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MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

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SUBJECT: Multi-Agency Research and Development Priorities for the FY 2024 Budget

The United States has long enjoyed broad bipartisan support for Federal investment in science and technology. This ongoing support helps to ensure American leadership in discovery, cures, and solutions for decades to come. The Biden-Harris Administration will continue to propose investments that will define America's next generation of global leadership in innovation, while infusing the work of government with greater equity, and the scientific research and technologies being developed with more durable benefit for all.

Federal funding for research and development (R&D) is essential to maximize the benefits of science and technology that advance health, tackle the climate crisis, and bring prosperity, security, environmental quality, and justice for all Americans. In addition to supporting R&D, agencies should make use of research results to carry out their own missions and ensure that the results of Federally funded research are made widely available to the public to facilitate understanding, participation, and inclusive decision-making; to other scientists to promote the exchange of ideas that is key to the advancement of knowledge; and, to innovators and entrepreneurs in every region of the United States, who will translate the research into world-leading businesses employing American workers. Equity should be the touchstone for all of these investments, including a deliberate emphasis on Historically Black Colleges and Universities, Tribal Colleges and Universities, Minority Serving Institutions, rural communities, and other disadvantaged communities that have been historically underserved, marginalized, and adversely affected by persistent poverty and inequality. And, as we seek to make our supply chains more resilient, these R&D investments should protect intellectual property developed in the United States and help create products that are made in the U.S. workers.

This memorandum outlines the Administration's multi-agency R&D priorities for formulating fiscal year (FY) 2024 Budget submissions to the Office of Management and Budget (OMB). The priorities covered in this memo will require Federal investments in R&D; actionable and equitable measurement of program outcomes; science, technology, engineering, and mathematics (STEM) education, engagement, and workforce development; research infrastructure; public access to Federally funded research; and, technology transfer and commercialization. These priorities should be addressed within

the FY 2024 Budget guidance levels provided by OMB. Agency budget submissions should note when they address these priorities. Agencies engaged in complementary activities should consult with one another during the budget planning process to coordinate resources, maximize impact, and avoid unnecessary duplication. Agencies should include summaries of these consultations—including through National Science and Technology Council bodies—in their OMB budget submissions. As in previous years, the investments supported by the Budget for the R&D priorities listed below will be highlighted in the FY 2024 Analytical Perspectives Volume.

Multi-Agency Priority Guidance

FY 2024 Budget submissions should invest in the fundamental infrastructure—the knowledge, institutions, places, networks and people—that makes science possible. There should be a coherent commitment to building a robust and inclusive ecosystem for American science and technology. To do so, agencies must focus on evidence-based, promising practices and mechanisms for fostering, conducting, using, and sharing the fruits of research. Examples of such practices include easy disclosure practices for Federal grants through use of a persistent digital identifier, reducing administrative burdens while improving scientific integrity, evidence-based professional development and mentoring structures, robust anti-harassment and anti-discrimination policies, and full activation of our domestic talent pool, including through more inclusive national engagement. All of these practices are part of reimagining how the Federal science agencies drive equitable innovation. Furthermore, agencies should seek collaborations with private industry, mission-aligned non-profits, and other external stakeholders who can help make these significant investments more sustainable. Towards this end, agencies should prioritize investments that modernize Federal laboratory, testing, and prototyping infrastructure and, where possible, share that infrastructure with universities, non-profits, and the private sector to promote discovery, education, training, and commercialization.

Agencies should balance priorities to ensure that resources are allocated for agency-specific, mission-driven R&D, including discovery-oriented research and use-inspired research, while at the same time focusing resources, where appropriate, on the following multi-agency R&D and STEM education activities that cannot be addressed by a single agency.

- Preparing for and preventing pandemics
- Reducing the death rate from cancer by half
- Tackling climate change
- Advancing national security and technological competitiveness
- Innovating for equity
- Cultivating an equitable STEM education, engagement, and workforce ecosystem
- Promoting open science and community-engaged R&D

The following sections describe in greater detail the motivation and priorities within these seven domains.

