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Editorial

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Survival for All: Let's Share Benefits and Hardships

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Traditional and New Bioresources

Libraries have played a central role in the inheritance of human knowledge. Thus, publicity and systematic management are keys in accomplishing the library's mission. In natural science, natural history museums have been functioning as a public domain of knowledge inheritance. Because of this, morphologists and taxonomists have been conducting research by using specimens in museums. Recently, biological databases have provided public access to various types of research sources, such as research papers, sequences of nucleic and amino acids, and medical samples. Although such new public resources for life science have great potential, they have unstable financial bases.

The comparison between traditional and new public resources for life science will provide a clue to maintain the new resources for life science under the current conditions of economic austerity (Table 1). Established museums rarely face the risk of closure because their value seems prevalent in society, whereas new bioresources such as databases often find survival difficult. The reason for this difficulty is that obtaining funds to maintain research resources generated by research projects is generally more difficult than obtaining funds for new projects [1]. This issue arises because the importance and use of funds regarding maintenance of research resources is generally not well-known.

Table 1: Similarities and differences among research resources for life science and natural history.

	Database	Biobank, Repository	Museum
Data type	Digital data	Biological materials	Scientific Objects (Specimens)
Examples	Sequences, Array data	Blood, Tissues	Whole bodies or tissues of organisms
Accessibility	Public	Limited	Limited
How to access	Via internet	Via distribution service	Visiting
Transfer of Ownership	Obligatory	Voluntary	Voluntary
Main contents of maintenance	Updating of linked information	Protection from physical damage and loss of information	Protection from physical damage and loss of information
History	Short	Short	Long
Budgets	Unstable	Medium	Stable

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Importance of Maintaining Bioresources

The importance of bioresources may be obscure for a non-user; however, the recent development of databases and biobanks has created tremendous benefits for life sciences, comparable to public infrastructures. In other words, researchers commonly use the results of previous projects, such as genome projects and genetic variation projects, which are similar to us assuming the availability of public infrastructures. For example, today's researchers using model organisms cannot imagine designing a PCR primer without genome sequence information in a database.

Such new bioresources also have the potential to produce new research frameworks. The genome-wide association study (GWAS) has revealed many genes' association with human diseases on the basis of the development of human sample banking systems. The GWAS's success is about to expand into a large-scale genome cohort project, and is expected to enable researchers to access large-scale data without compromising the patients' and/or participants' confidentiality [2].

Cost of Maintaining Bioresources

Database contents in life sciences are closely associated with information of other external databases. For example, information on genome position is required to manage information on genetic variation. Accordingly, databases of human variation should be updated the description of genome positions according to data updates of the human genome. This type of correlation between data is increasing with life science discoveries. This relationship is the primary reason for databases to be updated continuously to remain useful and user-friendly. Further, recent developments in the awareness of evolutional analysis among life science researchers and an increase of ortholog information obtained by comparative genomics has created dense links among databases of biological information in multiple species. The more rapidly changing research field as well as the increasing links to external information included in the databases has increased the cost of updating database. Continuous employment of the original database developers produces effective performance in updating. Thus, a stable economic base is desirable in database maintenance for the continued development of the scientific infrastructure.

To support further research, catalogs of specimens in museums need to be digitized for the use via the Internet, which requires a reconsideration of the current situation. Further, specimens in museums and samples in biobanks are useless without associated information; therefore, the catalogs and labels of these biological materials must be maintained with meticulous care. Thus, compiling and updating of catalogs and labels requires skillful caretakers who are familiar with academic usage and the value of the biological materials, which also requires stable budgets.

Economics of Bioresources

The economic conditions in the leading countries for science can hinder budget increases for academic fields that do not produce information that would immediately stimulate the world economy [3,4].

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Although developing countries are also facing difficulties due to the worldwide economic depression [5], they try to stay positive to generate funds for science [6,7]. Owing to their increasingly remarkable contributions to science [8], the current situation surrounding science has the potential to change the role of management of scientific information as well as scientific materials. Previously, relatively few leading countries managed and maintained bioresources, including biological samples and specimens with their scientific information originating from developing countries. Now is the time for researchers and decision-makers of both developed and developing countries to understand the value of maintaining bioresources and their related information.

What Researchers can Do?

First, researchers must confirm the common understanding about importance of "publicity" as a member of the research community, since we are aiming for common benefits on earth for future generations. This understanding is a prerequisite to gain budgetary support for maintenance of systems for sharing scientific materials and information. Systems sharing the genome sequences in various organisms originated from the policy that requires researches to deposit the DNA sequences they identified before publishing. This principle of the sharing system may also work for biological materials. Currently, biological materials, even type specimens in taxonomy, can be owned by individuals. If the materials and information of bioresources are shared by researchers worldwide, scientific discoveries will accelerate globally. In my personal experience, I collected in total 196 blood samples of wild savanna monkeys from 20 local groups in central Ethiopia for a population genetic study [9]. Because I maintained information about the blood samples, such as location and time of sampling as well as biometric data of the captured individuals, the samples could be shared with a virus epidemiological study [10]. This collaboration began at an individual level. However, an effective system for sharing these bioresources could expand and systematize the opportunities for initiating such collaborations, thereby increasing the likelihood of valuable applied research.

Second, the activities to maintain research resources must be appreciated by reviewers of academic journals. Research papers reporting the updated research infrastructure, such as databases, biobanks, and digital catalogs of museums, should be appreciated by reviewers of academic journals, as well as papers reporting construction of new data infrastructures. Encouraging authors to share bioresources via existing systems and updating them may also prove valuable for the future of the science community.

Third, we need to keep in mind to inform general public concerning the importance of well-maintained research resources. Each researcher should continuously report how important bioresource sharing systems are for human society. When the draft sequence of the human genome was published, project leaders announced with the then-Presidents and then-Prime Ministers of member countries of the international consortium via mass media that the genome sequence is a common treasure of humankind with the potential to vastly improve our welfare. People who heard the announcement may await the concrete link of the genome sequence to current scientific results. When researchers can communicate with scholars and students from non-life science majors, we should introduce the benefits of research infrastructures produced by the projects such as the genome sequence and genetic variation.

Fourth, to produce such publicity, close collaboration among librarians, informatists, annotators of life science databases, managers of museums, and leaders of biobanks can reinforce the general recognition of bioresources and share the know-how to maintain these precious resources.

I would like to congratulate the launch issue of the International Journal of Evolution. I hope this launch serve to increase awareness of evolutionary biology on the public and to stabilize our research environment as well as our friendly competition.

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