

## **Multiplexed Optical Detection of Heavy Metal Contaminants in Plants**

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### **Project Location:**

University of Rhode Island-Kingston

### **Project Description:**

Current methods to detect heavy metal contaminants in soil and plant samples involve bulky and expensive equipment, i.e., atomic absorption spectroscopy (AAS) or inductively coupled plasma-mass spectroscopy (ICP-MS), prohibiting their use in portable on-site testing. Single-walled carbon nanotubes are an ideal candidate in the construction of next-generation sensors. Their intrinsic fluorescence is exceptionally photostable, with emission properties that are responsive to single molecules. It has been demonstrated that the fluorescence from nanotubes responds to the presence of heavy metal ions. Additionally, in the near infrared imaging window of 900-1400 nm, there exist >20 species (chiralities) of nanotubes that can be separated from a mixture, functionalized, and utilized for multiplexed optical sensing. Here, we will create a family of functionalized nanotubes to quantify concentrations of heavy-metal contaminants that have accumulated in plant samples. Nanotubes appropriately functionalized with small-molecule or aptameric chelators of heavy-metal ions will have the capacity to simultaneously monitor bulk concentrations of up to 20 distinct species of heavy metal contaminants. Upon specific binding of a heavy-metal ion to the chelator-nanotube complex, a characteristic red-shift is expected in the near-infrared emission spectrum due to perturbations in the localized dielectric environment of the nanotube. By sequentially separating by nanotube species and conjugating specified chelating agents, we propose to engineer specificity and selectivity to the optical nanosensors.

*This project involves **primarily lab or computer work***

### **Required/preferred skills for student applicant:**

Optical microscopy

Plant biology

General laboratory skills (pipetting, weighing, etc.)

### **Student transportation needed for project?**

No