Preparing for and preventing pandemics

The COVID-19 pandemic has claimed an unparalleled number of lives and cost the U.S. and global economy trillions of dollars, demonstrating our continued vulnerability to current and future biological threats. As COVID-19 variants and other pathogens like influenza and monkeypox spread globally, we must work with renewed urgency to accelerate development of needed scientific capabilities that can stop outbreaks before they become epidemics or pandemics, regardless of natural, accidental, and deliberate origin. Almost every agency has a role in pandemic preparedness and prevention, and budget submissions should expand upon previous pandemic preparedness and biodefense R&D investments to address priority areas for fundamental science and technological innovation in support of the [*American Pandemic Preparedness: Transforming Our Capabilities*](#) plan (a

core element of the U.S. National Biodefense Strategy). Specific priority areas that require concentrated focus and multi-agency collaboration include pathogen agnostic genomic sequencing for early warning in human, animal, and plant communities; next-generation home, point of care, and host-directed diagnostics; accelerated novel antibody engineering; prototype pathogen research for medical countermeasure (MCM) development; alternative vaccine and therapeutic delivery mechanisms to simplify MCM administration; “universal vaccines” against viral families or subfamilies, including influenza viruses and coronaviruses; broadly-acting antivirals; immune system modulators; innovations to improve vaccine and therapeutic production capacity and flexibility; innovations to improve indoor air quality and to reduce disease transmission in buildings; next-generation personal protective equipment; and applied biosafety and biosecurity innovations. Achieving U.S. and global pandemic preparedness goals will depend on additional S&T efforts to de-risk advanced manufacturing practices, support supply chain resilience, and foster innovative finance mechanisms to support private sector R&D partnerships. Developing these transformative capabilities quickly and at scale, while implementing robust biosafety and biosecurity controls, is vital to ensure our S&T investments reduce biological risks.

Further, G7 leaders committed to support science in the 100 Days Mission to shorten the cycle for the development of safe and effective vaccines, treatments, and tests from 300 to 100 days. International collaboration in support of 100 Days Mission scientific goals will be vital in transforming our capabilities to stop future outbreaks before they become pandemics, including through activities that mobilize the global scientific community, strengthen international early warning systems, harmonize clinical trials approaches, promote development and global distribution of medical countermeasures such as rapid and accurate diagnostics, build local health security capacity, and create sustainable financing for health security S&T capabilities development.

A crucial safeguard against pandemics is a strong, resilient, public health system. To support a rapid, scalable, and equitable public health response, agencies should invest in R&D to develop fundamental public health capabilities such as an integrated data infrastructure, evidence-based health communication strategies, including information integrity where science, data, and evidence related to the human and technological aspects of these issues are both considered, and digital health technologies needed to implement high-quality virtual healthcare. Progress towards our goals in pandemic preparedness and public health should be measured through regular pilot and demonstration projects to assure our efforts to create a world free from catastrophic biological incidents.

Reducing the death rate from cancer by half

To guide the White House Cancer Moonshot, the President has set the ambitious goal of cutting the age-adjusted death rate from cancer by at least 50% over the next 25 years. This includes developing and deploying effective ways to prevent, detect, and treat cancer through new breakthroughs and ensuring existing tools reach more Americans equitably. Agencies should prioritize and collaborate on laboratory, clinical, public health, and environmental health research programs across the following focus areas:

Close the Screening Gap: Americans missed nearly 10M cancer screenings as compared to prior years due to the COVID-19 pandemic. The development of innovative approaches to cancer screening and early detection, including more precise, less invasive, and even at-home methods, should be prioritized to reduce that deficit and expand equitable access to effective cancer early detection going forward.

Understand and Address Environmental and Toxic Exposures: Studies have shown that exposure to environmental contaminants and toxic chemicals can lead to a higher risk of certain types of cancer. A robust scientific research and regulatory agenda should be pursued to enable increased understanding of the impact of environmental exposure in an effort to better prevent and mitigate cancer-related exposures.

Decrease the Impact of Preventable Cancers: Research efforts should focus on fully understanding and developing additional approaches to reach people with cancer prevention tools to include, for example: cancer-related vaccines, effective treatments for cancer-causing infectious agents, techniques to detect and address pre-cancer (like we do with colonoscopies today), and approaches to decrease the impact of nutrition- and tobacco-related cancers. Efforts are also needed to expand access to cancer-prevention approaches through evidence-based public health and community health efforts to ensure these preventative tools are reaching all U.S. populations.

