The Hub for Co-operative Medical Research
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Biobanking: the future

Biobanks are collections of biological samples and their associated clinical data, organised in a structured, readily analysable format. Academic biobanks for medical research typically contain tissue samples, blood and other body fluids, as well as cells and DNA samples of human origin. As research data from these samples can be linked with data from medical records, environmental exposure, lifestyle information and other medically relevant information, biobanks are considered invaluable resources for medical research.

The core asset of Biobank Graz (www.meduni-graz.at/biobank/) is a large collection of clinical samples – actually one of the largest in Europe – comprising millions of well-organised formalin-fixed, paraffin-embedded (FFPE) tissue blocks as well as blood and cryo samples.

Biobank Graz provides powerful logistics and automated infrastructure enabling prospective collection of samples and data designed according to the needs specified by scientists.

To aid in the analysis of samples, Biobank Graz is directly linked to cutting edge technologies and sustainable high quality research services, housed in centralised core facilities operated by experienced technical and scientific staff at the Centre of Medical Research (ZMF) of the Medical University of Graz. It is the mission of Biobank Graz to efficiently support the partners at all steps of the research co-operation.

Biobank Graz is a publicly-owned non-profit organisation that is ISO 9001:2008 certified and supported by public funds. It is committed to handling the available biological material in a responsible manner protecting the personal rights and privacy of sample donors. Biobank Graz considers itself as a research partner and not a simple sample provider. It is the goal of Biobank Graz to provide answers to customers’ questions by combining:

- The well-established clinical experience of the University Hospital 
  -> Clinical expertise
- The unique technology platforms at the ZMF
  -> Technology advantages
- The largest biobank in Europe (Biobank Graz)
  -> Service advantages

Biobank Graz lays the foundation for medical research and development of new therapies by providing biological material and the respective, anonymised data. This enables a faster and target-oriented development of new and better diagnostics and therapies for a variety of syndromes and disease types. The public has a clear understanding of the importance of research and the role of biobanks in advancing medical knowledge and treatments.

Advanced and sustained healthcare for the general population

One of the central medical and health policy challenges of the next decades is the treatment of diseases adjusted to the needs and requirements of patients and the economy. Biobank Graz lays the foundation for medical research and development of new therapies by providing biological material and the respective, anonymised data. This enables a faster and target-oriented development of new and better diagnostics and therapies for a variety of syndromes and disease types. The public has a clear understanding of the importance of research and the role of biobanks in advancing medical knowledge and treatments.
vested interest in these operational capabilities and new options provided by biobanks since every person (sick or not) can potentially profit from medical progress. Due to the high number of samples, as well as clinical data available even on a single person level, biobanking is the main driving force to replace generalised medicine by personalised and stratified medicine. The medical innovations that will develop through the new concept of Biobank Graz can revolutionise the handling of human health and disease. Thus, Biobank Graz will considerably contribute to the long-term financing and distributive justice of the health system.

Sample collections for personalised treatment strategies

Currently, Biobank Graz has more than five million samples in storage that represent a double-tracked collection strategy. At LKH University Hospital Graz, samples from selected patients and donors who have agreed and signed an informed consent form are deposited in Biobank Graz. Based on its collection strategy, Biobank Graz houses two groups of samples:

- **A non-selected, cross sectional biobank**, including essentially all pathological samples and clinical data from the population of the Austrian state of Styria. These samples of a non-selected patient group characteristic of central Europe have been collected and stored over the last 30 years;

- **A disease-focused clinical biobank**, providing different types of human biological samples of the highest quality and with detailed clinical follow-up data during the whole course of disease, including long-term observation for specifically selected diseases and targeted disease groups. Disease-focused collections are based on the major research interests of co-operating institutions. The strategic combination of both types of collections in Biobank Graz provides the ideal basis for epidemiological studies as well as allowing scientists to validate biomarkers for the identification of specific diseases and determine responses to treatment. Hence, samples can be used for testing and the validation of strategies for personalised monitoring and treatment.

Automation and high sample quality

As a key resource Biobank Graz contributes to biomedical research both at the national and international levels. As life science is developing rapidly, biobanks are constantly restructured to adapt to changes of standards and to secure the highest quality for new technological achievements in bioscience in pre-analytics. Furthermore, highly sophisticated research analyses such as proteomics, metabolomics, lipidomics, and others, force biobanks to constantly improve sample quality. Therefore, Biobank Graz has implemented automation of different working processes to be faster and more efficient, based on standard operating procedures (SOPs) according to ISO 9001:2008.

As an example, the handling of blood and body fluid samples has dramatically changed at Biobank Graz. In the past, the whole sample process was performed manually. Now, handling of fluid samples is based on a fully automated robot to improve sample, as well as data, quality. This robot automatically identifies and aliquots samples (blood, plasma, urine etc.), and immediately stores these aliquots at -20°C to minimise the time of processing of samples at room temperature.

To keep this high standard even for long-term storage, samples are transferred to a fully automated -80°C sample storage system.
Sample handling is performed at -20°C, avoiding freeze-thaw cycles of all samples. Due to its flexible height, the storage system offers a small footprint in combination with a high storage capacity.

