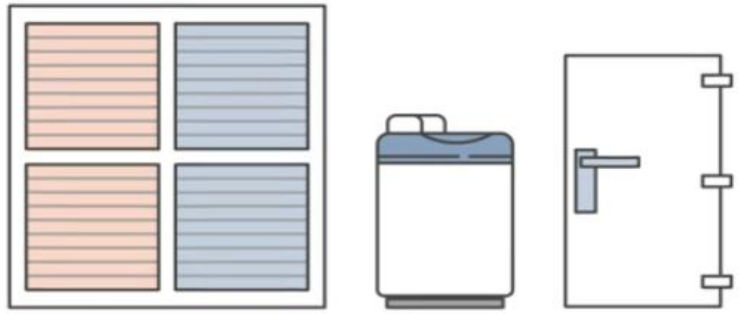
- Evaluation of BBMRI-ERIC survey (Austrian part) was performed, but some content was unclear for a detailed evaluation
- We have involved Austrian Biobanks
  - Unclear responses have been resolved
- Following Questions have been raised additionally to get a fundamental understanding of the current biobanking infrastructure in Austria:
  - Equipment for samples processing (Type and Quantity)
  - Equipment for sample storage (Type and Quantity)
  - Automated storage systems (Type and Quantity)
  - Floor space (in m_2)
  - Staff (in FTE)
  - Independence of biobank regarding choices on, e.g., resources (electricity, water) and waste management



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RESULTS - CURRENT ENVIRONMENTAL PRACTICES

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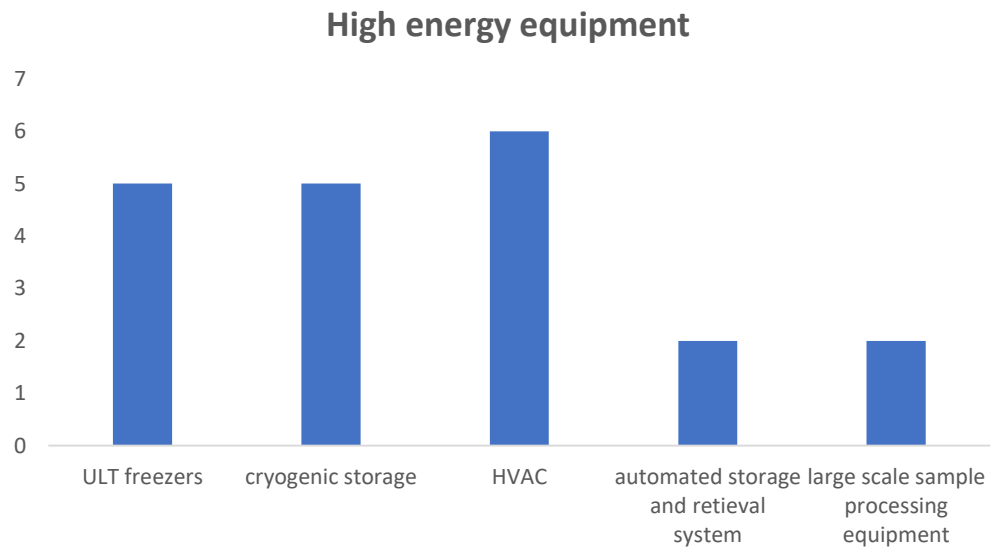
A.) ENERGY SOURCES AND TECHNOLOGY

BBMRI.at partner biobanks reported to use the following high-energy consumption equipment:

- Cryogenic storage (5)
- HVAC (Heating, Ventilation, and Air Conditioning) (6)
- ULT freezers (5)
- Large scale sample processing equipment (2)
- Automated or semi-automated storage and retrieval systems (2)



Most biobanks don't know if their equipment is energy efficient

Misconception about resource demand of cryo tanks: Low electricity demand but LN_2 production is very energy intensive

The lower the temperature of a freezer or cryo storage system → the higher is the energy and resource demand (no matter how the system is cooled!)

