

Collaborations to Advance Bioinnovations

DRAFT Concept for an NSF EPSCoR Workshop

Overview

The New Hampshire Center for Multiscale Modeling and Manufacturing of Biomaterials (NH BioMade), in partnership with colleagues from South Carolina, Puerto Rico, Arkansas, and Iowa, as well as the Advanced Regenerative Manufacturing Institute, propose to hold a national symposium on bioinnovations to share knowledge among academic and industry researchers and catalyze new collaborations. The symposium would be held June 25-26, 2024, in Manchester, NH.

Background

Advances in biomedical product and devices hold great potential to save patient lives and improve overall quality of life. This national symposium will focus on three bioinnovations:

- Tissue engineering, which has considerable promise to grow replacement organs for patients, ideally from their own cells in order to assure acceptance after transplant.
- Biosensors, e.g., wearable or imbedded devices, which can assess biological conditions, monitor processes, e.g., in a tissue foundry, etc.
- Advanced orthopedic implants, which are essential due to the aging population and need for patient specific hardware.

There are crosscutting topics that will be explored during the symposium as well. For example, biomaterials, such as those used in tissue engineering, biosensors, and implants, have stringent and potentially conflicting specifications (weight, strength, porosity, electrical conductivity, and complex geometries). Their natural analogs are heterogeneous and hierarchical in their composition, structure, and properties. Fabricated man-made biomaterials are homogeneous and not yet widely available. In addition, advanced manufacturing processes are required in order to create biomedical devices and products for mass customization. Finally, computational modeling to drive the design and manufacturing of biomedical products, devices, and materials will be essential in order to realize the potential benefits. This model-make-measure approach is a part of integrated computational materials engineering to optimize solutions for the given application.

Why New Hampshire?

New England is home to an emerging biomedical ecosystem centered in the Cambridge, MA with four EPSCoR jurisdictions, i.e., NH, ME, RI, and VT, in close proximity to benefit from the growth of the industries and technologies in these areas. There are several efforts in NH, in particular, that will support these efforts to build capacity in New England for a vibrant biomedical ecosystem.

The New Hampshire Center for Multiscale Modeling and Manufacturing of Biomaterials ([NH BioMade](#)) was established in 2018 to advance the design and manufacture of hierarchical, heterogeneous biomaterials and enabling the knowledge to predict and control their composition, structure, properties, and function. Four synergistic research thrusts address four distinct material systems: 1) composites for orthopedic bearings; 2) sheet metal for trauma fixation; 3) microporous polymeric scaffolds for tissue

engineering; and 4) porous, conductive structures for biosensor applications. NH BioMade is led by the University of New Hampshire (UNH), with research partners at Dartmouth College and the Thayer School of Engineering, and Keene State College, and is supported by a five-year award (#1757371) from the National Science Foundation EPSCoR Research Infrastructure Improvement (RII) Track-1 program.

The Advanced Regenerative Manufacturing Institute ([ARMI](#)), which is a non-profit Manufacturing Innovation Institute (MII) within the National Institute of Standards and Technology's (NIST) Manufacturing USA network, is focused on large-scale manufacturing of cells, tissues, and organs. It operates a consortium of more than 160 member organizations, i.e., BioFab USA, and a tissue foundry, a 30,000-square-foot, state-of-the-art development center to enable the scalable, consistent and cost-effective manufacturing of engineered cells, tissues, and organs. ARMI was established in 2016 with an \$80MM award from the US Department of Defense Manufacturing USA program. Its newest endeavor, the BioFabrication Cluster, received a \$44MM grant from the US Economic Development Administration in 2022 to create the ecosystem for a new industry focused on cells, tissues and organs for human transplant. **NOTE APRIL WORKSHOP**

NH Life Sciences (NHLS) is a nonprofit organization (501-C6 pending) supporting and fostering a vital and prosperous life science community in New Hampshire. The NHLS scope encompasses the Medical Device/MedTech, Biotech, BioPharma, Diagnostics, and Research life sciences subsectors. The NHLS mission is to help build a vibrant life sciences community in NH by connecting and providing a voice for life science companies to support economic growth, innovation, workforce development, effective public policy, and improved patient health. NHLS plays an important role in helping our Life Sciences ecosystem come together, convening stakeholders across industry, government, and academia to ever deeper levels of engagement across NH and beyond to establish NH as a leader in the life science industry.

