Kimberly Turner's Very Small Research

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A look at Kimberly Turner's microelectromechanical systems (MEMS) research.

Kimberly Turner's primary research focus is very small—literally. Her lab works on tiny devices, called microelectromechanical systems (MEMS). They can function as filters, sensors, and switches, and have myriad applications in everything from car airbags through videogame controllers to inkjet printers.

Turner is developing exquisitely sensitive devices that can detect minute changes in mass—changes that can indicate the presence of a single molecule of a material. This new generation of sensors could have a broad range of applications, including food safety monitoring and detecting trace amounts of chemical warfare agents, long before they can be...
MEMS devices can also be designed to sense movement. A MEMS gyroscope built by a former student has attracted a lot of attention, Turner says, because it is far more robust than alternative MEMS designs. She sees applications for such a MEMS gyroscope in guiding satellites and even missiles: “anything that requires precise tracking.” The technology could also be used in place of the Global Positioning System (GPS), which fails if the signal from a satellite-based transponder to a GPS receiver is blocked.

Turner’s other main research focus—a project that’s really skyrocketed—is developing adhesives inspired by the marvelously sticky feet of geckos, which enable the animals to wander across ceilings and grip glass.

After studying the intricate system of nano-scale hairs on a gecko’s feet, Turner’s team has developed synthetic adhesives that mimic the functionality of the gecko’s feet. The adhesives are reversible, so they can be stuck and unstuck, just like the feet of a gecko on the move. In one application, diminutive robots could be outfitted with sticky feet to allow them to climb over rough, rocky terrain and up and down walls. The US Army is interested in their potential use in war zones, where hand-sized, sticky-footed “microrobots” equipped with sensors could be surreptitiously sent into buildings to scout for dangers before soldiers enter.

“What they’d like them to be able to do is reconnoiter environments that aren’t confirmed as being safe,” Turner says. “This would be just as valuable in disaster site evaluation and search-and-rescue as in a combat environment.”