Faculty Perspective

Coping with Bioterrorism: How to Prepare for and Respond to an Attack

By Geoffrey Zubay

A n effective terrorist knows how to plan his acts of terror to achieve maximum impact. Thus far terrorists have tended to use explosives both because they have been so suc-
cessful and because the handing of biological agents requires new skills.

Now, however, fears are mounting that terrorists will turn to biological agents because such weapons are eas-
er to hide, cheaper and far more devastating than explo-
sives. How real are such threats, and what can we do to prepare for them?

Bioterrorism remains in many ways a subject that disturbs some people to the point where they would rather ignore the situation altogether. The word “bioterrorism” has yet to appear in many English lan-
guage dictionaries. To a Lexis-Nexis search, the term first appeared in American newspapers in 1997. Yet there is a long history of the military use of biological and chemical weapons.

The sixth-century Assyrians are believed to have poisoned their enemies with a toxin derived from a fungus. In the 14th century, Tartar armies are said to have thrown the corpses of plague victims over enemy walls in an effort to sicken the opposition. A modern example of chemical warfare is the use of mustard gas by the German army on Allied troops during World War I.

But while bioterrorism is as old as recorded history, what distinguishes today’s version are technological advances that have been in our under-
standing of how pathogens produce their toxins. On the one hand, this has resulted in the discovery of a wide range of new bioweapons. In 1984, a group of religious cult members released the nerve gas sarin in the Tokyo subway, killing and injuring 5,000 people. Anthrax-containing letters were mailed in several regions of the U.S. in 2001. Twenty-two people were infected, and five died as a result of contact with spores in the envelopes.

On the other hand, we now know more about procedures for protecting ourselves against serious pathogens. Against this background, how can we best prepare for bioterrorist emergencies?

The Centers for Disease Control and Prevention (CDC) have ranked biological agents based on the danger they pose and the likelihood they could be used as agents of bioterrorism. Category A agents (anthrax, smallpox, plague, tularemia, botulism, Franciscella tularensis, Yersinia pestis and Clostridium botulinum) are considered to be disseminated and/or highly infectious and are characterized by high mor-
tality rates. Because of their speed of action, they are likely to strain the public health infra-
structure it released Category B agents (V cholerae, salmonel-
la and viral encephalitis) for consideration. These agents are considered because of their lower mortali-
ty rates and the ease with which they can be spread. However, Category C agents (e.g., hant-
viruses) are emerging pathogens considered to have a potential for weaponization due to their potentially high morbidity and mortality rates and their availability.

According to research per-

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tion in this country, very few are protected.

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march of such a catastrophe, the Department of Homeland Security and the National Institutes of Health (NIH) are encouraging radi-

tion researchers to work on developing a device that can quickly detect and route radiation exposure. Such a device would enable people who have been exposed to harmful levels of radiation to be treated quickly, and would keep others from panicking unnecessarily. Current technology can assess only a few hundred individuals per day.

A case in point is the $25 million NIH grant recently awarded to Columbia for designing new technologies for rapid radiation screening in densely populated areas. Columbia is the lead institu-
tion in carrying out the five-year project, which also involves Harvard’s School of Public Health, the National Cancer Institute and New York University. A team of me-

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nists, chemists, mechanical engineers, biologists, mathematicians and computer scientists is working to develop a “radiation sensing device” that can detect radiation—so that they can share a common language with the doctors and scien-
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The rapid screening device the Columbia researchers have in mind involves using advanced automated image analysis and robotics to quickly examine tissue samples (i.e., a fingerprint of blood) for quantitative indicators of radiation exposure (e.g., fragments of DNA or DNA repair complexes). The mechanical engineer-

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The rapid screening device the Columbia researchers have in mind involves using advanced automated image analysis and robotics to quickly examine tissue samples (i.e., a fingerprint of blood) for quantitative indicators of radiation exposure (e.g., fragments of DNA or DNA repair complexes). The mechanical engineering professors for their part will need to study basic biology—how cells divide and change when exposed to radiation—so that they can share a common language with the doctors and scientists involved in the project.

“Our engineers need to have a working knowledge of basic biology in order to design these devices,” says Alexander Yao, chair of mechanical engineering at SEAS. “I am encouraging them to get out of their com-
fort zone,” he adds.

Yao and Nabil Simaan, associate professor of mechanical engineering and an expert in mechanical engineering, are a part of a team involved in the project. Already, conceptual designs with significant innovation are underway, and plans have been created for purpose-built robotic devices to integrate the numerous steps required to meet the goal of high-throughput, minimally inva-
sive mass screening.

To Help Build Rapid Radiation Screening Device, Mechanical Engineers Join Forces With Biologists

By Alex Lyda

T he indictment of dirty bomb suspect José Padilla last week caused some in the world’s attention once again on the idea that an explosive device packed with radioactive material could be detonated in a major city by a determined terrorist, with only basic knowledge of radioactive isotopes to guide him.

Depending on the strength of the blast and the potency of the material, a dirty bomb could contaminate an area the size of a subway station, several city blocks or, in many square miles. The dam-
age would be less devastating than that wrought by a nuclear device, but dirty bombs are much easier to cre-
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