Proteins perform the cellular tasks required for life. The great variety of their biological activity is due in part to their vast combinatorial space: \(20^n\), where \(n\) is the number of amino acids present in any given peptide chain and 20 being the number of natural amino acid monomer building blocks. Yet we do not have the tools to properly engineer these diverse molecules. One approach is to start small: I will present foundational synthetic biology frameworks to rationally develop peptides, tiny proteins that display great sequence diversity but are more amenable than larger molecules to redesign and engineering. My approach is to expand nature’s repertoire to build novel synthetic peptides with extremely useful properties. In addition, I will discuss novel tools for the discovery of novel antimicrobials in biological information, and synthetic biology approaches for building cell-based therapeutics. My overarching vision is to generate a peptide encyclopedia encompassing peptides that target every medically relevant microbe and to devise therapies that nature has not previously discovered. The synthetic peptides that I am developing offer solutions to some of the most pressing unmet clinical challenges we face, including treating currently untreatable antibiotic-resistant infections.

Biography: César de la Fuente, Ph.D. is a Postdoctoral Associate and Areces Foundation Junior Fellow at the Massachusetts Institute of Technology (MIT) working with Prof. Timothy K. Lu and will be starting as Assistant Professor at the University of Pennsylvania in 2019. Earlier in his career, César completed postdoctoral research with Prof. Robert E.W. Hancock at the University of British Columbia, where he had received his Ph.D. in Microbiology and Immunology. Dr. de la Fuente’s scientific discoveries have resulted in over 50 peer-reviewed publications to date. He is first inventor and co-inventor of multiple patents and has consistently been awarded independent funding, including a prestigious doctoral “la Caixa” Foundation Fellowship and a Postdoctoral Fellowship awarded by the Ramon Areces Foundation. Several technologies that Dr. de la Fuente has helped to create are currently under development, and one has been licensed. Dr. de la Fuente’s work has been recognized by NPR Science Friday, Science, Nature Reviews, Popular Science, MIT News, El País, and El Mundo. César is a recipient of numerous awards; most recently he was recognized by MIT Technology Review as an “Innovator Under 35” and named “Boston Latino 30 Under 30” and a 2018 Wunderkind by STAT News. His research focuses on establishing foundational platforms for the engineering of biological systems, with a focus on proteins. To achieve this, César leverages a convergence science approach, drawing on principles and tools from peptide design, synthetic biology, bioengineering, microbiology, and computational biology. These platforms are being applied to tackle a wide range of biomedical challenges, including the global health problem of antibiotic resistance, cancer, and microbiome engineering.

This series at the University of Rhode Island is made possible through the generosity of Amgen, West Greenwich, R.I.

Refreshments provided by the Joseph Estrin Endowment.