

Medicine

A Pint-sized System for Detecting Bioagents

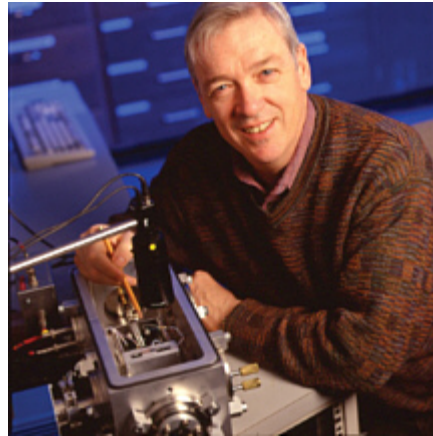
What do proteins and airport security have in common? More than you'd think. If Hopkins [School of Medicine](#) Professor Robert Cotter's predictions -- which he describes as "optimistic" -- prove correct, within two to three years portable, miniature mass spectrometer devices that can identify lethal bioagents will be commercially available to help airport screeners combat terrorism.

Cotter's project to create small but effective mass spectrometers is in its fifth year, with funding from the Defense Advanced Research Projects Agency. The goal, notes Cotter, is to reach the point where "we could put in different biology agents -- bacteria or viruses or spores -- and ultimately identify which bioagent it was."

When a bacteria, virus, or spore is analyzed by a mass spectrometer, a laser beam first breaks up the bioagent into proteins or smaller peptides. (The process of using lasers -- something called "laser desorption" -- in mass spectrometry garnered its developers this year's Nobel Prize in Chemistry.) These proteins or peptides are then sent through a tube in the mass spectrometer. The mass of each of the protein's molecular components can be measured according to how long it takes the molecules to travel down the tube. The spectrometer thus determines the identity of the protein using its "mass spectrum." Once the mass spectrum of an unknown protein is obtained, it can, in theory, be matched with spectra of known proteins and identified.

Cotter points to the miniature mass spectrometer.

Photo by [Tamara Hoffer](#)



There are several obstacles to overcome before it will be possible to actually identify bioagents using mass spectrometry, says Cotter. One problem is that a bioagent bacteria might well be

mixed with something else, like *E. coli*. The combination would yield a spectrum of the composite of the particular combination of *E. coli* and the unknown bioagent.

So the challenge, Cotter says, is to identify reliable bioagent markers -- characteristics that are constant no matter what other materials the agent is mixed with. Another challenge is to continue building the data banks of genomic information to use as cross references for unknown bioagents. "We don't have genomes for everything," says Cotter. "But it's a building process -- they're doing organisms very, very rapidly."

Finally, there is the hardware itself. Commercial mass spectrometers are roughly the size of refrigerators and thus not ideal for applications like airport screening. Cotter's lab has developed its own homegrown 3-inch mass spectrometer, but Cotter says that mass production won't occur until there is a recognized market.

"People didn't just begin worrying about this September 11, but it is something people are really interested in right now," Cotter notes. "Of course, it's not all hardware. It has a lot to do with straightening out the problems in the Middle East. But those are political solutions. We don't get funded for them." -- *Sally McGrane (MA '03)*