Yale Institute for Nanoscience and Quantum Engineering

Friday- February 27, 2015

12:00 to 1:00 p.m.

BECTON SEMINAR ROOM

Light lunch will be served at 11:45 a.m.

Francois Perreault

Department of Chemical & Environmental Engineering, Yale University

"Graphene Nanomaterials in Membrane-Based Water Treatment: Biofouling Mitigation and Antimicrobial Mechanisms"

Fouling of membranes by microorganisms is a major limiting factor in membrane-based water treatment. Membrane biofouling reduces permeate water flux and membrane selectivity, resulting in increased operation costs for membrane processes. Traditional biofilm control strategies are not compatible with the polyamide thin-film composite membranes used in advanced membrane technologies and therefore, for these membranes, novel biofilm mitigation strategies are required. In this seminar, the potential of graphene for biofouling control in membrane processes is explored. The unique physicochemical properties of graphene oxide are used to impart antimicrobial and antifouling properties to membranes via a surface functionalization approach. Graphene oxide functionalized membranes are shown to successfully reduce biofilm formation on membranes without altering the membrane transport properties. The antimicrobial and antifouling mechanisms of graphene oxide are then described, providing a fundamental insight into the interactions of graphene oxide with organic and biological foulants.

Seng Fatt Liew

Department of Applied Physics, Yale University

"Artificial Selection for Structural Color on Butterfly Wings and Comparison to Natural Evolution"

Brilliant animal colors are often produced from light interacting with intricate nanomorphologies present in biological materials such as butterfly wing scales. Surveys across widely divergent butterfly species have identified multiple mechanisms of structural color production, however, little is known how these colors evolved. Here, we examine how closely-related species and populations of Bicyclus butterflies have evolved violet structural color from brown-pigmented ancestors. We used artificial selection on a lab model butterfly, B. anynana, to evolve violet scales from brown scales, and compared the mechanism of violet color production with that of two other Bicyclus species: B. sambulos and B. medontias, which have independently evolved violet/blue scales via natural selection. The UV reflection peak of B. anynana brown scales shifted to violet frequency over six generations of artificial selection (i.e. less than a year) due to changes in the dimensions of the lower lamina in ground scales and loss of pigmentation. These changes mimicked the natural evolution of violet/blue structural color in the other Bicyclus species, except changes sometimes occurred in a different scale type. This work shows that populations harbor large amounts of standing genetic variation that can lead to rapid evolution of scales' structural color via slight modifications to their physical dimensions.

HOST: Paul Fleury