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RESULTS - CURRENT ENVIRONMENTAL PRACTICES

BBMRI.at
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A.) ENERGY SOURCES AND TECHNOLOGY

- All biobanks receive their electricity via the universities and are not able to choose a provider on their own.
- 5 biobanks receive an electricity mix derived from fossil energy and renewable resources such as solar, wind energy, hydro energy, geothermics and heat pump
- 1 university is equipped with own solar panels
- 1 university purchases UZ46 certified green electricity

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B.) WATER CONSERVATION

- No measures are implemented to manage water usage → biobanks are located at universities and are no independent biobanks
- Water consumption is not measured separately
- No biobank has a recycling or rainwater harvesting system in place

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RESULTS - CURRENT ENVIRONMENTAL PRACTICES

BBMRI.at
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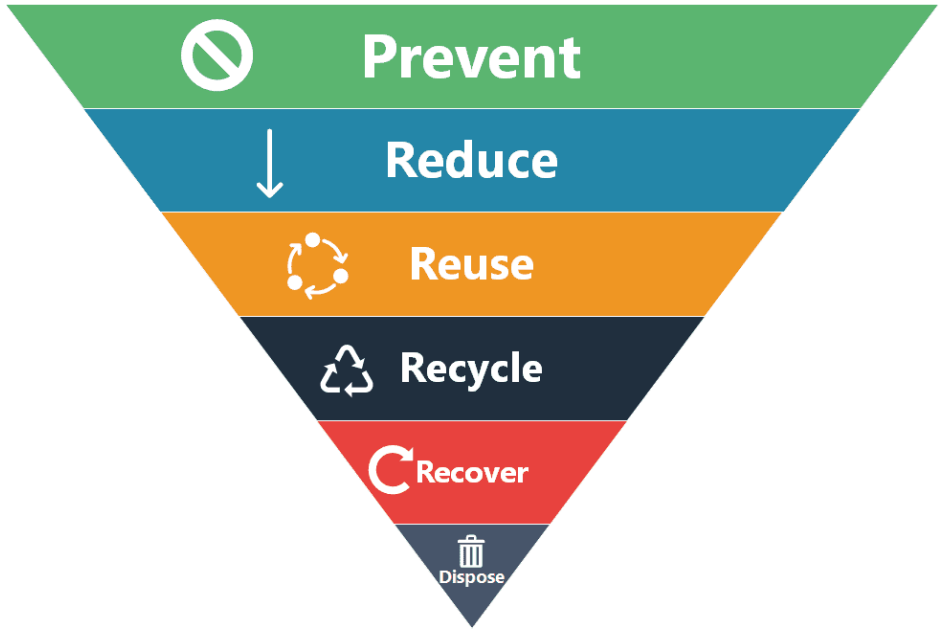
C.) WASTE MANAGEMENT

- 4 biobanks have no significant problems with hazardous waste
- 2 biobanks mention the high number of primary tubes as a challenge
- No new solutions for improving hazardous waste management are planned at the BBMRI.at biobanks.
- Most biobanks have not yet considered methods to reduce non-hazardous waste within their operations.
- Some examples to reduce waste:
  - Using digital systems to reduce paper waste
  - Reusing materials like boxes for sample shipments



https://axil-is.com/blogs-articles/waste-management-hierarchy/

Regulations governing the disposal of infectious materials are very strict (incineration / autoclaving of hazardous waste)

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RESULTS - CURRENT ENVIRONMENTAL PRACTICES

BBMRI.at
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3 BBMRI.at biobanks reuse materials:

- Tissues from animal experiments
- Sharing of unused equipment for (secondary) use via e.g. the equipment pool of the university
- Reusing materials like boxes for sample shipments

Recycling Programs

- All BBMRI.at biobanks have a general waste management concept and separate waste according to Austrian waste separation law. (paper, plastics & metal, glass, organic waste)
- 2 biobanks are part of additional recycling programmes that are supported by companies or lab ware providers.

