Detecting "Dirty Bomb" Radiation

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In the realm of national preparedness, few scenarios are as scary as the possibility of a "dirty bomb." The National Institutes of Health (NIH) is funding a $25 million grant to find new technologies that will provide rapid mass-screening of radiation exposure.

Y. Lawrence Yao, together with researchers from Columbia University Medical Center and department colleagues, is part of a multi-institute consortium that, among other tasks, is charged with developing a high-throughput "biodosimetry" device capable of rapidly testing a large swath of the population in the event that an RDD (radioactive dispersal device), commonly called a "dirty bomb," is detonated in a major metropolitan area. This group is collaborating on an effort to design the most effective and quickest technologies that involve advanced imaging, lasers, and robotics.

Radiation affects cell division. When cells divide under normal conditions, the break is clean, with no extraneous cellular material. After radiation exposure, however, pieces of damaged chromosomes, micronuclei, appear along with divided cells and can be tested for DNA breaks.

The advances in these technologies being pioneered by Yao and his colleagues will accelerate the screening process based on blood from a finger stick. With the help of a highly automated, efficient, and eventually portable device—a prototype of which is already whirring in Mudd's basement—doctors can quickly determine the scope of radiation exposure and whether medical treatment is needed by processing tens of thousands of samples per day, instead of only a few hundred.

Yao and his colleagues, and the NIH, are confident that this device can operate at high volume and full throttle, with the hope that it is never needed.

Yao, who also directs Columbia's Manufacturing Research Laboratory (MRL), engages in multidisciplinary research that includes nontraditional manufacturing, laser materials processing, laser assisted material removal, shaping, and surface modification, laser applications in industry and art restoration, and robotics in industry and health care.

In 2009, he received the Janette and Armen Avanessians Diversity Award, established to recognize outstanding performance of engineering faculty in enhancing diversity in departmental, school, and university programs at Columbia. The award winner receives a cash prize of $1,000 and a plaque. Nominations are evaluated on the basis of excellence in advancing diversity at Columbia Engineering.

Before joining Columbia in 1994, Yao served as a senior lecturer in the School of Mechanical and Manufacturing Engineering at the University of New South Wales, Sydney, Australia.

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