Bring Cutting Edge Research Through the Pipeline to Patients and Communities: The development and deployment of new ways to prevent, detect, and treat cancer will be necessary to increase cancer survival rates. In particular, focus should be given to fundamental research that supports precision medicine, increases understanding of how to target effective treatments to patients, improves cancer survivorship, and speeds progress on some of the deadliest and rare cancers, including childhood cancers. Emphasis should be given to driving innovation, from discovery to patient treatment, by accelerating trial accrual and enrolling populations that reflect the diversity of those diagnosed with cancer in America. Agencies should evaluate ways to use, expand, and share Federal datasets, some already rich with diverse patient populations, to drive investigations.

Support Patients and Caregivers: Cancer can be overwhelming to any person or family and gaps in support can lead to gaps in positive outcomes. In order to make the experience around cancer—from screening, to getting a diagnosis, to treatment, care, and surviving—easier on those living with cancer and their caregivers, evidence-based and scientifically-sound public health approaches should be pursued. That means making it easier for people to access screening and diagnostics, bringing trials and quality care closer to home, including through the use of telehealth, providing patients and caregivers with the data and knowledge they need to make informed care decisions, and giving people with cancer, and the people who care for them, a seat at the table in order to improve our cancer research and development system.

Tackling climate change

The United States and the world face a profound climate crisis with a narrow window to avoid the most catastrophic impacts and to seize the opportunities that tackling climate change presents. Climate change is interacting with and exacerbated by nature loss and community inequities. The President has directed a whole-of-government approach to reduce climate pollution in every sector of the economy, conserve nature, increase resilience to the impacts of climate change, address environmental justice, and protect public health, while creating good-paying jobs that provide a free and fair chance to join a union and collectively bargain. Agencies should identify and prioritize R&D investments that advance the understanding of climate change, its interactions with nature loss and human systems; the innovations in clean energy and climate technology and infrastructure solutions; the ability to evaluate and track the effects of policies, projects, and programs on climate mitigation, resilience, and ecosystem services; and, workforce capacity to develop and effectively implement mitigation and resilience solutions.

Climate science: Advancing climate science—including physical, biological, social, and economic science—improves our understanding of Earth’s climate and the changes that pose the greatest risk to communities and ecosystems. Climate science guides identification and implementation of solutions to address mitigation and adaptation to climate change, and it informs Federal, State, local, Tribal, and territorial governments with capacity building and training to increase access to and use of data, information, and climate services. A critical priority is understanding changes in weather and in climate extremes and tipping points—from temperature and precipitation, to drought and wildfire, to thawing of permafrost, to ice loss, sea-level rise, coastal flooding, and severe storms—that result in actionable information for

communities. Agencies should coordinate research and modeling investments and information dissemination capabilities through the U.S. Global Change Research Program with the goal of producing knowledge and modeling outputs that are needed to address local-scale climate threats. Those modeling outputs should be able to feed directly into derivative risk models and climate information delivery platforms that are made broadly accessible to the public to advance understanding and support adaptation and mitigation decision making.

Innovation in clean energy and climate technology and infrastructure: Spurring innovation, commercialization, and deployment of clean energy and climate technologies, including those to lower costs and decrease emissions in the power, buildings, transportation, industrial, and agricultural sectors is necessary to support achievement of a 50-52 percent reduction from 2005 levels in economy-wide net greenhouse gas pollution in 2030, carbon pollution free electricity by 2035, and net zero economy-wide emissions no later than 2050. Climate innovation investments should include multi-agency support for game-changing clean energy and other emissions mitigation technologies, such as electricity generation from advanced solar, nuclear, fusion, offshore wind, and geothermal; advanced transmission and distribution systems for a net-zero grid and electrification; energy storage; carbon capture (including engineered and natural removal), utilization, and storage; net-zero aviation, shipping, freight, and off-road vehicles; next-generation mobility systems and charging; clean hydrogen, fuels, and feedstocks; net-zero industrial processes; low-cost net-zero buildings and infrastructure; methane and carbon-reducing agricultural practices; and circular economy innovations.

Transforming the energy system also requires coordinated investments in the science and technology ecosystem and infrastructure, including systems science, high-resolution digital modeling and simulation, optimization and controls, supercomputing capabilities, and macro-energy systems. Agencies should support interdisciplinary decarbonization research, including research in the humanities, economics, and behavioral and social sciences on risk assessment, policy, and siting, to ensure that climate innovation efforts are successful and benefit everyone. This research should be informed by the perspectives of and inclusive of solutions by historically marginalized and overburdened communities.

