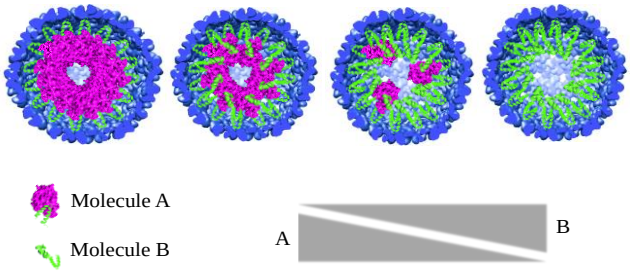
QCB Evenings

Monday, March 4th • 5:30-7:00pm • Chemistry C033

A story of virus particles: Characterization of a biological tool repurposed for remarkable controlled design of soft materials

❖ **Ekaterina Selivanovitch, Douglas Group**

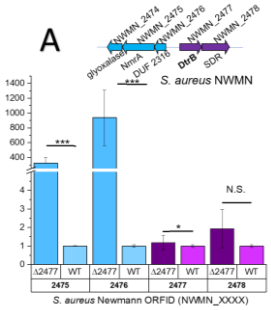
The conventional inquiries into viruses have revolved around the idea that they are pathogens capable of hijacking an organism's cellular machinery. However, within the last few decades scientists have begun to repurpose these remarkable particles for applications in biotechnology and nano-medicine due to their predictable self-assembly and ease of functionalization. Virus-like particles (VLPs) have been used in our lab towards the development of a wide array of VLP-based nanoreactors with control over the nature and packing density of the encapsulated "cargo". This will allow us probe important scientific questions about the behavior of biomacromolecules, specifically enzymes. We have constructed VLPs with a controlled number of enzymes and other macromolecules sequestered within the capsid, in an effort to recreate the crowded cellular environment in which biomacromolecules typically operate. The effects of such conditions are not yet fully understood and gaining further insight is essential for understanding metabolic pathways and developing synthetic catalytic biomaterials. Prof. Pedro de Pablo and his group (Madrid, Spain) are experts in probing the biophysical characteristics of single VLPs by using atomic force microscopy coupled with fluorescence. In collaboration with the De Pablo lab, we are developing a system where complementary ensemble measurements and single-particle analysis techniques are used to elucidate the properties and biophysical behavior of our VLP nano-containers.

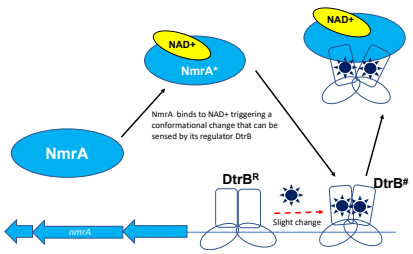


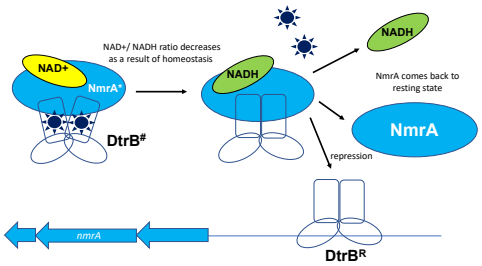
Regulation of RNS adaptive stress response in *Staphylococcus aureus* through uncharacterized operon containing a TetR-family of transcriptional regulator and a NmrA-type nucleotide binding regulatory protein.

❖ **Abhinaba Ray, Giedroc Lab**

Staphylococcus aureus is a gram-positive commensal pathogen, a facultative anaerobe which and a major cause of various nosocomial infection, soft tissue infections to potentially life-threatening diseases such as osteomyelitis, pneumonia and bacteremia. Being one of the leading organisms to have acquired high antibiotic resistance in form of Methicillin resistant *S. aureus* (MRSA) and ability to form strong biofilms, has made *S. aureus* a pathogen of global concern. It is established in the literature that *S. aureus* biofilms can be readily dispersed by Reactive Nitrogen Species (RNS), but the molecular mechanism and the key players involved in the dispersal of biofilms remains unclear. Over the years, our lab has established that the transcriptomic response of *S. aureus* to RNS stress greatly overlaps with that of Reactive Sulfur Species (RSS) stress. RNS stress on *S. aureus* also leads to the expression of poorly characterized genes that we believe to be associated with RNS mediated stress adaptation. The uncharacterized part of gene contains two cysteine containing TetR-family proteins (DtrB and TetR_B), which are expected to sense RNS stress and regulate the expression of the genes for its adaptation. Although at a very preliminary stage, we have been able to identify one key operon containing a NmrA-type of proteins, which are expected to bind to nucleotide cofactors (NAD^+ or NADH) as well as other proteins and play an important role in RNS sensing and transcriptional regulation. In this presentation we are going to outline how we think RNS stress is sensed and regulated in *S. aureus* and how can we connect it to the dispersal of the biofilms.







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Pizza and Beverages will be provided