

## NANO HIGHLIGHT

### Design of Biocompatible Nanoparticles for Probing Living Cellular Functions and their Potential Environmental Impacts

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PIs: X. Nancy Xu<sup>1</sup>, D. Gillet<sup>2</sup>, H. Elsayed-Ali<sup>1</sup>, C. Osgood<sup>1</sup>, R. Van Duyne<sup>3</sup>

<sup>1</sup>Old Dominion University, Norfolk, VA; <sup>2</sup>CEA in France; <sup>3</sup>Northwestern University

Membrane proteins in living cells can specifically recognize an array of structurally unrelated chemotoxics and assemble membrane transporters (efflux pump) optimized for extruding them selectively out of the cells. These smart sensing and transport mechanisms occur at the nanoscale region. Using single nanoparticle optics, the Xu group has demonstrated real-time sizing of single nanoparticle transport in and out of living cells [1].

In this NIRT program, we have assembled a team of scientists and engineers with expertise in chemistry, material science and engineering, molecular and cellular biology, and protein engineering, and are using state-of-the-art instrumentation and methods developed by these PIs to design biocompatible nanoparticles for probing such fascinating sensing and transport mechanisms in real-time, and to assess the potential environmental impacts of nanomaterials. This study will lead to new knowledge that is essential to better understanding of nanoparticle optics, the future design and assembly of biologically inspired smart molecular pumps and sensors, and the potential impacts of nanomaterials on our environment. Such new knowledge will advance our understanding of an array of research topics in biology, chemistry, environment, material science and engineering.

In the first year of the NIRT project, we have accomplished an array of research and educational activities and laid down a solid foundation to achieve our objectives: (i) we have designed and prepared nanoparticles with controlled sizes, shapes, and surface functional groups for the study of membrane transport of living bacterial cells in real-time (A-B); (ii) we have been investigating the biocompatibility of these nanoparticles using an *in vivo* model system; (iii) we have created an interdisciplinary educational environment for students in biology, chemistry, engineering and material sciences; build a productive international collaboration; establish the institution infrastructure and collaboration. We have created broad synergistic activities, including developing a new interdisciplinary nanobiotech course for students (Chem/Bio/ECE 455/555), giving the first of annual public lecture series on Frontiers in Nanoscience and Nanotechnology and actively participating Scholarship and Research Day to educate the general public about nanoscience, nanotechnology and this NIRT program.

#### Reference

[1] For further information email: [xhxu@odu.edu](mailto:xhxu@odu.edu); visit website: <http://www.odu.edu/sci/xu/nirt/nirt.html>

