Establishing a National Strategy for Shared Research Resources

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Abstract

President Biden’s renewed push to develop cures for society’s most devastating diseases including cancer and Alzheimer’s, in tandem with infrastructure investments to “Build Back Better,” represents an opportunity to harness our nation’s critical shared research resources (SRRs). For over 40 years, SRRs have played a key role in accelerating biomedical research discoveries and innovations by providing widespread access to cutting-edge technologies, services, and scientific expertise. Yet a national strategy that addresses how to leverage these resources to ensure new treatments, cures, and economic vitality is noticeably absent. A national strategy for SRRs—led by the National Institutes of Health (NIH)—is crucial to advance key national initiatives and enable long-term efficiency, coordination, and economic impact of these critical assets.

One-Sentence Summary: A national strategy for shared research resources is necessary to achieve our nation’s cross-cutting research priorities.

The Need for a National Strategy

When optimally integrated into the scientific infrastructure, SRRs are inherently designed to promote the lasting, sustainable growth required for research innovation and societal advancements. Here, we demonstrate the importance of SRRs to the biomedical research enterprise and explain why the current patchwork approach to SRRs investment fails to capture the full potential of SRRs.

As our nation enters a critical juncture in research history following the COVID-19 pandemic, now is the time to capitalize and expand upon SRRs' inherent strengths to transform the way in which we prepare, collaborate, and respond to future needs. To be successful, a national strategy will require research and policy stakeholders to join forces and concentrate on two key components: 1) identifying the knowledge and policy gaps that preclude realizing the full potential of SRRs and, 2) addressing these missed opportunities by developing mechanisms that encourage integration of SRRs across the scientific pipeline and stimulate innovative research to advance knowledge and research achievements. This two-pronged approach will not only enable federal and institutional entities to achieve shared research goals including improved rigor and reproducibility and team-based science approaches, but it will also provide a firm foundation for the next generation of researchers to continue generating groundbreaking scientific discoveries.

Importance of SRRs

For decades, SRRs located in academic core facilities, national laboratories, and research institutes have served as a ready-made vehicle for fostering multi-disciplinary initiatives that propel our nation's scientific agenda forward. Nobel Prize winning breakthroughs such as genome sequencing, super-resolution light and electron microscopies, and functional brain imaging are but a few examples demonstrating how SRRs have fundamentally changed the way scientists conduct basic, translational, and clinical research (1).

A particularly important and relevant example of this is the rapid response to the COVID-19 pandemic which revealed SRRs' formidable strength to pivot with a concerted, multidisciplinary, and agile response at a time when research efficiency and flexibility was needed. Because SRRs are inherently capable of coordinating research efforts across multiple users, regions, and area of scientific inquiry, rapid sample processing and analysis enabled experts to swiftly deliver high-impact data for COVID-19 testing and advance our fundamental knowledge about the treatment of the disease, including identification of SARS-CoV-2 variants (2,3).

Current Patchwork Approach

The importance of SRRs was elevated by the establishment of the National Center for Research Resources (NCRR) at NIH in 1990. Over the next 20 years, NCRR became a strong supporter and champion of shared resources, developing innovative approaches for SRR collaboration and enabling their representation at the policy table (4). Unfortunately, this momentum was lost when the NCRR was dissolved in December 2011 (5) and its programs were merged with other NIH infrastructure programs (animal facilities, facility construction, etc.) in the Office of the Director under the Division of Program Coordination, Planning and Strategic Initiatives

(DPCPSI). While DPCPSI continues to provide funding for shared instrumentation and construction, there is still a strong sense that SRRs lost its crucial voice within the NIH and on the national stage.

Currently, SRRs are supported through multiple mechanisms across NIH's 27 Institutes and Centers (I/Cs), an approach that has complicated the oversight, development, and support for SRRs by host institutions. This patchwork strategy has promulgated confusion for researchers regarding which resources are available to them and resulted in unnecessary duplication and inefficient operation of SRRs. It has also failed to leverage SRRs to address new opportunities that are vital to long-term sustainability of the biomedical research enterprise.

