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

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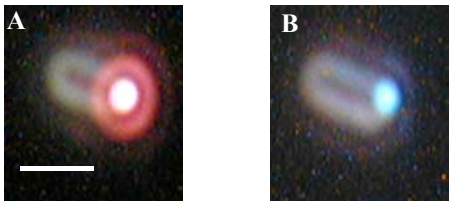
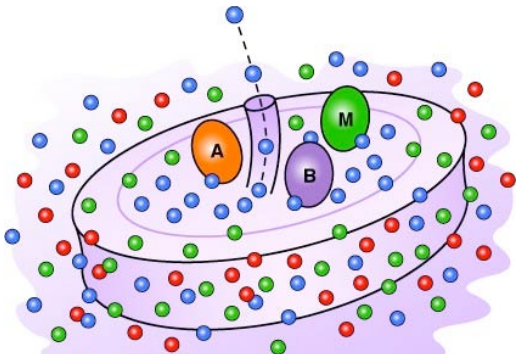
Membrane proteins in living cells can specifically recognize an array of structurally unrelated chemotoxics and assemble membrane transporters (efflux pump) optimized for extruding them selectively out of the cells [1]. These smart sensing and transport mechanisms occur at the nanoscale regime. Using single nanoparticle optics, the Xu group has demonstrated real-time sizing of single nanoparticle transport in and out of living cells (A-B) [2-4].




(A) Extracellular and (B) Intracellular Ag Nanoparticles;

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.




(C) Illustration of membrane transport of nanoparticles in and out of a living cell

In the first four months, we have focused on (i) design, synthesis and characterization of monodisperse silver and gold nanoparticles with controlled size and shape [5]; (ii) design of experiments for the study of the dependence of assembly of membrane pump upon their interactions with nanoparticles; and (iii) study of dependence of cytotoxicity and genotoxicity of nanoparticles upon their size, shape and surface properties *in vitro* and *in vivo*. We have created an interdisciplinary educational environment for students in biology, chemistry, engineering and material sciences; built a productive international collaboration; and established the institution infrastructure and collaboration by sharing research facilities at ODU, Jefferson National Lab, Northwestern University, and CEA. We have created broad synergistic activities, including developing a new interdisciplinary nanobiotech course for students (Chem/Bio/ECE 455/555), and giving the first of annual public lecture series on Frontiers in Nanoscience and Nanotechnology.

## References

[1] **For further information** email: xhxu@odu.edu; visit website: http://www.odu.edu/sci/xu/nirt/nirt.html
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