Summary of presentation and discussion on 5 main topics

Austrian Cohort Research Days

25. - 26. April 2023
Hotel Regina, Rooseveltplatz 15, A-1090 Wien

Aim of the Austrian Cohort Research Days

- Develop a concept for Austria, how to address the question of national cohorts (and harmonization of different cohort initiatives)
- Bring expertise together and develop synergies
- Draw the conclusions from this research days and define the next steps
- Address different ministries with a joint good proposal / concept (but also consider the public-private-partnership concept)

Generational/Family Cohort

Moderator: Maria Uhl, Thomas Waldhör

- **From research to biobanking - The unique informative value of the human placenta**
  C. GUNDACKER, *Med Uni Wien*

  The maternal-fetal interface placenta is an upstream organ of the fetus that takes over the functions of the lungs, liver, intestines, kidneys and glands of the fetus while these organs are not yet fully functional. Most pregnancy-associated diseases are caused by or related to placental dysfunction. The placenta can be studied in a variety of in-vitro and ex-vivo models that provide fundamental insights into the functions of the human organ. A variety of tissues and cells can be stored; some primary cell types also in the form of a 'living' biobank that can be retrospectively studied as well.

- **The Harvard Cohorts: Lessons learned,** E. SCHERNHAMMER, *Med Uni Wien*

  During her presentation, E. Schernhammer presented the US Nurses Health Studies, which were established in the 1970s and examined the long-term effect of nutrition, hormones, environment, and nurses' work-life on health and disease developmen. E. Schernhammer provided technical comments on the third wave of the study like storage of biomaterial and highlighted some significant findings related to coronary heart disease and depression.

Exogenous Factors in Cohorts

Moderators: Maria Uhl, Benedikt Warth

- **Investigation of Epigenetic Changes - possible cohort scenarios ,**
  M. WIDSCHWENDTER, Uni Innsbruck; HEAP

  Epigenetics is the study that shows how our environment and behaviors can cause changes that affect the way your genes work. Therefore, assessing genetic and environmental factors together in an integrated manner is essential for determining disease (incl. cancer) risk. Epigenetics provides an explanation as to how the environment, intrinsic factors such as hormones, the microbiome and ageing processes change the activity state of genes and how these changes can be passed on from one generation to the next ("transgenerational inheritance"). Correctly stored tissue samples are therefore highly relevant for enabling cancer research.

Previous biobanks based on cohorts have (i) essentially only archived blood, (ii) usually only collected one sample from a proband, (iii) documented little epidemiological (especially exposome and lifestyle) and phenotypic information, and (iv) collected or inadequately stored samples for epigenetic analyses and are therefore only of limited value for studying the influence of the environment via the epigenome on disease development.
Prospective cohorts should therefore include the following requirements:

(i) Self-sampling based (e.g., oral mucosa, vaginal swab, urine sediment)
(ii) Repetitive/Longitudinal
(iii) Inclusion of electronic digital data collection (lifestyle and exposome, e.g., toxins, nutrition, sleep behaviour, exercise, etc.)

Three specific cohorts could be discussed and implemented in Austria by considering the above requirements in order to cover the entire life span:

(I) In utero exposure ("Austrian Birth Cohort")
(II) Population cohort - Women ("Austrian's Women's Health Cohort")
(III) Population Age cohort ("Austrian Aging Cohort")

- **Human biomonitoring and health-related environmental research,**
  M. UHL, Umweltbundesamt, Human Biomonitoring Platform; PARC

  M Uhl introduced the role of the Environment Agency Austria in human biomonitoring, its mission to promote environmental health. These include the protection of human health through environmental legislation (e.g. air pollution control, Water Framework Directive ,etc.), the assessment of risks to human health and the environment from chemicals and biocides, the EU and WHO strategies on environment and health and the EU strategy on health in all policies: Austrian Health Goals: Health Goal 4: "Secure air, water, soil and all habitats for future generations", the health-related environmental monitoring within the State of the Environment Assessment/Report.
  Human Biomonitoring is one of the tasks of the Agency and includes the detection of chemicals and their degradation products in blood, urine, breast milk or other human material (hair, saliva, fingernails, tissues) within various studies, the establishment of reference values (statistically derived), the comparison with Human Biomonitoring values (e.g. Human Biomonitoring values of the German Human Biomonitoring Commission, serum concentrations corresponding to daily or weekly tolerable intake (TDI or TWI) values, Human Biomonitoring Guidance values, Biomonitoring Equivalents (BE), Derived No Effect Levelinternal (DNEL), the identification of exposure pathways/factors and their significance, the combination with effect biomarkers and the identification of adverse effects and their impact on health. Embedding HBM in epidemiological studies/cohorts would be extremely beneficial to identify the most important exogenous factors in terms of disease prevalence.
  The tasks of the Austrian Human Biomonitoring Platform an advisory body to the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology were explained, including reporting obligations to the National Council and participation in European research programs such as the Human Biomonitoring Initiative for Europe (HBM4EU) as well as the Partnership for the Assessment of the Risks from Chemicals as partner and coordinator at the national level.