New Opportunities

Recently, The Federation of American Societies for Experimental Biology (FASEB) identified five key actions needed to maximize investments in SRRs (6): (1) improve institutional stewardship of SRRs, (2) expand access to SRRs, (3) grow a more diverse, equitable, and inclusive SRR workforce, (4) increase and sustain investments in SRRs, and (5) prioritize sustainability in SRR decision-making. Each of these actions offers new opportunities for leveraging the country's investments in SRRs to improve the efficiency and impact of research on society.

SRRs offer unique opportunities for addressing systemic challenges facing the research community. For example, SRRs have been actively involved in improving the rigor and reproducibility of biomedical research, most notably through efforts of the Association of Biomolecular Resource Facilities (ABRF). The research group model of ABRF has been a champion for addressing the cognitive bias in research design and data analysis by revealing the strengths and limitations of advanced technology and its applications (7). While this is only one aspect of the bigger problem (8), it is a key element that could be expanded and developed further to improve research conduct.

Another opportunity in which SRRs are well-positioned to help is in fostering a more diverse, equitable, and inclusive workforce (9,6). SRRs serve as the epitome of team science, promoting research across a diverse array of scientific disciplines and harboring a range of talents and expertise that make them an ideal entry point into the research enterprise. Expanding access to SRRs by faculty and students at non-research universities would be a productive way to facilitate training and research opportunities for underrepresented populations.

A Path Forward

As SRRs continue to demonstrate their importance and value to the country's research success, these examples signal the importance of scaling-up SRRs investments to create broader transformational change at the national level. Therefore, a national strategy is needed to improve inter-agency coordination of SRR programs, address challenges and new opportunities, and ensure long-term research sustainability. We recommend NIH lead and coordinate this important effort by establishing an Advisory Committee to the Director (ACD) Working Group for the Advancement of SRRs that addresses, among other topics, the following themes.

Streamline SRRs across NIH and Other Federal Agencies

SRRs are interdisciplinary laboratories whose expertise and technologies do not align with traditional scientific disciplines. The fact that many federal agencies support SRRs through individual institutes and directorates with disciplinary focus has created a confusing array of funding initiatives and programs. Harmonization across federal agencies is needed to recognize the interdisciplinary nature of SRRs and align funding and expectations accordingly.

Support SRR Career Development

Currently, there are no training programs focused specifically on SRRs. This oversight needs to be addressed by recognizing the unique SRR career path, supporting its education and training, and promoting career advancement of scientists working in SRRs. This should include an emphasis on developing a more diverse, inclusive, and equitable workforce as well as instituting internship and mentorship programs that foster professional development networking and partnership opportunities, similar to existing efforts in various regions throughout the country (10).

Expand Access to SRRs

SRRs are located primarily in research-intensive universities, national labs, and institutes. The large majority of institutions of higher education do not have access to these facilities, and their faculty and students are effectively precluded from research and career opportunities using advanced technologies. Expanding access of SRRs to these groups would foster a talent pipeline across the educational landscape and ensure that untapped potential is harnessed and developed early in the educational process.

Leverage SRRs to Improve Rigor & Reproducibility and Environmental Sustainability

SRRs are leading the way in applying best practices to improve the rigor, reproducibility, and transparency of scientific research. Their success and impact are reliant on properly maintained instrumentation, well-designed experiments, rigorously tested methods and procedures, quality control and assurance of results, and data integrity. These attributes of SRRs make them ideally positioned to lead efforts to improve rigor and reproducibility by developing national standards and certifications across a wide spectrum of scientific disciplines. Furthermore, widespread adoption of the SRR model and best practices provides the foundation for synergizing a more sustainable approach to the conduct of science within and across institutions, enabling not only cost efficiency, but also improved utilization of space, infrastructure, materials, and energy (11, 12).

Conclusion

Audacious goals require strategic planning, streamlined coordination, and most importantly a unified vision. The scientific breakthroughs that have positively impacted our quality of life—innovations ranging from gene therapy to the recent COVID-19 vaccine—serve as powerful reminders that SRRs are a major component of these successes. We owe it to the next generation to invest in SRRs and continue forging a path toward scientific excellence.

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