Biospecimen Utilization: A Critical Challenge in Global Bioresource/Biobanking Operations

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THE FOCUS OF THIS SPECIAL ISSUE of *Biopreservation and Biobanking* is on biospecimen utilization by entities that collect, store, and distribute biospecimens for research, “biobanks.” In the “Experts Speak” column of this special issue, we asked experts in the field to describe their perspectives about the impact of the choice of various terms used to describe biobanks and how the terms reflect biospecimen distribution and utilization. In this guest editorial, we use the term “bioresource” to emphasize the goal of biobanks to be readily available and serve as a resource to the scientific community.

As Al Diffalha and colleagues describe in their article in this special issue, the availability of biospecimens and associated data for research has led to major scientific developments and improvements in health care. However, a number of recent surveys have suggested that bioresource managers consider underutilization of biospecimens to be a significant problem. In addition, biospecimen underutilization has been identified as not only a matter of practical concern but also an ethical issue, since participants who contribute their biospecimens expect them to be used for research. A recent worldwide survey of the bioresource community by Henderson et al. published in this special issue provides additional data focusing on bioresource performance metrics and utilization, as related to sustainability. These data suggest that target biospecimen utilization rates tend to be much higher than actual utilization rates with many bioresources reporting utilization rates <10%.

Additional studies are needed to define and standardize the metrics for assessing underutilization. In their article in this special issue, Rush and colleagues propose a broad framework to evaluate the value and impact of bioresources, with a particular emphasis on utilization from the perspective of the researcher and funder. They discuss how patterns of biospecimen utilization may vary depending upon different research approaches and the type of bioresource. Strategies for bioresources to increase biospecimen utilization and their overall value to the research enterprise are also described.

Biospecimen utilization may be affected by the choice of biobanking model. Grizzle and colleagues describe in their article some of the different biobanking models that may be

used for providing biospecimens for research. They also discuss the advantages and disadvantages of these models and show how the choice of the model(s) and how the various models are operated and managed affects biospecimen utilization.

The use of specific types of biobanking models and how they affect biospecimen utilization are further explored in two additional articles in this special issue. The factors leading to underutilization of biospecimens from classic biobank models are discussed in a commentary by Grizzle and Sexton. These factors include biobanks operating without clearly defined goals, inaccurately estimating the potential number of users, and collecting biospecimens without carefully considering the need for certain types of biospecimens by investigators. The authors propose ways that classic biobanks can address these issues and increase the utilization of biospecimens from their collections.

In anticipation of this special issue, the December 2018 issue of *Biopreservation and Biobanking* published an advance article by Grizzle et al.¹ in which they describe their experience with three decades of operations of two prospective bioresources. In the prospective model, biospecimens are collected in response to real-time requests from investigators rather than being collected based on projected future requests. The authors describe how the prospective model can be employed to optimize biospecimen utilization. The disadvantages of this model are also discussed. Readers are strongly encouraged to read this article that is very important to the issue of biospecimen utilization (see <https://www.liebertpub.com/doi/full/10.1089/bio.2018.0073>). A brief summary of the article is included as an Appendix 1 to this guest editorial for readers' convenience.

In addition to the choice of biobanking model, biospecimen utilization is affected by many other factors, including the identification of a scientific need for the biospecimens, the design of the bioresource, strategic planning, biospecimen quality and fitness for purpose, informed consent, access policies and procedures, and marketing. An article from Bledsoe and Sexton in this special issue describes how some of these factors affect biospecimen utilization and offers strategies for optimizing biospecimen utilization from bioresources.

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Biospecimen quality and fitness for the intended purpose are an important factor in ensuring biospecimen utilization. In a review by Otali et al., the authors describe the technical, biological, medical, and other tissue variables that affect biospecimen utilization and the challenges related to biospecimen characteristics that may limit their use. They also suggest approaches to address these challenges including carefully reviewing investigators' requests for biospecimens, working with them to resolve any issues, and continually educating investigators from diverse fields on factors that cause variability in the morphological and molecular characteristics of tissues. In the article by Hartman et al., the authors discuss complex quality features related to biospecimens and data and their increase in demand by researchers; they discuss why this is a challenge for bioresources and utilization of existing collections, and ways that bioresources can help address this demand moving forward.

In summary, the articles in this special issue address the wide range of issues affecting biospecimen utilization. Our hope is that these contributions to the literature will move the field forward in addressing this critical issue in global biobanking/bioresource operations. Addressing this chal-

lenge is essential to optimize our investments in biobanking/bioresources and to capitalize on their potential for scientific and medical advancement. In addition, it is essential for maintaining trust of all the stakeholders in biobanking, especially research participants and the public, and ultimately, for ensuring biobank/bioresource sustainability.