Agencies should also prioritize the use-inspired basic research essential for the development of future generations of climate mitigation technologies, including: electrochemistry, catalysis, fusion and plasmas, photoelectric chemistry, photonics, chemical separations, surface chemistry, and subsurface flow and transport.

Climate change adaptation and resilience: Agencies should increase the understanding of the effectiveness of adaptation and resilience measures, including through integration of physical, natural, and social sciences, and should make science-based information more accessible and decision-ready. Agencies should prioritize efforts to connect science and decision making through meaningful engagement with climate information users, including through the application of user-friendly climate tools and services, evaluation of adaptation and resilience programs and interventions, science-based risk communication, citizen science, and community-engaged research programs. These R&D efforts should focus on more proactive and accessible resilience and adaptation strategies for disadvantaged communities that are historically underserved, marginalized, and adversely affected by persistent poverty and inequality, in order to co-create resilience solutions that are more just, inclusive, and equitable. Because climate risk exacerbates existing environmental and societal inequities and contributes to cumulative burdens on disadvantaged communities, these investments should advance economic and environmental justice, equity, and public health through reduced vulnerability to climate impacts.

Nature-based climate solutions: Agencies should promote R&D programs aimed at understanding and improving the effectiveness of nature-based climate solutions, including protecting and restoring terrestrial, freshwater, coastal, and ocean ecosystems to provide carbon sequestration and storage and to enhance ecosystem and human community resilience, address environmental injustices, create economic opportunities for farmers, ranchers, fishers, and foresters, and improve national security. Agencies should also identify mechanisms to invest in capacity building, training, and technical assistance programs to strengthen the development of the workforce (e.g., scientists, engineers, social scientists, practitioners) with skill sets to design, implement, and manage effective nature-based solutions and hybrid options that integrate traditional and nature-based approaches. Agencies should promote R&D efforts to include ecosystem services in cost-effectiveness and benefit-cost analyses; track natural assets through the emerging national system of natural capital accounts and associated environmental-economic statistics; and synthesize knowledge of these and other connections between nature, climate, economy, and society through the National Nature Assessment.

Greenhouse gas monitoring: Measurement, monitoring, reporting, and verification of greenhouse gas emissions and removals is critical to understanding and enhancing the progress and effectiveness of local to global actions to address the drivers of climate change. Agencies should prioritize investments that enhance the Nation's ability to measure and monitor greenhouse gas flows to and from the atmosphere from human and natural sources, accelerate the transition of relevant research capabilities to operational use, and enable a long-term, cost-effective framework for greenhouse gas monitoring.

Advancing national security and technological competitiveness

Agency investments in science, technology, and innovation should strengthen our long-term global competitiveness while reducing catastrophic risks from current and emerging technologies. Investments should prioritize key, competitive technologies; commercialization and scale-up; international cooperation; and catastrophic risk mitigation.

Critical and emerging technologies: Agencies should collaborate to prioritize world-leading research and innovation in critical and emerging technologies, including: trustworthy artificial intelligence (AI), quantum information science (QIS), advanced communications technologies, microelectronics, nanotechnology, high-performance computing, biotechnology and biomanufacturing, robotics, advanced manufacturing, financial technologies, undersea technologies, and space technologies. In AI, agencies should prioritize fundamental and translational AI research to make AI trustworthy, equitable, robust, safe, secure, and both rights- and privacy-preserving. In QIS, agencies should continue research that addresses the hardest problems impeding progress and accelerate the development of quantum technologies that can have societal impacts in the next five years.

Across all critical and emerging technologies, agencies should work to minimize bias and discrimination, appropriately share and use the Federal government's vast troves of non-sensitive data to conduct large-scale analysis that not only preserves and protects privacy and safety, but also utilizes high-fidelity, high-resolution modeling and simulation tools to address critical challenges, including those in public health, climate science, and disaster resilience. Agencies should also collaborate with one another, and with non-government entities, to invest in research institutes that address crosscutting and multidisciplinary challenges related to critical and emerging technologies. Agencies should actively pursue public-private research collaborations that will expedite American leadership in these technologies and grow our inclusive 21st-century economy. Finally, agencies should support and leverage science and technology intelligence and net assessment techniques to evaluate U.S. competitiveness compared with other global actors in the technologies, policies, and innovation ecosystem elements that underpin national and economic security.