Biobank Graz has also advanced the processing and storage of tissue samples. Samples used to be stored in common liquid nitrogen tanks, where handling is complicated and contains risks for the operator. Today, new semi-automated cryo-storage systems without interruption of the cold chain are being validated in the second phase to become the new standard at Biobank Graz. Similar trends are available for tissue samples stored at room temperature. Semi-automated storage systems for FFPE samples replace the time-consuming work processes of manual handling (incoming and outgoing) of FFPE tissue blocks in the daily routine.
Ethical and legal guidelines to guarantee donors’ privacy

The use of clinical data and samples from Biobank Graz is restricted to ethically and scientifically approved research. Before patients donate biological samples, a medical doctor explains the biobanking activities and for which purposes their samples will be used. To give acceptance for the usage of samples and/or clinical data, the patient has to sign a written informed consent, developed by Biobank Graz and approved by a local ethics committee. Only following this procedure can any sample and data from a patient be used for further scientific investigations. At the same time, the confidentiality of the donor is maintained and each research project needs approval from ethics committees to access samples from Biobank Graz. A data protection policy in accordance with current ethical and legal guidelines is top priority and mandatory for a certified biobank like Biobank Graz. A series of data protection measures prevent the association of information generated from a given sample with the respective sample donor. All samples are automatically encoded when data are entered into the biobank’s database and only a sample code is disclosed to researchers. Research data are stored separately from all sample-related clinical and personal information. Furthermore, an independent data trustee guarantees sample donor anonymity in the emerging field of sample use from Biobank Graz.

Co-operation and networking

Locally, Biobank Graz runs a variety of interdisciplinary co-operations with departments, clinics and institutes of the LKH University Hospital Graz, which assures the collection of large numbers of scientifically relevant samples and their clinical data on a high quality level. Many institutions of the Medical University of Graz are engaged in the activities of Biobank Graz, based on written co-operation agreements. Beside these local co-operations, Biobank Graz is an active and leading player in (inter-) national projects and activities aimed at improving interactions between and co-operation amongst biobanks and scientists. Co-ordination, consolidation and networking of existing European biobanks for the further development of biomedical science are central points for Biobank Graz. The development of biobanking networks is increasingly essential for enhancing the knowledge about health and disease and will have a major impact on healthcare planning, implementation strategies and further biomedical research.

The importance of the networking of biobanks has been emphasised repeatedly and there are several major biobank networking initiatives worldwide, including the European Biobanking and Biomolecular Resources Research Infrastructure (www.BBMRI.eu). As a next step, BBMRIil will become the European part of the OECD Global Biological Resource Centre Network (GBRCN). As one of the leading biobanks in Europe, Biobank Graz intends to set up an additional networking project comprising emerging biobanks around Central and East Europe (CEE). Biobank Graz will strengthen the CEE network to facilitate the consolidation of biobanking and scientific societies in CEE regarding biospecimen research.
Biobanking networks will generally provide access to larger amounts of different human samples to scientists all around the world and thus facilitate research and further contribute importantly to population health and social wellbeing. Larger numbers of rare archival materials of high research relevance will be provided and will enable comparison between different ethnicities and lifestyles. Furthermore, only in biobanking networks can high level standards of sample quality be agreed upon and subsequently implemented.

**Research services at Biobank Graz**

As a central service unit of the Medical University of Graz, Biobank Graz supports academic, industrial as well as co-operative research all over the world. In recent years, a large number of clinical projects and trials have been carried out using samples, data and/or the logistic services of Biobank Graz. Thus, Biobank Graz contributes to research results which are the basis for medical benefits for public community and the healthcare system.

**Service and Communication Center**

To improve the communication between scientists and Biobank Graz, the Service and Communication Center (SCC) was implemented. The SCC is a central information service centre for sending biobank-specific research questions to Biobank Graz. It serves as an interface to the customer and is established as a research hub. Hence, the SCC provides the co-ordination and centralisation of processes of a comprehensive one stop service. With access to in-house research facilities and institutions, Biobank Graz enables short routes and quick response to enquiries of customers and partners.

Biobank Graz, with its expertise in biobanking, is one of the unique clinical biological resource centres in Europe and our daily business is based on close co-operation of the following organisations:

- Institutes, departments and core facilities of the Medical University of Graz with their analytical and technological expertise; and
- Institutes, departments and research departments of the LKH University Hospital Graz with their well-established clinical expertise.

Based on this structure, Biobank Graz can provide the expertise using a single point of contact; the Service and Communication Center of Biobank Graz.
The objectives of the Service and Communication Center are:
- Provide a ‘gateway’ based on customer requests for sample-related research;
- Co-ordinate and centralise processes of customers and collaborative projects;
- Extensively ‘commercialise’ the service portfolio of Biobank Graz;
- Increase the number of large co-operative research projects (academic/industrial);
- Integrate Biobank Graz into large collaborative research projects;
- Strengthen data delivery oriented projects;
- Strengthen in-house networking: ‘Biobank Graz – Core Facilities – Institutes – Research Management’;
- Know-how transfer through consulting and training.
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