College of Engineering
Department of
Mechanical & Industrial Engineering

The Robert W. Courter Seminar Series

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ZOOM: https://lsu.zoom.us/meeting/register/tJApd-mhqzssHNAtbx8xlujIXfCf28JLgcJB

Functional Imaging: when "seeing is believing" may not be sufficient

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Given the importance of visual information in characterizing the world around us, we always strive to "see things" to make assessment. Microscopy has been the workhorse of biological and material discovery for the last three centuries. High resolution imaging of materials structure is a hallmark of materials science, but properties should also be resolved on the nanoscale to establish quantitative nanoscale structure-property relationships. Therefore, in many instances just having the structural information may not be sufficient to understand the materials under investigation. For example, chemical imaging can be utilized to create a visual image of the composition, structure, and dynamics of materials (living or non-living). Through chemical imaging, we can gain fundamental understanding of spatial and functional behavior of matter in four dimensions (space and time).

Our group combines spectroscopic measurements with microscopy techniques to visualize the electronic, optical, and biological properties of materials (biomaterials and non-biological materials) with a resolution commensurate to that of sample under study. In this talk, application of this method for regenerative medicine will be given. The components of regenerative medicine span from single cell to whole-organ. To ensure that research is translated from bench to bedside, we need to have the ability to assess regenerative processes in cells, tissues, organs and patients at a biochemical level. Conventional methods in pre-clinical research use "label" (such as dye, contrast agents, fluorescence, quantum dots) to study the cells/tissues. However, the reagents to label the system itself might perturb the system. For example, hematoxylin and eosin (H&E)-stained cryosections are often utilized to provide a preliminary diagnosis in cancer. In addition to being amenable to artifacts, H&E processing involves the use of xylene, an organic solvent that removes lipids. As a result, capturing and assessing lipid-related diagnostic information is not possible. Hence, there is an unmet need to develop bioanalytical methods that are non-invasive, non-destructive and label-free (methods that do not require reagents). Some label-free techniques such as Raman, second harmonic generation (SHG) and Hyperspectral microscopy will be discussed, which are being used to study adipogenesis in human adult stem cells (ASCs) and lipidomics in brain tissues.

* Dr. Manas Ranjan Gartia received his Ph.D. degree from University of Illinois at Urbana-Champaign (UIUC) in 2013, and joined LSU as an Assistant Professor in the Department of Mechanical and Industrial Engineering in 2015. He has published over 90 journal and conference papers as well as 8 patents (issued/pending). His research focuses on designing and developing sensor technologies and devices for the applications of biomedical imaging, environmental sensing and mobile health. Dr. Gartia received the *LSU Alumni Association Rising Faculty Research Award in 2017*. His recent work on breast cancer gene detection using a smartphone was also highlighted by local TV channels such as *WBRZ, WAFB, LPB* and local newspaper *The Advocate*.