The Department of Chemical and Biological Engineering at the University at Buffalo is proud to announce

The 2017 Eli Ruckenstein Lecture

"Hydrogels as synthetic ECM analogs through bio-click reactions"

Kristi Anseth

University at Colorado Boulder
Distinguished Professor, Tisone Professor,
and Howard Hughes Medical Institute Investigator

Friday, April 14, 2017 at 1:00 p.m.
Screening Room First floor, Center for the Arts
UB Amherst Campus
Reception to follow immediately after in Atrium
RSVP: cbe@buffalo.edu or 716.645.1174

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

About Eli Ruckenstein

Eli Ruckenstein, SUNY Distinguished Professor, joined the faculty of the University at Buffalo in 1973. Ruckenstein spent his formative years behind the Iron Curtain, in Romania, where — with a combination of native intellect, genuine scientific curiosity, and sheer strength of will — he began what would become a professional lifetime of achievement in engineering and science, receiving the George Spacu Award for Research in Surface Phenomena from the Romanian Academy of Science as well as awards from the Romanian Department of Education for teaching, for research in turbulent heat and mass transfer, and for research in distillation.

In 1969, he escaped to the West, where his prolific and imaginative research has advanced almost every area of interest to chemical engineering. He has received the Alpha Chi Sigma Award for his work in transport phenomena, the Walker Award for his work in catalysis, and the Founders Award for his overall contributions to science from the American Institute of Chemical Engineers and the Kendall Award for his research in colloids and interfaces, the Langmuir Lecture Award for his contributions to macromolecules, the Schoellkopf Medal for his work in supported metal catalysts, and the Murphree Award in Industrial and Engineering Chemistry from the American Chemical Society. His work in biomolecules was recognized with the Creativity Award from the National Science Foundation. He has presented two Berkeley Lectures in Chemical Engineering and is a winner of the Chancellor Charles P. Norton Medal from SUNY Buffalo. He is a fellow of the AIChE and the American Nano Society.

Eli Ruckenstein was elected to the U. S. National Academy of Engineering in 1990, and in 2004 he was chosen to receive the Academy's Founders Award. He has also been elected to the American Academy of Arts and Sciences, and he has received the Humboldt Award from Germany for his work in surfactants. The Hauptman-Woodward Medical Research Institute named him one of their inaugural Pioneers of Science awardees. His seminal contributions across such a broad range of disciplines were further recognized when the President of the United States awarded him the National Medal of Science in a White House ceremony in 1999. His impact upon the development of the chemical engineering profession resulted in the American Institute of Chemical Engineers designating him as one of 50 Eminent Chemical Engineers of the Foundation age. Several of Dr. Ruckenstein's papers have been republished in four volumes, two on thermodynamics of multicomponent solutions and nanodispersion by Springer, one on catalysis by Wiley, and the most recent on nucleation by CRC-Press.

“Hydrogels as synthetic ECM analogs through bio-click reactions”

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Abstract

Our group is interested in the development of biomaterials to serve as *in vitro* cell culture systems and decipher critical extracellular matrix (ECM) signals that are relevant in tissue development, regeneration, and disease. Specifically, we design synthetic ECM analogs that capture key features of the unique chemistry and physical properties of a cell’s niche—an environment that is not only tissue specific, but can be strikingly heterogeneous and dynamic. Unique to our approach is the ability to create cell-laden matrices in three-dimensional space in which the matrix properties can be changed on demand—so-called 4D biology. Hydrogels functionalized with peptides, proteins and small molecules represent an important class of biomaterials for cell culture; however, 4D culture requires that cells be directly encapsulated during gel formation necessitating novel biorthogonal chemistries. Here, our group has focused on the development of bio-click materials to create tunable cell-laden matrices, using strain-promoted azide alkyne cycloaddition, photoinitiated thiol-ene polymerizations, and bio-orthogonal tetrazine-norbornene coupling through inverse electron demand Diels-Alder. These bio-click reactions not only proceed rapidly and with high specificity, but are bioorthogonal. This talk will illustrate how we leverage these chemistries to present bioactive peptides, signaling ligands, and small molecules at will, and employ them to study the effects of matricellular signaling on diverse cellular functions and processes. For example, we exploit peptide-crosslinked PEG hydrogels to encapsulate human mesenchymal stem cells (hMSCs) and study how matrix density, degradability, elasticity, and adhesivity influence migration in real time. These 3D culture systems are important when testing hypotheses related to cell migration, protease activity, and paracrine signaling; all of which depend strongly on the surrounding microenvironment and cannot be captured in 2D culture. Beyond simply observing cells, we also apply microrheological techniques to measure local gel degradation, and reporter molecules to detect local cell activity in situ (e.g., protease activity, apoptosis). Finally, results will demonstrate that these reactions are compatible with protein encapsulation and conjugation while maintaining bioactivity for cellular signaling.

About Kristi Anseth

Kristi S. Anseth earned her B.S. degree from Purdue University in 1992 and her Ph.D. degree from the University of Colorado in 1994. After completing post-doctoral research at MIT as an NIH fellow, she joined the Department of Chemical and Biological Engineering at the University of Colorado at Boulder as an Assistant Professor in 1996. Dr. Anseth is presently a Howard Hughes Medical Institute Investigator, as well as a Distinguished Professor and the Tisone Professor of Chemical and Biological Engineering at CU. Her research interests lie at the interface between biology and engineering where she designs new biomaterials for applications in drug delivery and regenerative medicine.

Dr. Anseth is an elected member of the National Academy of Engineering (2009), the National Academy of Medicine (2009), the National Academy of Sciences (2013), and the National Academy of Inventors (2015). She is also a dedicated teacher, who has received four University awards related to her teaching, as well as the American Society for Engineering Education's Curtis W. McGraw Award. Dr. Anseth is a Fellow of the American Association for the Advancement of Science, the American Institute for Medical and Biological Engineering, the Materials Research Society, the American Institute of Chemical Engineers, and the International Union for Biomaterial Science and Engineering. She is currently the President of the Materials Research Society and also serves as an editor for *Biomacromolecules, Progress in Materials Science, and Biotechnology & Bioengineering.*

The UB Department of Chemical and Biological Engineering offers a world-class undergraduate education while pursuing integrative research and graduate training at the frontiers of chemical engineering, in the main areas of nanoscale science and engineering, computational science and engineering, and biochemical and biomedical engineering. The CBE department has undergone tremendous growth in the past few years, and added seven new faculty to our ranks. Our faculty includes three members of the National Academy of Engineering, a National Medal of Science awardee, and eight winners of NSF Presidential Young Investigator, New Young Investigator, and CAREER awards.

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The Ruckenstein Lecture Series
is supported by the Ruckenstein Endowment Fund

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