[Upper Valley MedTech Collaborative](#) (UVMTC) is the business association for medical device companies located in NH's Upper Valley (the region surrounding Dartmouth College and its Geisel School of Medicine). The UVMTC brings together medical technology entrepreneurs, companies, and investors in the region to address the complex challenges they face when trying to bring a device to market and to grow their medtech businesses.

Beyond New Hampshire

Based on conversations with colleagues at the recent (Nov. 2022) NSF EPSCoR National Conference in Portland, ME, there is interest among dozens of scientists and engineers conducting related research in South Carolina, Puerto Rico, Arkansas and Iowa. Prior to submitting a full proposal to NSF EPSCoR, we will circulate this white paper to those colleagues for comments and to raise interest in the symposium.

If awarded, we will publicize the symposium throughout the EPSCoR community and to industry partners. As the first steps toward a future joint effort with industry, we will extend invitations to regional and national consortia such as Mass Bio, a global leader in life sciences with more than 1,600 members, headquartered just an hour from Manchester. We plan to publish special issues in at least two peer-reviewed journals from the symposium presentations.

South Carolina: The current five-year NSF EPSCoR Track-1 project, Materials Assembly and Design Excellence in South Carolina ([MADE in SC](#)) has two research focus areas related to the topic for this symposium: stimuli-responsive polymeric materials and interactive biomaterials (award # 1655740). A proposed new Track-1 project will focus on AI-enabled devices for personalized healthcare.

Puerto Rico: The current five-year NSF EPSCoR Track-1 project, Center for the Advancement of Wearable Technologies ([CAWT](#)), has two research areas related to the topic for this symposium: design of a wearable optical setup to improve measurements of hemoglobin content and prediction of electronic conductivity and chemical structures using Natural Language Processing techniques (award #1849243).

Program

We envision a two-day program at a hotel in Manchester, NH, close to the state's regional airport, and an hour's drive from Boston Logan International Airport. The core of the program will be technical presentations by researchers, from academic and industry, in three breakout session tracks, each with 12 presentations over the two-day, including track keynote presentations:

1. Tissue Engineering
2. Biosensors
3. Orthopedic Implants

There will be a plenary talk each day, and presentations by industry personnel on topics, such as technology commercialization. There will also be structured networking opportunities and a poster session for student authors. An optional field trip to ARMI's tissue foundry will be offered in the afternoon of the second day. In addition, optional field trips to see research facilities at UNH and Dartmouth College will be offered on a third day.

Steering Committees

A program committee will be composed of senior and early-career faculty at UNH and Dartmouth College with additional members invited from ARMI, the University of Puerto Rico, the University of South Carolina, and Clemson University. The program committee, with input from the leadership teams of the three EPSCoR Track-1 projects, will identify prospective plenary and track keynote speakers. The program committee, led by the early-career faculty in order to provide professional development opportunities for them and personnel capacity building for the jurisdictions, will organize the special issues and invite top researchers in the field to give presentations at the symposium.

A logistics committee composed of professional staff from NH EPSCoR and UNH will provide support to the program committee. They will liaise with the venue event staff and manage registration, communication, travel advice, and administration of the EPSCoR award and other revenue, with oversight by the UNH Sponsored Programs Administration.

Participants

We anticipate that the symposium will attract 200-250 attendees from academia and industry. Travel support will be provided for up to 12 student authors to present posters. Through a NSF workshop grant, the registration costs will be low enabling EPSCoR researchers from across the country to participate as well as leading researchers in the area of bioinnovations to engage.

Outcomes

A tangible outcome will be the special issues of peer-reviewed journals. In addition, capacity build, in particular from the opportunity of early-career faculty to be guest editors of special issues and interact with top researchers in their fields through track organization, will be a significant outcome. Longer-term outcomes will be new collaborative research projects and continuing regional symposia to strengthen connections between university and industry researchers.

Evaluation

We will gather baseline data on participants during the registration process and update that data with an exit survey. During the symposium, we will use instant polling to measure satisfaction with the program. The NH EPSCoR staff will track citation information of the special journal articles over three years.

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