Department of
Chemical and Environmental Engineering

2013—2014 Seminar Series

**Friday, May 2 ,2014**
**9:30—10:30 AM**
**WCH 205/206**


## Amy J. Karlsson

**Assistant Professor**
**Department of Chemical**
**And Biomolecular Engineering**
**University of Maryland**


## Engineering Peptides and Proteins to Combat Human Disease


Rational design and directed evolution are both powerful approaches for engineering proteins and peptides. Our lab applies these approaches to exploit the power of proteins and peptides in studying and combatting human disease, and I will discuss applications of protein engineering in fungal disease and cancer. We applied a rational design approach to engineer non-natural antimicrobial β-peptides that exhibit antifungal activity against the fungal pathogen *Candida albicans.* Through this work, we developed a deeper understanding of the properties of β-peptides that contribute to their toxicity towards fungal cells and fungal biofilms, and we are currently working on ways to apply this understanding to designing improved antifungal agents. We have also used directed evolution to engineer antibodies that can fold and function inside cells, which has broad applications in human diseases, including cancer. The reducing environment inside cells prevents formation of the disulfide bonds normally required for proper antibody folding, but we have developed a bacterial inner membrane display system that harnesses the cytoplasmic folding quality control mechanisms of the *Escherichia coli* twin-arginine translocation pathway to engineer proteins able to fold in the cytoplasmic environment. We used this method to display and screen a combinatorial library of single-chain variable fragment (scFv) antibodies and isolated scFvs with dramatic improvements in both antigen-binding and intracellular solubility. We are now using our display method to engineer scFvs for studying and treating cancer and fungal disease.