Seminar

Wednesday, May 2, 2018

11:00 AM – 206 Furnas Hall

Surya Mallapragada

Professor

Department of Chemical and Biological Engineering

Iowa State University

Biomaterials to Modulate the Tissue Microenvironment

This talk will focus on two different collaborative projects that illustrate how biomaterials can be tailored to provide chemical or electrical cues to surrounding cells and tissues to achieve desired outcomes for treatment.

The first part of the talk will focus on how nanomaterials can be used to deliver combination therapies for the treatment of pancreatic cancer. Pancreatic cancer has a very high fatality rate, and the current treatment using gemcitabine (GEM) does not work effectively, partly due to desmoplasia. Development and use of dual delivery nanoscale devices to deliver miR-345 and GEM together resulted in downregulation of the Sonic hedgehog signaling pathway and led to inhibition of desmoplasia, pancreatic stellate cells and cancer stem cells. This, in turn, improved therapeutic outcomes of GEM in pancreatic cancer in mice through improving its perfusion in the tumor, and also led to significant reduction of metastasis.

The second part of the talk will focus on biomaterials to control stem cell fates. Over 200,000 peripheral nerve repair surgeries are carried out each year. The current gold standard for treatment involves autografts, which suffer from significant drawbacks such as partial denervation at the donor site. A promising alternative involves degradable conduits seeded with Schwann cells to provide physical guidance and to secrete neurotrophic factors to facilitate peripheral nerve regeneration. However, due to the difficulties in obtaining Schwann cells for this treatment, we have developed a 2D graphene inkjet printed circuit to electrically stimulate readily-accessible bone marrow-derived mesenchymal stem cells and transdifferentiate them to Schwann cell-like phenotypes. We have demonstrated enhanced secretion of nerve growth factor (NGF) from the transdifferentiated cells as opposed to the undifferentiated MSCs. This is the first time that transdifferentiation of MSCs to Schwann-cells have been successfully achieved solely with electrical stimulation.

Refreshments at 10:45

University at Buffalo
Department of Chemical and Biological Engineering
School of Engineering and Applied Sciences