Sample & Data Management: Quality Criteria & Legal Framework

Moderators: Luka Brcic, Georg Göbel

- **What is quality and how can biobanks contribute to improving it?**,
  H. HASLACHER, *Med Uni Wien, BBMRI.at*

  H Haslacher reminded that inappropriate quality of samples and/or the quality control is the major reason why diagnostic and research analysis results are not reproducible. Biobanks are responsible for providing and ensuring pre-analytical quality. Application of already existing international standards for pre-analytical sample quality (like from the standardization organizations ISO and CEN) give guidance on adequate pre-analytical handling and therefore adequate quality. BBMRI.at contributed to the development of these standards and BBMRI.at biobanks are committed to work according to them. It is very important to know what the planed usage of collected samples

is, because different examinations might require different approaches for collecting and preserving samples. For retrospective use of samples, it is necessary to know how samples were treated before archiving them in a biobank, in order to know which analysis can be performed, i.e. which "purpose" the samples are "fit for". Quality is also of the utmost importance for collected data accompanying samples. Many different parameters influence data quality. We need to know if the data are correct, current, reliable, who has collected data, how were data collected, are they confidential, is this kind of collection cost-effective, and many others.

- **European Health Data Space (Act) – Will everything be completely different (again) in research based on medical data?**
  Z. ŠKORJANC, *Uni Wien*

  Ziga Škorjanc presented the European Health Data Space (EHDS) and stressed both, the good and not so good aspects of this Act. EDHS aims to enable easier access to the huge amount of good data, even without the need for the Informed Consent from the patients. Through the designated authorities' approval it will be possible to have access to the anonymized, or, with adequate explanation why needed, to the pseudonymized data. The latter should be allowed for research purposes and training of Artificial Intelligence algorithms. It will also be possible to directly ask data-providers for the access to data, which, if turned down, will be possible to override through the regular procedure for the data access. He expects EDHS to be active and technically doable not before seven or more years.

Enabling Technologies: From Sample & Data Acquisition to Analysis and Reporting

Moderators: Lukas Wisgrill, Georg Göbel

- **New exposomic approaches for assessing and evaluating chemical exposure,**
  B. WARTH, Uni Wien, EIRENE/Exposome Austria

  Emerging global exposomics technologies are crucial for studying health and disease. Both untargeted and targeted liquid chromatography tandem mass spectrometry (LC-MS/MS) can reveal novel exposure-disease associations, as demonstrated by the identification of over 80 xenobiotics. The aim is to measure as many analytes as possible from diverse sample matrices in the future. Core facilities are required to offer these technologies to a wide audience, ensuring high-quality analysis and harmonization. Sample quality, particularly at parts-per-trillion exposure levels, is also vital, as are robust quality controls for level 1 identification. The Austrian EIRENE hub 'Exposome Austria' aims to provide this infrastructure both locally and internationally. Additionally, proper cohort planning and sample analysis strategies are essential for project success. Implementing high-quality standards, such as blank samples and longitudinal sampling designs, helps ensure the accuracy of identified associations.

- **Possible contribution to Austrian cohorts : Health data and cybersecurity,**
  K. ZATLOUKAL, Med Uni Graz, BBMRI.at

  Biobank samples and associated metadata are crucial, with hospital data being only part of the patient's history. Accessing complete patient data requires a secure and legally compliant environment, involving patient advocacy groups and fostering trust. Building a trusted health data environment necessitates new data access models, local trusted environments, and protection against cyberattacks, potentially utilizing encryption methods like fragmentiX. In addition to data security, comprehensive and legally compliant data is required, especially for AI technologies. Addressing big data storage and analysis challenges is essential for sharing and analyzing information, which requires significant resources and energy. Novel technologies must be developed to overcome these issues. BBMRI.at – the Austrian node of the European Biobanking Research Infrastructure aims to help resolve these future challenges. While many technological challenges have been solved, the infrastructure and legal requirements still need attention, especially for sampling material at home, biosensors, and healthcare apps into a trusted environment.

Industry needs and interests

Moderators: Helmuth Haslacher

- **Harnessing genomics to make healthcare systems sustainable: the present and future of predictive genomics,** F. FLORINDI, Thermo Fisher

  As the COVID-19 dust slowly settles, we are reminded of public health enemy number 1: The rising burden of non-communicable diseases. Existing effort to prevent NCDs are clearly not sufficient to wither the socio-economic perfect storm cause by ageing of our population paired with lowering fertility rate. A future where fewer and fewer taxpayers have to support the economic and human burden of a raising elderly population risks to be inequitable and unfair.
  Predictive genomics can help: solutions such as polygenic risk scores and pharmacogenomics reports can help decrease incidence of non-communicable diseases and adverse drug reactions, and more. What is the future of predictive genomics? What are the foundations on which predictive genomics is build? What are the risks and advantages of implementing predictive genomics?

- **Research collaboration: Success factors from an industry perspective**,
  F. MODLER, Pfizer Corporation Austria

  Florian Modler presented success factors for collaborations with industry. According to ChatGPT it "requires careful planning, clear communication, and an open and cooperative relationship between all parties." He further referred to a document published BBMRI.at partner Med Uni Graz in the context of the CORBEL EU Project1, which outlines the reasons for collaborations of academia and industry. Overall benefit is that a collaboration "allows firms and universities to tap into complementary skills of each other and thus potentially help with saving cost and enhancing research outcomes." Trust and good chemistry, quality and excellence, clear expectations from both sides, good organization with defined roles and responsibilities as well as a robust but flexible legal framework are major characteristics of a well-functioning public private partnership. Important for both sides is to stay in dialogue with each other to gain a better understanding of each other's thematic interests, cultures and requirements.

[1] Abuja et al. EATRIS-ERIC / CORBEL Academia - Industry Collaboration Best Practices Guide. https://eatris.eu)