Data Management to reduce carbon footprint

- So far no measures in place

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RESULTS - SUSTAINABLE BIOBANKING: CHALLENGES

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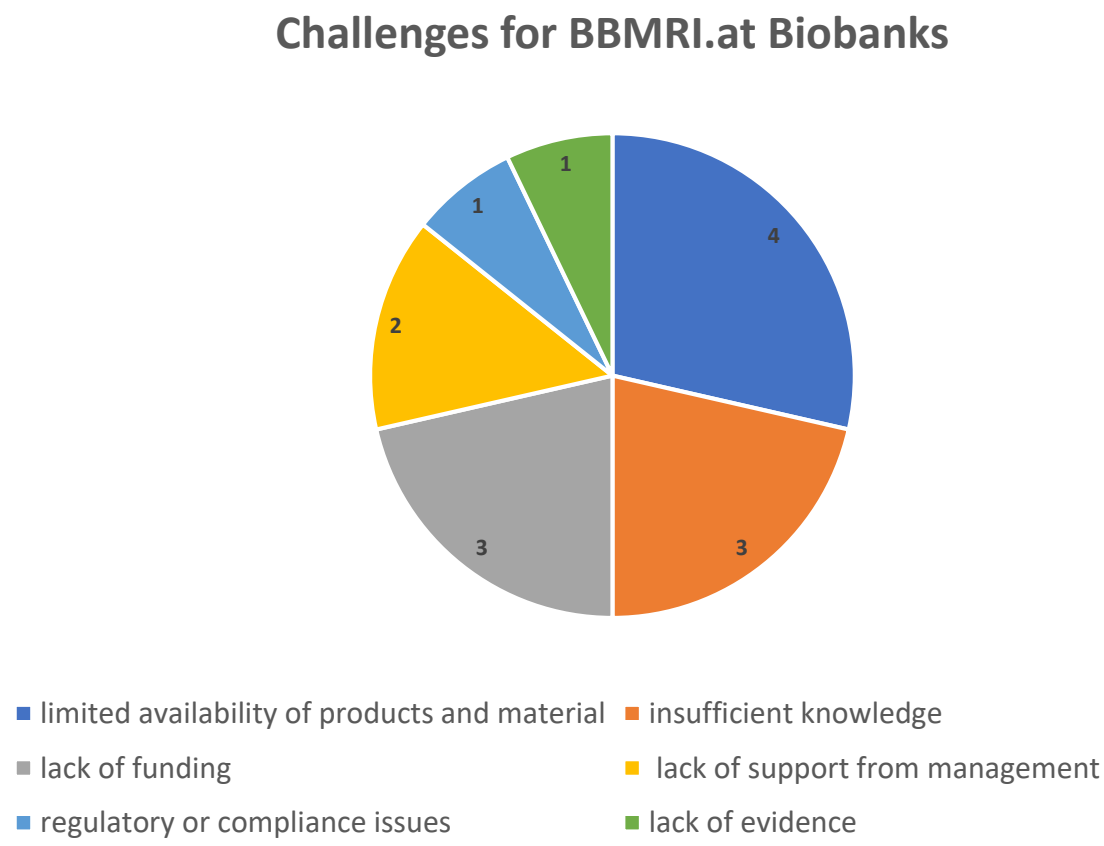
AUSTRIAN BIOBANKS ARE FACING THE FOLLOWING CHALLENGES IN IMPLEMENTING GREEN PRACTICES



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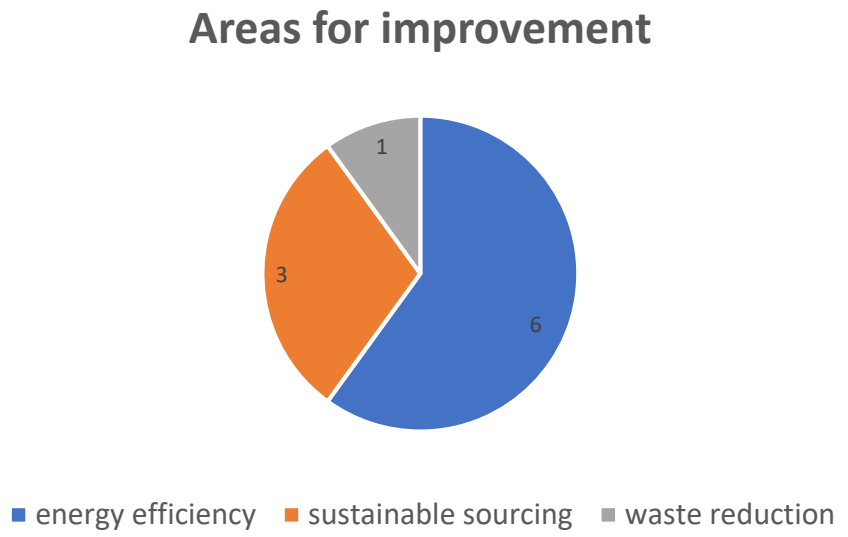
RESULTS - PERSPECTIVES AND ATTITUDES

- BBMRI.at partner biobanks generally view environmental sustainability as neutral in relation to their mission and operations, though two biobanks consider it somewhat important.