Commercialization and scale-up: For decades, many new products have been invented and innovated in the United States, but ultimately manufactured at scale elsewhere. Federally funded R&D can be an important pillar of rebuilding U.S.-based supply chains per E.O. 14017, seeding the market with cutting-edge new technologies, and providing a comparative advantage to American industries providing quality American jobs. Federally funded R&D investments should strategically target growing U.S.-based domestic manufacturing, job creation, and economic prosperity, including in communities historically underserved, marginalized, and adversely affected by persistent poverty and inequality. Investments in economic resilience should emphasize the scale-up of dual-use, hardware-intensive technologies such as semiconductors, as well as technologies that ensure safe, clean, and reliable access to critical products, materials, and minerals, including new manufacturing and biomanufacturing processes that can cost-effectively produce key goods on demand.

International cooperation: International engagement not only produces better science and technology outcomes, but also improves U.S. standing and maintains the norms and practices that underpin the global scientific commons. Agencies should leverage international datasets and expertise, participate in multinational standards-setting bodies and scientific and technical organizations, and enhance international cooperation, including through joint projects, people exchanges, and co-development and co-production initiatives. When considering international investments or withdrawing from international programs, agencies should evaluate how participation might enhance U.S. competitiveness or create vulnerabilities in our absence, especially if competitors fill the void in U.S. presence in a manner that is detrimental to U.S. national or economic security interests.

Catastrophic risk mitigation: Agency investments should mitigate catastrophic risks, including risks associated with biological, nuclear, and cyber weapons. In particular, investments should emphasize biosecurity and biosafety; system survivability, including modernization efforts that ensure the survivability of our strategic deterrent; and nuclear non-proliferation, integrated arms control, and treaty verification. Investments should reduce the risk of nuclear accidents and miscalculation; enhance strategic stability through improvements in cross-domain crisis communication; and assess the national security risks associated with fusion energy. Investments should prioritize resilient and secure undersea, terrestrial, and space-based communications and should defend critical infrastructure and sensitive networks against cyberattacks and supply chain attacks. This includes funding research in the foundational elements of cybersecurity and in improved authentication mechanisms, zero-trust architectures, security and resilience of embedded systems, anomaly detection for critical infrastructure, software security, and intrusion detection.

Innovating for equity

Agencies should operationalize the Administration's whole-of-government effort to advance equity for all, including at the program level, including the deployment of scientific research and technological advances to drive equitable outcomes for the American public. For example, agencies should develop and implement measurable strategies to promote diversity, inclusion, equity, and accessibility and advance environmental justice, across all R&D focus areas, while building equitable STEM education and workforce ecosystems for all learners and workers. Further, as part of the whole-of-government approach to advance equity across the Federal Government, when possible, program level activities should seek to encourage meaningful engagement with and participation of underserved communities and underrepresented groups, for example, in accordance with the Justice40 Initiative.

Innovative funding mechanisms and programs: Agencies should pursue R&D program structures and policies to equip under-resourced institutions, including some Historically Black Colleges and Universities, Minority Serving Institutions, Tribal colleges, community colleges,

and institutions in underserved geographic regions to successfully compete for R&D funding. Taken together, these institutions educate the majority of the American population, so their success significantly strengthens the Nation's ability to develop a diverse, vibrant, and excellent STEM workforce, and contribute to the STEM innovation ecosystem. Furthermore, agencies should coordinate to assess and ensure that Federal resources are not distributed to any institutions who have been found to violate safe, respectful, and non-discriminatory STEM workplaces.

