

THE MATERIALS SCIENCE AND ENGINEERING DEPARTMENT
WINTER COLLOQUIUM SERIES PRESENTS:

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Lattice Engineering of 1D and 2D Peptoid Nanocrystals

A surprisingly large number of polypeptoids, either sequenced-defined or not, are able to form supramolecular assemblies with nearly identical rectangular crystalline lattices, where the backbones are extended and aligned directly atop one another. Evidence from direct cryo-TEM imaging, AFM, NMR and X-ray scattering, on many different peptoid nanostructures, further reveal that there is a common conformational motif (referred to as the Sigma strand) where all the backbone amides are in a cis conformation, and adjacent monomers alternate in backbone chirality. This universal structural behavior across many different side chains, enables precision engineering of the peptoid lattice to control nanoscale morphology, and introduce function. Here, we introduce point mutations at specific locations within a peptoid nanosheet crystal lattice to explore the impact of attractive and repulsive ionic and polar-pi interactions. Unique morphologies resulted from these structures including the pH-dependent formation of nanofibers, and binary superlattices. Insights into the molecular basis of these findings by cryo-TEM 3D reconstruction and MD simulation will be discussed.

Ronald Zuckermann is a Researcher Emeritus at the Molecular Foundry at the Lawrence Berkeley National Laboratory, where he studies the mimicry of biomolecular architectures using bio-inspired polymers. He received his BS in Chemistry in 1984 from Harvey Mudd College where he did undergraduate research in synthetic organic chemistry. He then went to UC Berkeley to study Bioorganic Chemistry with Prof. Peter Schultz. His thesis work was on the synthesis of semi-synthetic nucleases capable of the sequence-specific cleavage of RNA. After receiving the first Schultz group PhD in 1989, he became one of the founding chemists at Protos Corp., a combinatorial drug discovery start-up in Emeryville, CA. There he developed several key drug discovery technologies such as robotic combinatorial library synthesizers, affinity selection methods, and a novel class of heteropolymers called "Peptoids". Chiron Corp. acquired Protos in 1991 where this work continued and was applied to small molecule drug discovery, biomimetic materials, and nucleic acid delivery. Dr. Zuckermann was promoted to Research Fellow in 2003. In early 2006, he left Chiron to direct the Biological Nanostructures Facility of the Molecular Foundry at Lawrence Berkeley National Laboratory to do research at the interface of chemistry, biology and nanoscience. There he served as Sr. Scientist and Director of the Biological Nanostructures Facility, where he pioneered the field of peptoid nanoscience, and continues to study the folding of sequence-defined peptoid polymer chains into protein-like nanoarchitectures. He is the organizer of the Peptoid Summit conferences, the founder of the International Community for the Advancement of Peptoids and has published over 200 papers and is co-inventor on 40 patents.

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In person only; no Zoom

Questions? Contact allison.macknick@northwestern.edu