Modern Biobanks

Part 1: An Indispensable Resource in Biomedical Research

There is no such thing as a universal cure for cancer. For major molecular differences exist between different cancers as well as within each individual type of cancer. This is where so-called precision medicine comes in: individual tumor-associated changes in the respective patient serve as therapeutic targets - with growing success in an ever larger number of cancers [1]. Scientists are also conducting high-throughput genomic studies among healthy individuals to identify risk factors that increase the likelihood of an outbreak of disease. In such cases, preventive measures can protect against the disease’s development or increase the chances of successful treatment in the early stages of the disease. Biobanks are becoming increasingly important for the research to generate new findings in the field of precision medicine and develop innovative diagnostics [2].

What Are Biobanks?

Biobanks collect, process and store blood, tissue and other bodily materials, and make these (along with medical information on the donor) available for medical research under clearly defined legal and ethical conditions. Modern biobanks have little in common with the “deep-freeze warehouses” of times past. Nowadays, most university hospitals in Germany have a centralized biobank that operates to the highest scientific standards. These biobanks compile almost all of a hospital’s relevant biomaterial collections in one place. Only institutions meeting the high quality demands of biomaterials and the related clinical and personal data can be successful partners in biomedical research in the long term. For the biosamples’ quality is decisive to the reproducibility of research results [3].

Natural Killer Cells to Combat Cancer - Using Biobanks for Research

There are many examples of how the biobanks’ work successfully supports the development of precision medicine. The following example from cancer research can be applied to countless other diseases. Heidelberg University Hospital has been conducting research into cancer medicine
for many years now. This includes “natural killer cells”, which are able to kill tumor cells within a matter of minutes.

The biobank at the National Center for Tumor Diseases (NCT) in Heidelberg plays a key role in this research as it provides suitable, quality-assured tissue that contains sufficient quantities of cancer cells. In the search for an effective means to combat cancer, the protein HMGB1 was discovered in natural killer cells. This protein paralyzes a mechanism of energy production that is generally used by tumor cells (but not by healthy body cells). The protein interrupts an important metabolic pathway that tumor cells use to break down glucose and turn it into energy, and can therefore be used as a new active substance to combat cancer [4].

Networks in Germany

Successful examples such as this show how biobanks play a decisive role in the advancement of medicine and science. Hence the Federal Ministry of Education and Research (BMBF) has supported the establishment and networking of biobanks at German university hospitals in recent years. In 2014, the German Biobank Node (GBN) [5] was set up as a national coordination office to pool expertise in biobanking in Germany and facilitate networking between biobanks. Under the GBN umbrella, eleven BMBF-funded biobank sites and two IT development centres work together within the German Biobank Alliance (GBA) to facilitate access to the biomaterials available at different biobanks for (inter)national biomedical research. A preliminary version of an online tool enabling the search for biomaterials and data across all GBA biobanks is already available. The GBA biobanks are moreover harmonising standards for the collection, storage and analysis of samples and related data. The new ISO 20387 standard published in August 2018 sets benchmarks for quality management – as the first ISO standard specifically for biobanking. The biobanking working group of TMF e.V. (Technology, Methods, and Infrastructure for Networked Medical Research) provides a national exchange platform for biobanks [6].
Biobank networks will continue to grow in importance in the future, as sufficiently large sample sets of the according quality (including extensive data) can only be compiled for research projects through cooperation. This is particularly true in light of the rapid increase in the molecular subtyping of almost all diseases. Take lung cancer, for example, which was considered a single disease until just a few years ago. It can now be divided into numerous therapy-relevant molecular subtypes. Some of these subtypes include cancers that affect less than one percent of all patients and are therefore already considered rare diseases.

**BBMRI-ERIC: European Research Infrastructure**

The pan-European research infrastructure of national biobank networks BBMRI-ERIC (“Biobanking and Biomolecular Resources Research Infrastructure – European Research Infrastructure Consortium”) [7] supports access to biomaterials and data, develops tools to assure the quality of samples and data, and forms the interface to other European research infrastructures. On the European level, the German Biobank Node is tasked with representing German interests and shaping European cooperation within the framework of BBMRI-ERIC. Through GBN, the German biobanks are thus decisively involved in the development of European quality criteria, the discourse on ethical and legal framework conditions, and the establishment of a biobank IT network, which will in future also enable searches for biomaterials and their data across all European biobanks [8].

**The BBMRI-ERIC Directory: An Online Catalogue of Biobanks**

Central biobank catalogues are extremely helpful when it comes to increasing the visibility of biobanks and their collections. The directory offered by BBMRI-ERIC [9] has been developed continuously over the past few years and is now firmly established. It provides an overview of existing collections and facilitates the transfer of samples between biomedical facilities by means of software-supported communication between biobanks and enquiring researchers [10]. Such a register also creates transparency for patients and participants in clinical trials, and helps to boost their willingness to participate in trials [11].

**Outlook**

(Inter)national networking between biobanks makes it possible to provide researchers with extensive, multi-centre sample collections with clinical data. Worldwide, this will enable a considerable increase in knowledge and new therapeutic possibilities for a whole host of diseases.
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