Tissue Template Engineering & Regeneration Laboratory

The multidisciplinary **Tissue Template Engineering and Regeneration Laboratory,** directed by Professor Gary Bowlin, has two primary foci: biomaterials for biomedical applications and engineering templates for regenerative medicine and biomedical implants.

-Research Focus 1-

The **Biomaterials for Biomedical Applications Group** works to develop "ideal" engineered templates for the regeneration of a variety of functional tissues including blood vessels, bone, and cartilage. The laboratory's current focus is the design and application of novel, application-specific, electrospun templates via traditional electrospinning, electrospun fiber-clusters, air-impedance electrospinning, and near-field electrospinning.

Dr. Bowlin and colleagues are pioneers and world-leaders in the electrospinning of nano-to-micro scale fibrous templates from biopolymers including collagen types I, II, III and IV, elastin, fibrinogen, gelatin, hemoglobin and myoglobin as well as synthetic, bioresorbable polymers (poly (glycolic acid), poly (lactic acid), polydioxanone and polycaprolactone), and various blends of all the above to utilize the strengths of each individual component in designing templates.

-Research Focus 2-

The **Engineering Templates for Regenerative Medicine and Biomedical Implants Group** features collaboration with Dr. Marko Radic from the University of Tennessee Health Science Center, Immunology, This group is engineering acellular templates (varying architecture and composition) that will harness the body as a bioreactor to promote *in situ* regeneration. The group is highly focused on the template-interacting, microenvironment-determining neutrophils (TIMNs)) and their potential to promote regeneration and tissue integration (i.e. angiogenesis).

This team has investigated the role of the initial, *in vitro* and *in vivo*, neutrophil response to electrospun templates of different architecture and composition to provide preliminary data in support of this paradigm shift regarding the innate immune system-template response. Derived from these data, we have shown that a tailored template architecture (fiber diameter, pore size, and surface-area-to-volume ratio (SAVR)) and composition (fiber polymer and SAVR-dependent adsorbed proteins as determined by *in situ* quantification) regulates the neutrophil-driven, early-stage innate immune response.

For more information please visit:
http://www.memphis.edu/bme/faculty/profile.php

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-Infrastructure-

Electrospinning & Template Characterization

- Customizable, Traditional Electrospinning System
- Custom Air-impedance Electrospinning System
- Custom Near-field Electrospinning System with 3D Polymeric Additive Manufacturing Capabilities
- Pascal 140 Series Mercury Porosimeter
- Pascal 240 Series Mercury Porosimeter

Tissue Bioreactor & Template Cell Interaction Characterization

- Bose® 5500 Test Instrument
- Bose® 5500 Test Instrument 24-well Plate Compressive Loading Bioreactor
- Bose® 3DCulturePro Bioreactors
- Rotary Cell Culture Systems
- Odyssey CLx System (LI-COR, Inc.)
- MagPix System (Luminex Corp.)

-Recent Publications-

- Localized Delivery of Cl-Amidine from Electrospun Polydioxanone Templates to Regulate Acute Neutrophil NETosis: A Preliminary Evaluation of the PAD4 Inhibitor for Tissue Engineering. Frontiers in Pharmacology, 2018.
- The Effect of Manuka Honey on Neutrophil Cytokine Release. Tissue Engineering Part A, 2017.
- Electrospun fibers/branched-clusters as building units for issue engineering, Electrospinning, 2017.
- Electrospun Template Architecture & Composition Regulate Neutrophil NETosis In Vitro and In Vivo, Tissue Engineering Part A, 2017.