Reference

1. Grizzle WE, Sexton KC, McGarvey D, Menchhofen ZV, Li-Volsi V. Lessons learned during three decades of operations of two prospective bioresources. *Biopreserv Biobank* 2018;16:483–492.

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Appendix 1

Summary of Grizzle et al. "Lessons Learned During Three Decades of Operations of Two Prospective Bioresources," *Biopreserv Biobank* 2018;16(6):483–492.

There are multiple models of biobanking that have been used to develop various types of bioresources.^{A1,A2} The prospective model was initially used by the Cooperative Human Tissue Network^{A2,A3} to develop the prospective bioresources of its member institutions. The focus of the prospective bioresource is to collect and process human biospecimens to meet the requests of investigators in their support of biomedical research. This type of bioresource is thus *investigator centric*. The prospective bioresource operations are in contrast to those of the classic biobank in which selected human biospecimens are collected and processed to meet future projected research needs for specific biospecimens—a model that is *biospecimen centric*.

The prospective model also differs from all other models of biobanking, including the population-based model, data-focused model, and the clinical (pathology) archival model.^{A2} The advantages and disadvantages of the prospective model, in contrast to other models, are discussed both in the "Lessons Learned" article and in the article of this special issue, "The Utilization of Biospecimens: Impact of the Choice of Biobanking Model."^{A1–A3}

The "Lessons Learned" article also describes some of the more important lessons learned by two prospective bioresources at the University of Alabama at Birmingham (UAB) and at the University of Pennsylvania (UPENN)

during three decades of operations. One of the major lessons is the critical importance of ensuring that investigators' requests are informed, specific, detailed, and accurate. This is accomplished by having a detailed standard application that the investigator completes and discusses with bioresource personnel before beginning biospecimen collection. In some cases, if the investigators' requests are considered impracticable and/or beyond the scope of the bioresource, their applications would not be accepted.

Investigators must be made aware of the carefully developed and clearly described cost recovery policy. Specifically, all biospecimens collected that meet the specified requirements of the investigator belong to the investigator once collected; thus, the investigator is immediately responsible to the bioresource for cost recovery associated with all collected biospecimens. Each investigator should have a shipping account for delivery of the biospecimens.

The informatics system of a prospective bioresource must be robust and flexible with a primary focus on the investigator and prospectively collected biospecimens. It is important that its specimen diagnostic vocabulary be nonredundant.

Another important lesson is the requirement that quality control be performed when the biospecimens are collected in accordance with the investigators' requests. For the biospecimen to be assigned to a specific investigator, it must

meet all of the investigators' requirements. An investigator is then informed and a rapid shipping date is established. Also, there should be rapid billing.

It is very useful for a prospective bioresource to develop a close collaboration with other bioresources that are focused on distribution, so that requests for biospecimens can be efficiently shared. Among cooperating bioresources, this might include a common approach to cost recovery and standard operating procedures. Also, as with all bioresources, participation in the International Society for Biological and Environmental Repositories (ISBER) is important, especially to track new developments in technology affecting bioresources. The prospective bioresource should rapidly adapt to changing technology.

The regulatory/ethical issues of a prospective bioresource differ from bioresources that are based on other models. Specifically, even though biospecimens may be distributed to investigators as "deidentified," it is important to have local Institutional Review Board (IRB) review of each investigator's proposal to ensure the research is acceptable to the institution of the investigator; thus, for a prospective bioresource, many different IRBs and ethics groups may be involved. In contrast to a "biospecimen centric" bioresource, a prospective bioresource knows the identity of the investigators for whom biospecimens are

being collected. This may affect the informed consents required for donors.

Detailed training of personnel in all operations (e.g., safety and regulatory/ethical issues) is critical. Because of increased effort, a prospective bioresource needs several personnel trained in the requirements of the International Air Transport Association.

Only a few of the lessons learned can be described in this summary. Readers of this special issue focused on biospecimen utilization are encouraged to read the complete "Lessons Learned" article published in the December 2018 issue of *Biopreservation and Biobanking*.

Appendix References

- A1. Grizzle WE, Sexton KC, McGarvey D, Menchhofen ZV, LiVolsi V. Lessons learned during three decades of operations of two prospective biorepositories. *Biopreserv Biobank* 2018;16:483–492.
- A2. Grizzle WE, Bledsoe MJ, Al Diffalha S, Otali D, Sexton KC. The utilization of biospecimens: Impact of the choice of biobanking model. *Biopreserv Biobank* 2019;17:230–242.
- A3. Clausen KC, Grizzle WE, LiVolsi VA, Newton WE. Availability of human tissues for research in cancer. *Science* 1987;237:10–11.