Grand Challenge: Biomaterials Innovation Ecosystem for the Development of Low-Cost and Improved Healthcare Delivery

The convergence of advances in computing (e.g., quantum computing), bioinformatics, imaging, robotics, tissue engineering and regenerative medicine promises game-changing benefits for future healthcare delivery. Biomaterials will be a key enabler many of novel technologies to stimulate advancements in cardiology, neurology, ophthalmology, dentistry, diagnostics, aging, orthopaedic and musculoskeletal medicine, real-time health monitoring and drug delivery. Indeed, the ability to engineer patient specific solutions will be facilitated in large part by advances in the application of biomaterials research. To meet this challenge and position UAB at the forefront of future healthcare delivery we propose a UAB *Biomaterials Innovation Ecosystem*; a strategic investment to develop biomaterials research infrastructure, bring together UAB biomaterials researchers and also attract key interdisciplinary faculty and external partners. The Biomaterials Innovation Ecosystem will accelerate research to improve patient outcomes and make UAB a leader in Biomaterials and a leader in the convergence of disciplines to advance health and health care delivery.

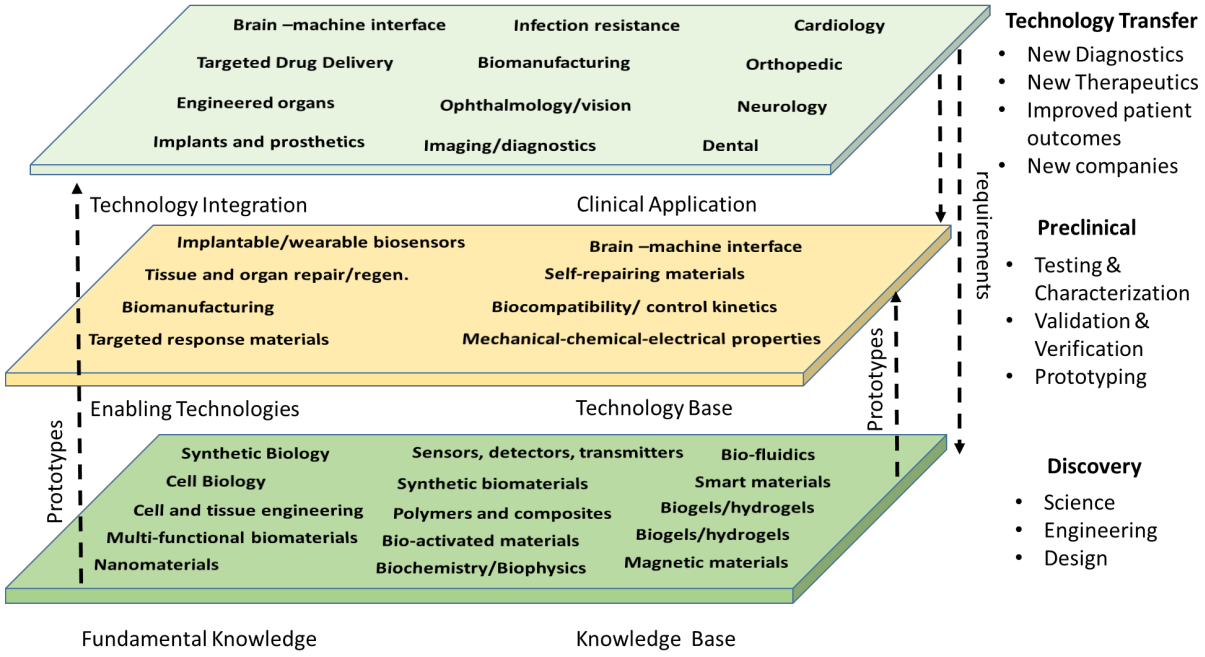

Fig. 1: UAB Biomaterials Innovation Ecosystem

Driven by the potential for tissue engineering and regenerative medicine technologies to restore and regenerate fully functional biological tissues and organs that can evolve as a patient ages and by drug delivery systems with potential to target specific sites within a tissue or tumor, there is an opportunity to develop next generation biomaterials that are not simply biocompatible, but can grow, adapt and function *in vivo* throughout the life of the patient. Thus, developing platform technologies to innovate biomaterials development and manufacturing to improve diagnosis, advance targeted and personalize therapy and enable tissue engineering and

regenerative approaches to tissue and organ replacement is a timely and achievable grand challenge.

Approach: UAB Biomaterials Innovation Ecosystem: The *Biomaterials Innovation Ecosystem* (Figure 1) will impact multiple clinical areas. It will stimulate collaborations between clinicians, scientists and engineers to innovate and advance the science and engineering knowledge base to develop novel biomaterials approaches to healthcare solutions. The vision for collaboration and progression from discovery-based science and engineering, development and validation of enabling technologies and demonstration of clinical efficacy of novel technologies is illustrated on the left. In parallel, UAB, in partnership with the IIE and local and national companies, will exploit the potential for broader development of enabling technologies and transfer of novel diagnostics and therapeutics to industry as shown on the right.

UAB is uniquely positioned to lead a national effort to develop next generation biomaterials with architecture and surface properties to accelerate development of tissue engineering, regenerative medicine and targeted drug delivery approaches to curing disease and replacing lost tissue and organ function. In 2017 leaders from the Schools of Engineering, Dentistry, Medicine, and the College of Arts and Sciences formed a working group charged with developing an approach to consolidate and grow biomaterials research at UAB. Interacting with more than 40 key opinion leaders and thought leaders across UAB, Alabama and the US, the group identified many opportunities including the potential to develop an infrastructure to solve medical problems across the clinical spectrum leading to opportunities for economic development in Birmingham and Alabama. Emergent themes for UAB include development of self-interrogating materials and self-healing materials with controlled surface chemistry and spatiotemporal control of bioactivity that include personalized materials adapted to patient specific genetic makeup. These innovations will impact all areas of medicine from cardiovascular, neurology, dentistry and orthopaedics to ophthalmology, transplant medicine, cancer therapy and personalized medicine. This effort will leverage existing strengths at UAB, local industry and partner institutions in materials innovation and applications development.

Funding: Development of a *Biomaterials Innovation Ecosystem* centered at UAB will drive new interdisciplinary research, technology innovation and its application across five UAB schools. Investments to grow and diversify the UAB research portfolio while taking areas of strength to a higher level will lead to a national center of excellence in an area fundamental importance to all of UAB's areas of medical strengths. In addition, processes and products emerging from the UAB biomaterials ecosystem will attract new investments, generate new businesses and boost economic development in Birmingham and Alabama; concentrating a powerful team to support a broad range of health and medical Grand Challenges.

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Potential Partners: **UAB**: Schools of Engineering, Medicine, Dentistry, Optometry, Business, CAS (Chemistry, Physics, Biology), University-Wide Interdisciplinary Centers, Engineering Innovation and Technology Development Center, Institute for Innovation and Entrepreneurship, UAB I-Corps. **Birmingham**: Innovation Depot, Southern Research, Birmingham Business Alliance, BioHorizons, Evonik. **Alabama**: University of Alabama at Huntsville, University of Alabama, Auburn University, Economic Development Partnership for Alabama, BioAlabama.