The presentation will focus on a selected set of ongoing NIH-funded projects at the College of Nanoscale Science and Engineering (CNSE) of the SUNY University at Albany. This will include an overview of the infrastructure, faculty, and operational model used by CNSE to integrate basic nanobio research with materials science and wafer processing.

The first example describes the design and optimization of a new, versatile chemotaxis device called the NANIVID (NANo IntraVItal Device), which is created using IC fabrication processes. This device is designed to better understand the tumor microenvironment, monitor interactions between different cell types, and the effects of particular chemical gradients. The NANIVID contains a customized hydrogel blend that is loaded with EGF, which diffuses out of the hydrogel to create a chemotactic gradient to attract specific cells to the device. Additionally, the NANIVID can be modified to act as a delivery vehicle to generate gradients of other soluble factors in order to initiate controlled changes to the microenvironment, including the induction of hypoxia, manipulation of ECM stiffness, etc.

The second example focuses on salivary gland hypofunction, a significant clinical problem often caused by the autoimmune disease Sjögren’s syndrome or by head and neck irradiation for cancer patients, and characterized by a loss of function of salivary gland acinar cells. In this project, the effort is focused on creating engineered substrates which resemble the nanoscale, microscale, and chemical characteristics of the basement membrane surrounding acinar cells in vivo. To accomplish this, homogenous electrospun PLGA nanofibers were used as an artificial basement membrane and deposited within curved “craters”, to mimic the microscale architecture of the basement membrane surrounding acini. Finally, the nanofibrous craters were covalently functionalized with basement membrane proteins laminin-111 and fibrin to promote apicobasal polarity in the acinar cells. The ultimate goal is to establish practical steps toward the eventual creation of a bioengineered implantable salivary gland.