NATIONAL SCIENCE FOUNDATION
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NSF 23-066

Dear Colleague Letter: Announcement of Upcoming Topics for the 2023 NSF's Convergence Accelerator Solicitation

March 3, 2023

Dear Colleague:

Building upon the National Science Foundation's (NSF) investments in foundational research, the NSF's Convergence Accelerator program, within the Directorate for Technology, Innovation and Partnerships or TIP, supports use-inspired solutions toward societal impact. The NSF's Convergence Accelerator program model comprises three phases: topic ideation, followed by convergence-research Phases 1 and 2. Teams funded by the Convergence Accelerator include multiple disciplines, a wide range of expertise, and cross-sector partnerships to stimulate innovative ideas and develop long-lasting, sustainable solutions to societal and economic challenges that are organized around the program's research track topics.

The purpose of this Dear Colleague Letter (DCL) is to make the research and innovation community aware of the convergent research topics selected from the program's recent ideation process (based upon Dear Colleague Letter/Request for Information NSF 22-021) for 2023.

These topics will be included as tracks for the 2023 cohort in an upcoming NSF's Convergence Accelerator funding opportunity requesting submissions. By issuing this DCL now, NSF intends to provide additional time prior to the release of the new funding opportunity for researchers, innovators, practitioners, educators, and other constituents to form multidisciplinary teams and consider proposal submission ideas addressing these topics.

TRACK TOPICS SELECTED FOR THE UPCOMING 2023 SOLICITATION

The goals of the NSF's Convergence Accelerator are to *accelerate use-inspired convergent research* in areas of national importance and societal and economic challenges, and to initiate convergent team-building capacity around exploratory, potentially high-risk proposals

addressing selected convergent research topics.

The following topics have been selected to be included in the 2023 solicitation that is expected to be published in the coming months.

TRACK K: EQUITABLE WATER SOLUTIONS

Water is vital for life. It shapes our environment, connects all living things, and is critical for survival. The objective of the NSF's Convergence Accelerator **Track K: Equitable Water Solutions** is to build upon foundational knowledge and advancements in environmental sciences, geosciences, engineering, computing, social and behavioral sciences, as well as other areas to develop viable solutions for water quality, quantity, and equity issues. This track serves as a platform for multidisciplinary teams to develop real-world solutions that address environmental justice challenges with water distribution, the safety of the water supply, and inequalities in the allocation of water resources. This convergent research track topic was chosen based on the results of NSF-funded community workshops, such as *Managing Water for a Changing Planet* and *Climate Resilience and Water Resources*. Broad topics within this track may include – but are not limited to – solutions that support:

- Design of sustainable water supply systems by delivering novel, effective, unbiased data-driven decision support tools – leveraging artificial intelligence (AI) and machine learning – and technical solutions, e.g., filtration devices, and new materials for transportation and storage among others.
- Development of tools, technologies, and approaches to address watersheds as a whole; specifically in relation to water distribution, the safety of the water supply, and inequalities in the allocation of water resources, including new computational and technical as well as social and behavioral solutions to water sharing, such as quality and quantity projections and economic models.
- Creation of equitable access and engagement with freshwater resources, including engagement through training and workforce development, new models, and technical solutions.

TRACK L: REAL-WORLD CHEMICAL SENSING APPLICATIONS

The overarching goal of NSF's Convergence Accelerator **Track L: Real-World Chemical Sensing Applications** is to develop novel energy-efficient and miniaturized or portable biological and chemical sensors for tangible applications. This track builds on a wide range of foundational knowledge and advances in olfaction, bio-sensing, and chemical sensing to undertake the challenging steps of transforming these scientific discoveries into practice. It serves as a platform for convergent teams to develop tools, technologies, and applications to address challenges aligned to chemical sensing. This convergent research track topic was chosen based on the results of NSF-funded community workshops, such as *Frontiers in*

Chemical Sensing: Synthetic, Neuromorphic and Cyborg Systems and *Chemical Sensing with an Olfaction Analogue: High-dimensional, Bio-inspired Sensing and Computation*. Broad topic areas within this track may include – but are not limited to – the following:

- Development of innovative biological and chemical sensor systems inspired by applications in environmental sensing, agriculture, food production and quality control, homeland security, home healthcare (e.g., miniaturized and low-power point-of-care diagnostic systems), and geoengineering (e.g., low-cost, long-life miniaturized wireless sensors for greenhouse and other toxic gases/species). Systems may be based on advances in biological olfactory research, gene editing, synthetic biology, electronic nose technologies, materials science, chemistry, analyte preparation technologies, signal transduction technologies, biomanufacturing, printed electronics, bio-hybrid systems, neuromorphic systems, detection algorithms, AI and machine learning, brain-machine interfaces, and robotics.
- Creating benchmarks and standards, calibration techniques, training data sets, and data management and storage platforms. Deliverables may include, but are not limited to, simulants, rapid sensor calibration techniques in context, standardized methodologies for collection and annotation of data from biological and chemical sensors operating in diverse real-world conditions, and open repositories for large-scale, sensor-derived datasets created with broader community participation.
- Development of models for integration across modalities for data fusion, inter-device transferability, and source localization in diverse contexts to generate real-time, reliable, and quantifiable results. These could include models based on advances in fate and transport and adaptive modeling, transfer learning, and dimensionality-reduction strategies.

TRACK M: BIO-INSPIRED DESIGN INNOVATIONS

Globally, societies face complex challenges, including climate change, environmental degradation, lack of sustainability, and threats to health and safety in natural and built environments. These challenges require creative solutions beyond current capabilities. The overarching goal of NSF's Convergence Accelerator **Track M: Bio-Inspired Design Innovations** is to bring together scientists and practitioners to develop concepts, approaches, and technologies that build and control in the same way nature does – capitalizing on millions of years of evolution – to find novel solutions to major societal and economic challenges. The convergent research track topic was chosen based on the results of an NSF-funded community workshop on *Bio-Inspired Design*. Broad topics within this track may include – but are not limited to – the following:

- Development of materials with features such as programmable self-assembly, multi-modal sensing, computation, memory, adaptation, and healing and regenerative

capabilities.

- Novel manufacturing capabilities that harness advances in synthetic biology, bioengineering, nanofabrication, and 3D printing.
- Engineering complex systems with novel properties based on principles of synthetic biology, bioengineering, and robotics or organismal biology (e.g., organoids, microbial consortia, collective swarms).
- Computational modeling and theory-enabled methods and tools for bio-inspired designs.
- Applications in areas including, but not limited to, environmental monitoring, bioremediation and preservation, sustainable materials, biological manufacturing, personalized healthcare, resilient infrastructure, and agriculture and food production.

The 2022 solicitation (NSF 22-583) and Broad Agency Announcement (NSFBAA-CA22-02) published by the NSF's Convergence Accelerator program provide further details about the program structure and can be used as a resource until the 2023 solicitation is published. For example, as outlined in the 2022 solicitation, in addition to the standard NSF merit review criteria of Intellectual Merit and Broader Impacts, proposals should also address Convergence Research, Partnerships, Deliverables, and Track Alignment, which constitute key components of funded NSF Convergence Accelerator projects.

Should you have questions about this DCL, please contact the Convergence Accelerator program at: Convergence-Accelerator@nsf.gov.

To receive up-to-date information on NSF's Convergence Accelerator program, including the anticipated 2023 solicitation and BAA, sign-up for the program's e-mail list or visit the program's website.

Sincerely,

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