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Luminescence-based Nanobiosensors for rapid detection of botulinum neurotoxins in foods

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11:00AM-12:00PM (Central Time)

Bio:

Timothy V Duncan received his undergraduate degree in chemistry in 2000 from Haverford College, located just outside of Philadelphia. He attained his Ph.D. in physical/inorganic chemistry in 2006 from the University of Pennsylvania, where he studied electronic materials for medical diagnostic and optoelectronic applications under Professor Michael J. Therien. After graduation, he completed a post-doc at the University of Pennsylvania with Professor So-Jung Park, which focused on single-molecule spectroscopy, novel bio-imaging agents, and color-tunable luminescent polymers. Since 2009 he has been a research scientist and primary investigator at the U.S. Food and Drug Administration's Division of Food Processing Science and Technology, where he studies the health and environmental safety of nanotechnology-enabled food contact materials and develops nanosensors intended to improve the Agency's ability to rapidly respond to foodborne disease outbreaks.

Abstract:

Botulinum neurotoxins (BoNTs) are potent toxins produced by *Clostridium* bacteria that are responsible for the illness botulism and are listed as bioterrorism agents. Rapid detection and discrimination of BoNT serotypes responsible for foodborne illnesses are critical to guarantee timely clinical interventions during outbreaks and to rapidly identify sources of toxins. The "gold standard" BoNT detection method, the mouse bioassay, is reliable and sensitive but it is also expensive, slow, and requires the use of live animals. We have developed a nanobiosensor based on Förster resonance energy transfer (FRET) between semiconductor nanocrystals (quantum dots, QDs) and dark quencher-labeled peptide probes that can detect biologically active BoNTs in aqueous media and discriminate the serotypes responsible for human foodborne disease. The high sensitivity, simple operation, short detection time, and serotyping capability imply that the nanobiosensor will be useful for rapid BoNT detection and serotype discrimination in food analysis. Here we present the nanosensor operation and performance benchmarks and report on our ongoing effort to translate this technology to a microfluidic chip-based platform capable of rapidly analyzing food samples in non-laboratory settings.