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Sniffing Dangerous Odors

The Disney/Pixar movie *Ratatouille* quickly teams a rat named Remy with a neurotic clumsy garbage-detail restaurant worker named Alfredo. They pool their separate talents, which are the rat's fantastic sense of smell and Alfredo's ability to move around a kitchen without attracting much notice, and prove that moviegoers can learn to love a rat.

A real rat in a restaurant would cause as much commotion as a live rat sniffing at your luggage at an airport. So joining a rat's sense of

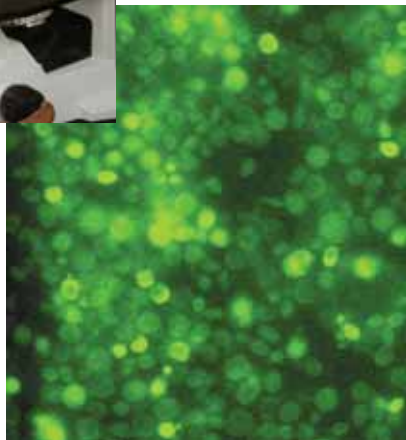
Yeast is a fungus that is best known as the living ingredient in the fermentation process. For centuries, yeast has played a significant role in the production of bread, cheese, wine, and beer.

The molecular biologists at Temple University empowered their yeast with a new ability by giving it a sense of smell and linking this olfactory ability to a green fluorescent protein. To prevent their biosensor from lighting up in the presence of every odor, they found the specific



Photo 1—Danny Dhanasekaran

Photo 2—Biosensor yeast glows green in the presence of explosive chemicals.



smell with Homeland Security's desire to ferret out two-legged rats bent on destruction can't be done at the four-legged animal level hiding under a TSA agent's hat. It would have to be performed at the molecular level for society to accept it.

Danny Dhanasekaran (Photo 1), a molecular biologist at Temple University, led a team of researchers on a five-year quest to design an acceptable rat sensor that could sniff out and identify dangerous chemicals at infinitesimally small quantities. They have now developed a living biosensor by genetically transferring a rat's olfactory receptors, its sense of smell, into a strain of yeast.

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rat sensor that would bind with the odors given off by explosives. Now, when their yeast smells explosive chemicals, they glow green. (See Photo 2.)

The goal now calls for fine-tuning the sensitivity and selectivity of their living biosensors so they can go beyond their current ability to detect explosives. The researchers need to isolate the specific rat sensor that would bind with other odors to create a full array of living

organisms that can detect specific chemical signatures. This type of genetic fine-tuning could lead to biosensors for the pharmaceutical industry that can screen new drugs. It can also lead to medical biosensors that could diagnose disease pathogens by their weak but detectable odors, and other biosensors that could sniff the air at construction sites, chemical disposal sites, buildings, schools, and factories for odors that indicate possible danger.

As you read this column, engineers are working to develop handheld devices that people can use either on site or remotely to monitor locations for explosive signatures. The one thing for certain is that this new strain of yeast will not be used in food production.

Recalling the Facts

1. How was this living biosensor created?
2. How can someone tell if the biosensor has detected a dangerous chemical signature? ©

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