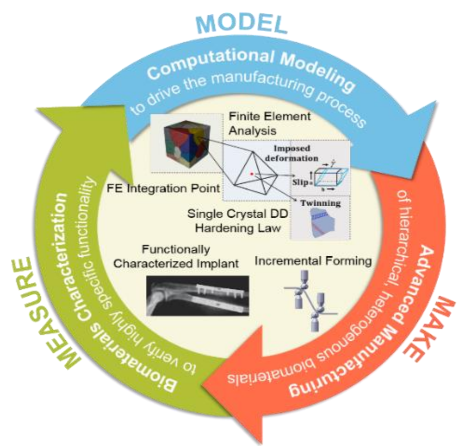
NH BioMade

Advances in biological research hold potential to save patient lives and improve overall quality of life. Biomaterials, such as those used in implants and tissue engineering, have stringent and potentially conflicting specifications (weight, strength, porosity, electrical conductivity, and complex geometries).



Systems-level approach to research

The goal of the NH Center for Multiscale Modeling and Manufacturing of Biomaterials is to advance the design and manufacture of biomaterials and develop the knowledge to predict and control their composition, structure, properties, and function. This will be accomplished through a model, make, and measure, systems-level approach to the research. The depth of knowledge and engineering innovations advanced by NH BioMade will be transferable to other biomaterials and manufacturing techniques for fundamental and industrially-based research and practice.

Addressing opportunities identified in the 2016 NH University Research and Industry Plan, NH BioMade will build research capacity by investing in: 1) intellectual capital through 11 new faculty hires across three institutions; 2) a shared, virtual core facility for high-performance computing, advanced manufacturing, and state-of-the-art biomaterials characterization; and 3) statewide education and training initiatives. It is closely aligned with the Advanced Regenerative Manufacturing Institute in Manchester, which is a DoD-established Manufacturing USA institute focused on large-scale manufacturing of engineered tissues and tissue-related technologies with $294M in initial investment.

Example of trauma hardware

NH BioMade is led by Brad Kinsey, University of New Hampshire professor of mechanical engineering and materials science, director of the UNH Center for Advanced Materials and Manufacturing Innovation, and interim director of the UNH John Olson Center Advanced Manufacturing Center, with research partners at UNH (John Tsavalas, Harish Vashisth, Erik Berda, Craig Chapman, Marko Knezevic, Kyong Jae Jeong, Yaning Li, and Igor Tsukrov) and Dartmouth College (Ian Baker, Doug Van Citters, Katherine Mirica, Weiyang Li, and Chenfeng Ke).

The core facilities created for this research are with respect to high-performance computing (including CPU and GPU cores), advanced manufacturing (in particular rapid prototyping), and biomaterials characterization, (including a micro-computed tomography scanner). Research-based seed funding opportunities will be available for emerging area pilot studies, industry-university collaborations, and utilizing the core facilities.

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www.nhepscor.org/nh-biomade

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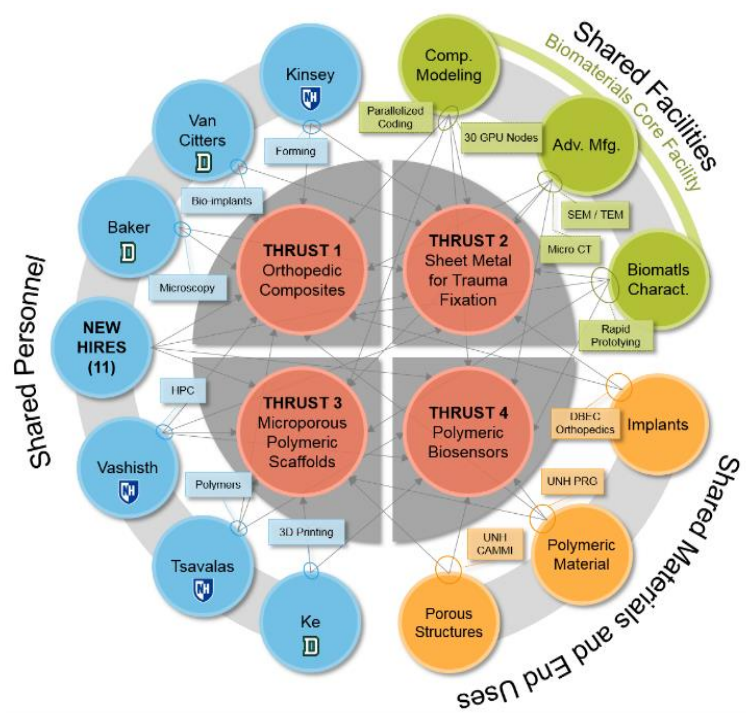
EPSCoR Advancing Research for a Better New Hampshire

NH BioMade Advancing Biomaterials

NH BioMade Research Thrusts

Research Thrust	Hypothesis
1: Composites for orthopedic bearings	Highly localized shearing induced by Equal Channel Angular Extrusion promotes polymer chain interaction and entanglements, which in turn directly impacts particle fusion and structural development at the crystalline scale and achieves regional differences in porosity, conductivity, and modulus.
2: Sheet metal for trauma fixation	Increased formability is exhibited by metallic alloys during non-linear deformation by locally controlling the dislocation behavior at the nanoscale, which creates a heterogeneous biomaterial in terms of strength and geometry.
3: Scaffolds for tissue regeneration	Well-defined, prestructured microparticles will enable 3D printing of heterogeneous physical and porous macrostructure through simultaneous self-assembly and top-down biomaterial fabrication.
4: Porous, conductive structures for biosensor applications	Supramolecularly cross-linked polymers can serve as a 3D printing template to create hierarchically-organized functional nanomaterials, allowing cooperative assembly of conductive MOFs with the polymer network, which in turn enables precise bottom-up control over molecular and nanoscale porosity of electrode materials.

NH BioMade Technical Integration Points



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