- All BBMRI.at partner biobanks mentioned energy efficiency as the most interesting area for improvement, followed by sustainable sourcing (3) and waste reduction (1).



- For most BBMRI.at partner biobanks, it is unclear whether they will invest in green technologies or practices in the near future. Two biobanks have stated that they do not plan to invest.

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RESULTS

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Industry collaboration and best practices

- 1 BBMRI.at partner biobanks is currently collaborating with an industry partners to implement green biobanking practices.

Staff training and awareness

- Except for one biobank that provides information on basic procedures, no biobank offers training on environmental sustainability practices to its staff.

Community Engagement

- 1 biobank currently engages with the local biobanks/community on environmental or sustainability initiatives, and started raising awareness about green biobanking within the broader community (EBW2025).

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RESULTS – FUTURE DIRECTIONS AND SUPPORT

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THE FOLLOWING RESOURCES WOULD ASSIST THE AUSTRIAN BIOBANKS IN TRANSITIONING TO MORE SUSTAINABLE PRACTICES:

- Dedicated funding and staff resources
- Regulatory guidance (e.g. can samples be stored at -70°C instead in -80°C ULT freezer)
- Implementation of sustainable energy and supply practices of the superior organisation (hospital/university)
- Personnel and equipment to perform evaluation studies (e.g. storage at higher temperatures)
- Guidelines for optimized storage

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LEARNINGS OF THE AUSTRIAN SURVEY

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- A lack of knowledge and understanding about equipment energy efficiency presents a key barrier to optimize performance and reducing energy
- The lack of implemented water management measures (e.g. recycling or rainwater harvesting system) represents a gap in resource efficiency
- BBMRI.at biobanks see also a main difficulty in the limited supply of sustainable products and materials
- Reuse is an established practice in biobanks

Possible measures to **Increase awareness**:

→ Provide clear information on basic topics

→ Increase visibility of resource use

→ Encourage practical everyday actions

→ Train staff with relevant context

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CONCLUSION OF THE AUSTRIAN SURVEY

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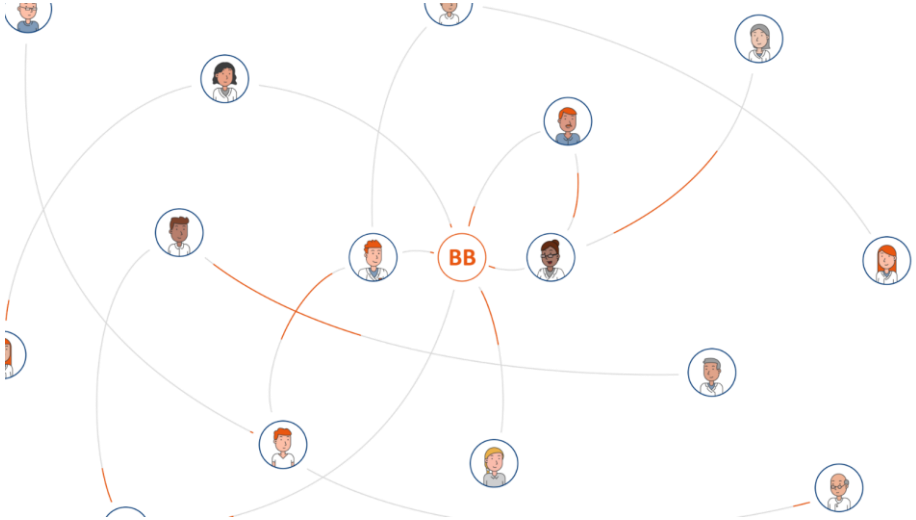
THANKS TO THE DEEP DIVE WE HAVE RECEIVED A FUNDAMENTAL OVERVIEW OF

- the sustainability landscape of BBMRI.at partner biobanks
- the awareness regarding certain subtopics like waste management, water and resource usage, future planning etc.
  - Water, Energy: dependency of superior organizations (=universities)

Moreover we have:

- Exchanged ideas and experiences
- Discussed blackout concepts
- Networked with local experts at the different facilities in Austria



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