Plenary Talks

Microbioengineering: Microbe Capture and Detection

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Recent deaths from outbreaks of microbial contamination particularly in foods, but also in water and air, the recent threats of biological warfare/terrorism, and the re-emergence of such diseases as tuberculosis have emphasized the importance of quick and accurate assessments of microbial contamination. In addition, microbial contamination of sterile surfaces, such as those of medical and surgical instruments and devices, cause considerable danger. Using a unique combination of leading edge technologies, microbe capture chips and a hand-held prototype detector have been developed which are capable of statistically sampling the environment for pathogens [including spores] and exotoxins, identifying the specific pathogens/exotoxins, and determining cell viability. This system is sensitive enough to detect very low levels [~20 cells/sq cm] of infectious bacteria in minutes.

The microbe capture technology is based on molecular recognition and pathogenesis using iron acquisition and eukaryotic receptor adhesion strategies. These non-antibody-based ligands are tethered to the sensor chip in a patterned array. In addition to statistically sampling the environment, pathogen identification can be made based on which ligands are bound by microbes. Capture events are detected using intrinsic fluorescence of the cells and spores such as that from metabolites, amino acids, and other specific cell components. The multi-wavelength fluorescence detection device incorporates integrated parallel 'readout' of the sensor chip and employs a pattern recognition algorithm for pathogen identification. This system is both several orders of magnitude more sensitive and several orders of magnitude faster than current field sensors.

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Abstract

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