



Jeffrey Hartgerink, Ph.D.

Professor of Chemistry and Bioengineering
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Date: Friday, October 2, 2026

Time: 12:00 to 1:00 PM

Location: SR2 130

Title: Design, Self-assembly and Biomedical Applications of Collagen Triple Helices and MultiDomain Peptide Nanofibers

Abstract: Peptide design followed by solid phase synthesis and self-assembly is conducive to the preparation of complex biomimetic materials. Our lab has focused on two general categories of peptide materials: MultiDomain Peptides (MDPs), which form nanofibrous beta-sheet hydrogels, and Collagen Mimetic Peptides (CMPs) which emulate the triple helical structure of the most abundant protein in the human body. The collagen triple helix is the ubiquitous hallmark of collagen and collagen-like proteins. Until recently this structure has been believed to be largely static, always adopting a right-handed superhelical twist. However, we found through cryo-EM of designed self-assembling peptides that some members of the collagen super family adopt an untwisted structure. This suggests that collagen is far more flexible and varied than previously understood. I will discuss the design and synthesis of a new family of de novo designed collagen-like assemblies and propose novel applications for them in the area of immunomodulation and antibiotic strategies. We have found that MDPs form a sheer thinning / self-healing hydrogel ideal for applications in controlled release. These hydrogel systems can be readily engineered to deliver small molecule drugs, large protein-based biologics and / cells. In addition, we have found that these hydrogels can be 3D printed allowed for control over nano fiber alignment at both the nano- as well as the macro-scale with important ramifications in directed cell growth and tissue engineering applications.

Bio: Jeffrey D. Hartgerink is a Professor of Chemistry and Bioengineering at Rice University, where he also serves as Vice Chair of the Department of Chemistry. He earned his A.B. in Chemistry and Biology from Washington University in St. Louis in 1993, and his Ph.D. in Macromolecular and Cellular Structure and Chemistry from The Scripps Research Institute in 1999. As a graduate student, he worked with Donald Hilvert on the mechanism of chorismate mutase before joining the laboratory of M. Reza Ghadiri, where his research on self-assembling cyclic peptide nanotubes combined molecular modeling, solid-phase peptide synthesis, and high-resolution electron microscopy. Hartgerink continued his training as a postdoctoral fellow with Samuel I. Stupp at Northwestern University from 1999 to 2002, where he designed peptide-amphiphile nanofibers that self-assemble and mineralize to mimic the structure of bone and other biological tissues. He joined the Rice faculty in 2002 as an Assistant Professor, was promoted to Associate Professor in 2008, and became full Professor in 2013. Hartgerink's research program sits at the interface of supramolecular chemistry, peptide design, and biomedical engineering. His group develops synthetic strategies for controlling the self-assembly and folding of collagen-mimetic peptides, MultiDomain Peptide (MDP) nanofibers, and hydrogels, with applications spanning drug and immunotherapy delivery, wound healing, and tissue engineering. He and his group have authored more than 135 peer-reviewed publications and hold numerous U.S. patents on self-assembling peptide biomaterials.

Hartgerink's contributions have been recognized with a National Science Foundation CAREER Award, a Camille Dreyfus Teacher-Scholar Award, a Searle Scholar Award, and induction into the American Institute for Medical and Biological Engineering (AIMBE). He has also been repeatedly honored for teaching and mentoring at Rice, including multiple George R. Brown Awards for Superior Teaching, the Wiess School of Natural Sciences Excellence in Graduate Student Mentoring Award, the Rice University Presidential Award for Mentoring, and the Provost's Award for Outstanding Doctoral Advisor. Within the department, he has served as Associate Chair for both Graduate and Undergraduate Studies and currently serves on the Rice Faculty Senate Executive Committee.