From etiology to diagnostics and therapy: a convergent approach to foster comprehensive

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Abstract: Significant research efforts have been directed towards major diseases. Yet, burdens of some understudied diseases are on the trajectory of rapid increase. Due to limited prior research efforts, data related to the mechanism, defined biomarkers and effective therapeutic targets for these diseases are lacking. Instead of addressing these challenges individually, it is essential to leverage an interdisciplinary and collaborative approach of converging biochemistry, biophysics, biomaterials and bioengineering to foster a comprehensive solution. The presentation will detail a study on pelvic organ prolapse (POP), a heavily understudied disease that affected almost one in four women in the United States. We examined the multiscale structure, molecular composition and mechanics of collagen fibrils from pelvic floor connective tissues and established the correlation with clinical diagnostic scores in a patient-specific manner. This led to the development of novel silk-carbon nanotube composite fibers that were tailored to enhance collagen production of patients' dysfunctional fibroblasts and improve tissue repair in vivo after transplantation. Such a cellular therapeutic approach offers a simple, direct and effective way to restore the function of patients' cells for personalized treatment. Another disease model is periodontitis, which affects over 47% of adults over 30 and progresses silently to advanced stages. By assembling a research team of clinicians, chemists, engineers and data scientists, a big-data enabled sensor prototype has been under development to detect diverse salivary biomarkers specific. This was achieved by the integration of microfabrication, spectroscopy, nanoparticle synthesis and advanced machine learning for a portable and label-free salivary sensor for periodontitis detection and therapeutic monitoring. The study will also enable a therapeutic strategy of tuning the salivary components for the treatment oral diseases.

About the speaker: Dr. Rong R. Wang is Professor of Chemistry at Illinois Institute of Technology (IIT). She also serves as the Director of International Center for Sensor Science and Engineering (ICSSE) at IIT. Dr. Wang received her B.S degree from Jilin University, China, and her PhD degree from University of Tokyo, Japan. Prior to joining IIT, she was the Director's Postdoctoral Fellow at Los Alamos National Laboratory. Dr. Wang has expertise in bioanalytical chemistry, physical biochemistry, nanostructured and multifunctional materials, as well as molecular, cell and microbial biologies. Her research focuses on developing new methods, stimuli responsive composite materials and optical / electronic devices for disease diagnostics and intervention, and has been supported by NIH, NSF, DOE, NASA, FDA, as well as local funds and private foundations. Currently she is the PI of two NIH grants, one NSF grant, and one private foundation grant, in addition to several other grants that she contributes as an co-investigator. As ICSSE Director, Dr. Wang brings academic and industrial researchers together to establish cross-disciplinary research projects and education programs. More recently, in reposse to the *CHIPS and Science Act*, Dr. Wang serves on the Steering Committee of Midwest Semiconductor Network and the recently awarded Midwest Microelectronics Consortium Hub by DOD Microelectronic Commons. She is a Standing Member of NIH Cellular and Molecular Technologies (CMT) Study Section and an ad hoc reviewer of other Study Sections. Dr. Wang currently serves as Associate Editor of *Frontiers in Bioengineering and Biotechnology* and on the Editorial Boards of *Bioengineering* and *Journal of Functional Biomaterials*.