SES16-2016-000157

Abstract for an Invited Paper
for the SES16 Meeting of
the American Physical Society

Nanobiophysics for First-Year Non-Majors

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The nanobiological world is rich with physics, from the polymer physics of proteins and the cytoskeleton, to the thermodynamics of molecular motors, to the highly non-linear mechanical properties of cells. How cells and proteins behave on a physical level has become the focus of an increasingly exciting and dynamic area of cutting edge research. The physics of biology is also an important context for encouraging those undergraduate students who are otherwise reluctant to engage in physics, to take a closer look. I designed and currently teach a First Year Seminar on nanoscience at UNC that is open to all students including non-science majors. One of the overarching goals of the course is to impart on the students an understanding of how the nanoscale is fundamentally different than our human scale in terms of what physical processes are dominant (e.g. thermal forces, intermolecular interactions). I will present my strategies of introducing the concepts free energy and entropy, and applications of those concepts to biopolymer dynamics (protein folding) and molecular bond stability. I have found that simple lattice model problem sets and simulations help students gain a good grounding in the basic concepts of free energy. I will present an overview of my course, the challenges I've faced, and how I've addressed them.