UCMERCED | CHEMISTRY & BIOCHEMISTRY

DATE 04/19/2024 | TIME 10:30am | LOCATION COB1 110

CHEMISTRY & BIOCHEMISTRY SEMINAR SERIES:

Self-assembly of collagen triple helices and higher order assemblies

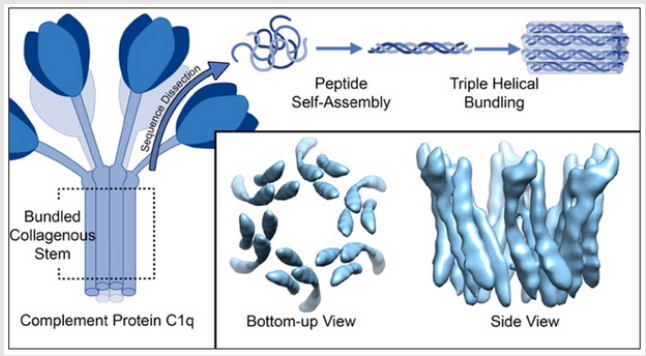
Abstract:

Collagen is the most abundant protein in the human body and plays major roles in wound healing, tissue regeneration, cancer metastasis and the overall integrity of both soft and hard tissues. The defining structural feature of collagen is the triple helix. Depending on the specific type of collagen, these triple helices pack into bundles which continue to pack in a hierarchical assembly process, eventually forming macroscopic collagen fibers. The triple helix is also found in a variety of proteins outside the traditional collagen family such as the Defense Collagens of the innate immune system. Despite this ubiquity the structure-stability-function relationship of the collagen triple helix is poorly understood. These challenges remain because collagen is extremely resistant to the most effective structural analytical methods such as NMR and X-ray diffraction due to extensive post-translational modification, crosslinking and low solubility. We have used Collagen Mimetic Peptides (CMPs), short synthetic peptides with an (Xaa-Yaa-Gly)n sequential repeat, to break through this barrier. I will describe our work to unravel the pairwise amino acid interactions that stabilize triple helix formation and a method for covalently stabilizing self-assembled helices. Understanding pairwise amino acid interactions coupled with helix stabilization has opened the door to applications in biomedical materials for these exciting biomimetic peptides and I will describe our initial efforts in these directions. Beyond the triple helix, collagen assembles into triple helical bundles which are even more poorly understood than the underlying helix. Recent work which exploits the structure of Complement Protein C1q has helped us to shed light on this critical packing problem and generate some of the first designed oligomeric triple helical assemblers.

Jeffrey Hartgerink

Professor of Chemistry and Bioengineering

Rice University



About the Speaker:

Jeff Hartgerink earned his PhD at The Scripps Research Institute with M. Reza Ghadiri and completed a postdoc at Northwestern University with Sam Stupp before beginning his independent research career at Rice University in 2002. His lab focuses on the self-assembly of short synthetic peptides and their application in a variety of biomedically relevant applications. Two projects his lab has made fundamental contributions in include 1) the understanding of collagen triple helix assembly, stabilization and design and 2) beta-sheet nanofiber assembly and gelation. In both cases the improvements in the basic understanding of peptide assembly has led to practical application in biomaterials design. This work is supported by the NIH, NSF and the Welch Foundation. Jeff regularly teaches introductory organic chemistry and graduate level courses in peptide chemistry and supramolecular chemistry. He has advised 30 students to their PhDs in Chemistry or Bioengineering. Jeff was recently honored with Rice's Brown Teaching Award for excellence in teaching and the Rice University President's Award for Mentoring.

For more info, contact: Andrea Merg, amerg@ucmerced.edu