Equitable data infrastructure: Agencies should develop data infrastructure that facilitates identification of inequities across sectors at scale, especially in underserved communities that have been systematically denied a full opportunity to participate. Agencies should develop policies and protocols to facilitate broader participation, including those that facilitate data linkage across Federal agencies that house the complementary data needed for equity assessment, that create or facilitate interoperable data systems, and that make data available to the public in ways that are useful to them, while protecting privacy and upholding ethical principles. This includes a focus on government-wide collection of robust demographic data, especially the underutilized, inaccessible, or missing data needed to measure and promote equity, including sexual orientation and gender identity; and access to, participation in, and use of Federal research and resources by underserved and marginalized groups and coordinated agency effort to address identified gaps in equitable allocation. Agencies should characterize their Federally owned or funded datasets to help the R&D community more clearly identify any bias in datasets, and support public access policies and data standardization to encourage engagement with, and wider distribution of, Federally funded research, data, and results, which strengthen scientific integrity and restores trust in government.

Actionable and equitable measurements: R&D agencies should employ evidence-based approaches to ensure that Federal investments are assessed and evaluated for effectiveness and impact, and Federal resources are equitably and broadly disseminated. Analyzing data requires building consensus about how to make sense of data, and other forms of evidence, to advance policy goals and assess policy outcomes, while ensuring equity is at the core of what the government delivers. This includes the evaluation of equitable selection and distribution of awards, procurements, and other multi-agency efforts, and the measurement and evaluation of end-user accessibility of Federal grants, opportunities, and research labs. To promote the Administration's commitment to evidence-based policymaking, agencies should develop coordinated investments in personnel within the agency that can increase equitable and evidence-based communication between the Federal Government and the American public. In support of the Administration's Justice40 initiative, research or applied science programs that meet the investment criteria should integrate metrics to track and report benefits that would flow to disadvantaged communities.

Cultivating an equitable STEM education, engagement, and workforce ecosystem

Agencies should develop budget submissions that consider support for our Nation's STEM students; the instructional, institutional, and informal environments for STEM learning; and the training and recruiting of our future STEM workforce. Agencies should consider the following priorities when formulating their budgets: engaging and motivating our Nation's students in STEM pursuits; preparing and supporting our Nation's STEM educators and institutions; increasing opportunity and reducing bias in our learning and working environments; training, reskilling, and upskilling of our STEM workforce; spurring innovation and entrepreneurship in our research communities; fostering international STEM collaborations that significantly increase domestic and global STEM talent; and attracting STEM talent from abroad. Agencies should also prioritize coordinated investments in educational opportunities related to emerging technologies, including instructional materials, at all levels. Agency coordination to reduce fragmentation and duplication while maximizing impact on STEM education, workforce development, and the Federal STEM workforce

should continue to be guided by the Committee on STEM Education under the auspices of the National Science and Technology Council. Furthermore, agencies should coordinate with State, local, Tribal, and territorial governments to ensure the effective deployment of Federal resources in local contexts.

Agencies should take steps to improve diversity, inclusion, equity, and accessibility in the research workforce, which should include: R&D investments in STEM education at all levels, and particularly at under-resourced schools and institutions; ensuring a living wage for our STEM graduate students and postdoctoral fellows; support for STEM educators; and demonstrable steps toward becoming a model employer. This effort will require multi-agency coordination of policies, tools, and personnel to evaluate and increase the flow of talent from early educational opportunities, internships, apprenticeships, and fellowships into persistent employment in the Federal STEM workforce, and broader science and technology ecosystem.

Promoting open science and community-engaged R&D

Science is a tool that should be available to all of America. More inclusive engagement in science benefits the American people, the environment, and the economy. Trust can be fostered when the American public is both knowledgeable about, and has the ability to be involved in, science research and its products. To build a trustworthy, responsive, ethical, and engaged U.S. scientific and technological enterprise, agencies should invest in making Federally funded R&D accessible to the public in accessible, interoperable, reusable, equitable, secure, and trustworthy way. Federally funded R&D should also be reproducible and transparent, as well as non-discriminatory in impacts on people, grounded in sociotechnical assessment of ethical, legal, and societal implications, and free from improper political interference—all while minimizing administrative burden.

Agencies should seek out public participation in R&D programs wherever possible. Community participation in the scientific endeavor enriches and extends the benefits to the Nation, can increase public trust in science, and leads to more innovative research of all kinds, including research that addresses the needs of diverse communities. Examples of public participation in R&D include open science, which broadens public access to scientific data and publications, and participatory modes of research, such as community-based datahubs that give members of the American public access to Federal resources and data, as well as community-engaged research that respectfully provides opportunities for the public, especially those historically excluded from the scientific enterprise, to contribute to the development of research questions.