Perspective

Clinical Biobanks, from the World to China

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The 2009 annual special issue of Time Magazine on March 23rd summarized the '10 Ideas Changing the World Right Now', in which 'Biobank' had been listed as the eighth. Biobank or biorepository has been developed since last century. Tissue banks represented the early type of clinical biobanks and mainly concentrated on clinical usage such as transplantation at the beginning. The first tissue bank in the United States started in 1949 is the United States Navy Tissue Bank. In 1976, the foundation of American Association of Tissue Banks (AATB) claimed the official show of biobanks on social stage (www.aatb.org). From the end of 20th Century to the beginning of 21st Century, diverse biobanks of clinical samples, seed banks, gene banks, germplasm banks of non-human species and other various types have sprung up. Accompanying with the speeding of entity storage, virtual banks or repositories as the information integration centers have gradually grown up. As biological resource centres (BRC), these biobanks or biorepositories coincide with the protection of biodiversity and the strategy of sustainable development. Organisation for Ecomnomic Co-operation and Development (OECD) commented that BRCs were essential for 'underpinning the future of life sciences and biotechnology'[1]. As the clinical BRCs, clinical biobanks have expanded their central role from clinical use to the usage for biomedical research. As the fundamental support of translational medicine, clinical biobanks have carried social expectation on discovering biomarkers, genetic expression profile, molecular basis of diseases, gene loci for drug sensitivity and new therapies based on large-scale samples and data[2-3].

Driven by this magnificent goal, joint specimen banks of multiple sites and the network of information show the future tendency of biobank development. In America, Biorepositories and Biospecimen Research Branch Office in National Cancer Institute started the Biospecimen Research Network (BRN) and the countywide Cancer Human Biobank (caHUB) program (biospecimens.cancer.gov). The famous MD Anderson Cancer Center runs its biorepository system on a federate basis, which is the collaboration and partnership with one central institution and twenty-six specific satellite biobanks[4]. Some developed counties including the United Kingdom[5-6], Iceland[7], Korea[8], Japan[9] have initiated national biobank projects. These projects aimed to combat serious and life-threatening diseases in national scope. In North Europe, the supranational Nordic biobank network program covered Finland, Iceland, Norway and Sweden and recruited transnational cohort of biobanks with over two-million cases and samples[10]. Furthermore, in 2011 after three-year preparatory working, the European continental-scale union as Biobanking and Biomolecular Resources Research Infrastructure (BBMRI) was matured (bbmri-eric.eu or bbmri.eu)[11]. These huge research communities expand the resources of specimens and information, promote the efficient usage and specimen quality via sharing network, and accelerate the advance of interdisciplinary biorepository science[3]. The development of biobanks simultaneously promoted the progress of the banking society. Founded in 1999, International Society for Biological and Environmental Repositories declared their interests focusing on diverse 'repositories of biological and environmental specimens' and related issuess (www.isber.org). Today, ISBER's 'Best Practices for Repositories' (the 3rd edition)[12] have become the most important reference standard for practical operation and the formulation of regulations in biobank domain, and ISBER's annual meeting has been known as the most professional forum in this area.

In China, biorepositories were started at the end of last century. A rapid bursting of clinical biobanks emerged in recent ten years, which has been greatly supported by Major Programs of National Natural

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Science Foundation and some territorial key programs in Chinese 'Eleventh' and 'Twelfth Five-Year' Plan. Most of the clinical specimen banks locate in developed areas. Many clinical biobanks started because of the high incidence of endemic diseases or the interests on specific diseases. For example, the Cixian Tumor Biorepository in Hebei Province aims at the regional high incidence of esophageal cancer[13]. Qidong in Jiangsu Province is a city bothered with high incidence of liver cancer for decades, therefore the foundation of the biobank for liver cancer was urged[14].

Large cities like Shanghai, Tianjin, and Beijing gather a number of clinical biobanks due to the high density of medical resources and research institutes, which promoted the formation of biobank network. The regional joint database enabling data communication in Shanghai is implemented by Shanghai Engineering Research Center of Biobank. It has united follow-up visiting results, medical information and specimen data from eighteen hospitals and institutions. The China Medicinal Biotechnology Association Biobank Branch is also located in Shanghai. The speeding evolution of biobank system in Shanghai benefits from the association's great efforts in meeting organization, practice training and other aspects in promoting the biorepository development.

