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Office of Science and Technology Policy
BIOECONOMY@OSTP.GOV

RE: Response to Request for Information: Building A 21st Century Bioeconomy

In these challenging economic times, it is imperative that we continue to focus research-and-development investments in areas that will provide the foundation for future growth, and help the United States maintain its scientific acumen and leadership role in the biomedical enterprise. Given rising health care costs, targeted investment in mechanisms that promote the identification of appropriate treatments, and avoid unhelpful or detrimental ones that would nonetheless be expensive, are particularly timely.

It is for these reasons that I urge the Federal government **to invest in establishing the U.S.'s first national biobank of human biospecimens (tissue samples, tumor cells, DNA, blood, etc.) for use in cutting-edge research into new treatments for diseases.** The goal of such a bank would be to assemble sufficient quantities of high-quality, well-characterized human biospecimens to meet the demands of modern, technically sophisticated experimental designs and research platforms. Biospecimen quality can influence assay results profoundly, leading to incorrect diagnoses and inappropriate treatment decisions in the clinic or irreproducible results and misinterpretation of artifacts as biomarkers in the laboratory. Perhaps the most disastrous example of this is the finding that the amount of time a breast cancer specimen spends in formaldehyde fixative influences the readout of assays for estrogen and progesterone receptors in the tumor; patients with tumors positive for these receptors benefit from tamoxifen chemotherapy, whereas patients with tumors that do not express these receptors get no benefit from tamoxifen. Tumors that spend fewer than 6 hours or greater than 24 hours in formaldehyde erroneously appear negative for these receptors; this means that patients *who would have benefited* from tamoxifen treatment *did not receive it* because their tumors were unlucky enough to be improperly fixed. This problem went undetected for years due to inconsistencies in biospecimen handling and the lack of any standards for comparison.[1]

As medicine evolves and treatment decisions become more tailored to individuals' diseases, such examples will arise with increasing frequency unless a stable source of high-quality biospecimens is available for assay development and other research purposes. The gateway to choosing appropriate therapy in modern medicine is the diagnostic assay, and this raises the consequences for patients of poor biospecimen quality to an alarming degree.

[1] See Check W. 2006. Raising the bar for HER2 results. *College of American Pathology (CAP) Today* (December).

The idea of a national biobank was identified as one of ten ideas "changing the world right now" by Time Magazine in 2009, which highlighted the work of the National Cancer Institute's Office of Biorepositories and Biospecimen Research (OBBR). Unfortunately, cuts in government spending since then caused NCI to scale back its ambitions considerably. Rather than building a much-needed national biobank that would be a standard-bearer and engine for harmonizing the fragmented amalgam of biobanks in the United States, the OBBR has had to focus its more limited resources on supporting studies on how biospecimen variables influence assay results and the development of biospecimen standards. These efforts are clearly significant and much-needed, but they won't get us nearly as far as would access to a mother lode of high-quality, highly annotated human biospecimens to really jumpstart new discoveries.

Other countries (including Britain, Canada, Norway, Sweden, and Iceland) have already built national biobanks. Recently, the Chinese Ministry of Science and Technology committed to building a national biobank and supporting the development of the biomedical industry in China, with an eye toward the development of innovative drugs and treatments that will have a lasting, positive influence on cancer patients. Why is the United States sitting on the sidelines?

**BACKGROUND**

A major roadblock for translational research has been the difficulty in acquiring high quality human biospecimens—each linked to comprehensive epidemiological, clinical, biological, and molecular data—from a large number of donors. This difficulty stems in large part from the lack of standard approaches and wide variation in the collection, processing, and storage of biospecimens; the degree and type of data annotation; patient informed-consent procedures; access policies; materials transfer agreement conditions; and supporting informatics. A major obstacle has been "the lack of long-term secure funding for developing and sustaining biobanks and biobanking research."[2]

Recognizing that a national tissue resource, although ambitious, is necessary to realize the promise of genomics and proteomics for the prevention and cure of cancer and other diseases, the National Dialogue on Cancer Tissue Access Working Group, in collaboration with the National Cancer Institute, commissioned a National Biospecimen Network (NBN) Blueprint a **decade** ago with the following goal:

> *"to establish a national, pre-competitive, regulatory compliant and genetic-privacy protected, standardized, inclusive, highest quality network of biological sample(s) banks…that is shared, readily accessible, and searchable using state-of-the-art informatics systems (e.g., amenable to molecular profiling capability)."*

The Design Team of scientists, clinicians, industry representatives, and patient advocates outlined essential requirements and made specific recommendations for realizing the vision of the NBN Blueprint to be the first nationwide, standardized biospecimen resource designed to

[2] Vaught J, Rogers J, Carolin T, Compton C. 2011. Biobankonomics: Developing a sustainable business model approach for the formation of a human tissue biobank. *J Natl Cancer Inst Monogr*, 42: 24-31.

facilitate genomic and proteomic research. With the Blueprint in hand, the NCI took steps to realize this vision. The OBBR was established in 2005 and articulated a strategic vision for a national biobanking initiative, the Cancer Human Biobank (caHUB).

Human biospecimens can be considered the center of the personalized-medicine universe. They are the bridge between intracellular molecular information and clinical information. They enable researchers to study the molecular characteristics of actual human disease, and then correlate those characteristics with what is known about the clinical progression of the disease. Human biospecimens are thus integral to understanding disease mechanisms and identifying potential drug targets, developing diagnostic screening tests for biomarkers of a specific disease subtype, and identifying appropriate patients for testing new drugs and prescribing current ones. This vision is dependent on the availability of high-quality human biospecimens for screening, monitoring, and research. Without them, research and clinical assays are subject to the fate of the improperly fixed breast tumors described above: in other words, garbage in—garbage out.

**POTENTIAL DEMAND AND VALUE PROPOSITION**

Industry reports indicate that the global market value of the demand for human biospecimens and related services is growing between 20 and 30 percent annually, and was estimated to be approximately $200 million in 2009.[3] However, even though there are over 180 commercial biobanks in the United States, with samples from nearly 400,000 donors, no single company holds more than a 3 percent share of the global biobanking market.[4] The heterogeneity in collection approach and biospecimen quality discourages harmonization and seriously impedes the pace of the cutting-edge research we now have the technology to undertake. This is exactly the type of situation that presents an opportunity for government leadership: a public solution that facilitates access to appropriate quality and numbers of biospecimens for diverse research needs.

I write in my capacity as a public citizen, informed by my work as a contractor to the National Cancer Institute and past experience as an NIH program officer involved in multiple areas of science. Full disclosure: I was the managing editor and lead writer of the National Biospecimen Network Blueprint (September 2003), and beginning in 2004, Rose Li and Associates, Inc., has been providing science-writing services to the NCI and beginning in 2005 to the then-newly formed OBBR to support efforts to address the challenges raised by current biorepository practices and procedures. Rose Li and Associates, Inc., also provides ongoing programmatic support to many other agencies and offices at the National Institutes of Health, covering topics as varied as biology of aging, health and retirement, psychological disorders, neuroscience, genetics and pharmacogenomics, science of behavior change, health economics, and child health. Even in these diverse areas, it is surprising how often the topic arises of research being hampered by

[3] Vaught, et al. 2011, p. 25.
[4] The future of biobanks: regulation, ethics, investment of the humanization of drug discovery. *Business Insights*. March, 2009, as referenced by Vaught, et al. 2011.

inadequate access to high-quality human samples. I expect that all of these areas, and the U.S. economy, would benefit from the creation of a national U.S. biobank.

There is clearly a compelling need for a national U.S. biobank, a significant research infrastructure investment that would benefit a wide swath of research areas and clinical applications, as well as technology development. Its progress and usefulness could be objectively measured and the resulting discoveries tracked. According to Vaught, et al. (2011), "the value creation that a national biobanking resource would bring to the research community would, arguably, exceed the costs for developing and sustaining such an institution."

What is needed now is the political will and the investment of funds to realize the vision set forth a decade ago for the creation of a national U.S. biobank. This vision should be a distinct component of our National Bioeconomy Blueprint.

Sincerely,

Rose Maria Li, MBA, PhD
President and CEO