In Beijing, a central joint biobank is advancing at the interphase from the first stage to the second. This Beijing Biobank of Clinical Resources (BBCR) has assembled over twelve specific clinical biobanks from different triple-A hospitals, in which at least ten major diseases have been covered, such as cerebrovascular diseases, cardiovascular diseases, chronic kidney diseases, mental diseases, orthopedic diseases, diabetes, hepatitis B, AIDS, tuberculosis, emerging diseases, cervical cancer and breast cancer. This giant project (www.beijingbiobank.cn) gained support by Beijing Committee of Science and Technology. In the future, Beijing Biobank targets the sharing infrastructure of physical and virtual clinical resources as a joint center to achieve prevention and treatment of critical illness.

Besides the city multi-disease network, a nosocomial network of comprehensive clinical specimen bank was established in Chinese People's Liberation Army General Hospital (PLAGH) in 2012. Different from the disease-directing specialty biobanks, it is the first general clinical biobank with multiple diseases in a single institution in Beijing, and probably the first comprehensive biobank in one hospital in China. Operation of the bank is based on the running projects and working process is basically followed the direction of flow chart (Figure 1). After the project and ethical issues have been approved, an agreement must been signed between researchers and the bank for banking management. During the usage of the specimens and related data, patients' privacy is protected under the terms of the consent and relevant regulations. Running such a comprehensive clinical bank requires massive coordination among the bank, the specific clinical departments, pathology department, biochemistry lab, and administrative level of the hospital. With all the efforts, the combination of clinical examinations, pathological diagnosis, follow-up cases, and clinical samples make a shortcut to quick and efficient analysis. This integrated banking model in PLAGH is an epitome of the prospective tendency as the incorporation of individual clinical banks into a resource network, and it provides a reference for setting up shared platform of multiple resources in huge general hospitals.

At the national level, integrated biological and medical resource center or network has been enrolled into the national strategic development plan. National Infrastructure of Chinese Genetic Resources (www.egene.org.cn) and National Scientific

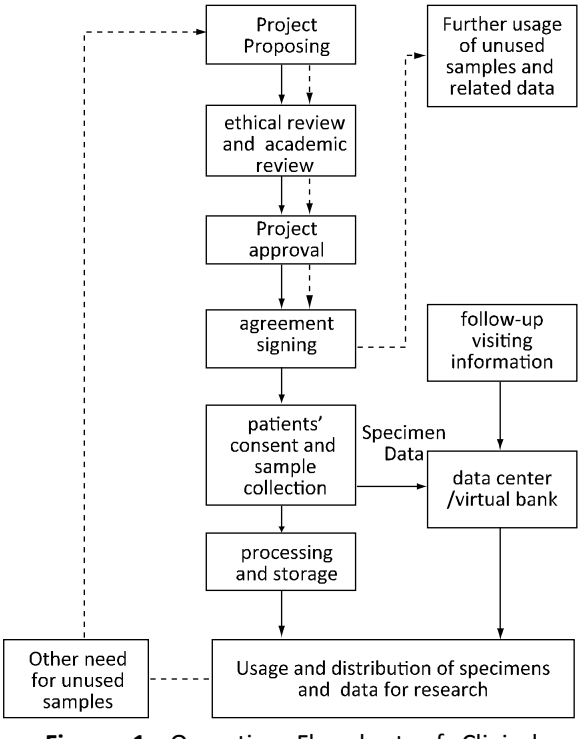

Figure 1. Operating Flowchart of Clinical Specimen Bank in Chinese PLAGH.

Data Sharing Platform for Population and Health (www.ncmi.cn) target at extensive demographic, genetic and medical resources from national population. Later in 2011, China National Genebank (CNG) is authorized officially (nationalgenebank.org), which is operated by Beijing Genomics Institute (BGI) (Shenzhen). Recently, CNG and the Chinese biobank association have designed and initiated the clinical biobank network as a virtual community, to link clinical resources with researchers on this sharing infrastructure.

Today's clinical biobanks in China concentrate not only on the professional construction of the biobank, but also on the long-term running with resources' usage and the efficiency of translational research. Looking back over the evolution of single biobank to bank union or network in China, it has followed the European and American biobank-developing progress. Fortunately, Chinese biobanks could learn successful experiences from foreign peer to make more accurate steps. Aiming to dig out genetic basis, risk factors and effective therapeutic methods of diseases, sharing and sufficient utilization of resources will direct the predictive planning of Chinese clinical biobanks and the national biobank community.

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