Researchers program bacterial cells to make computer-like decisions

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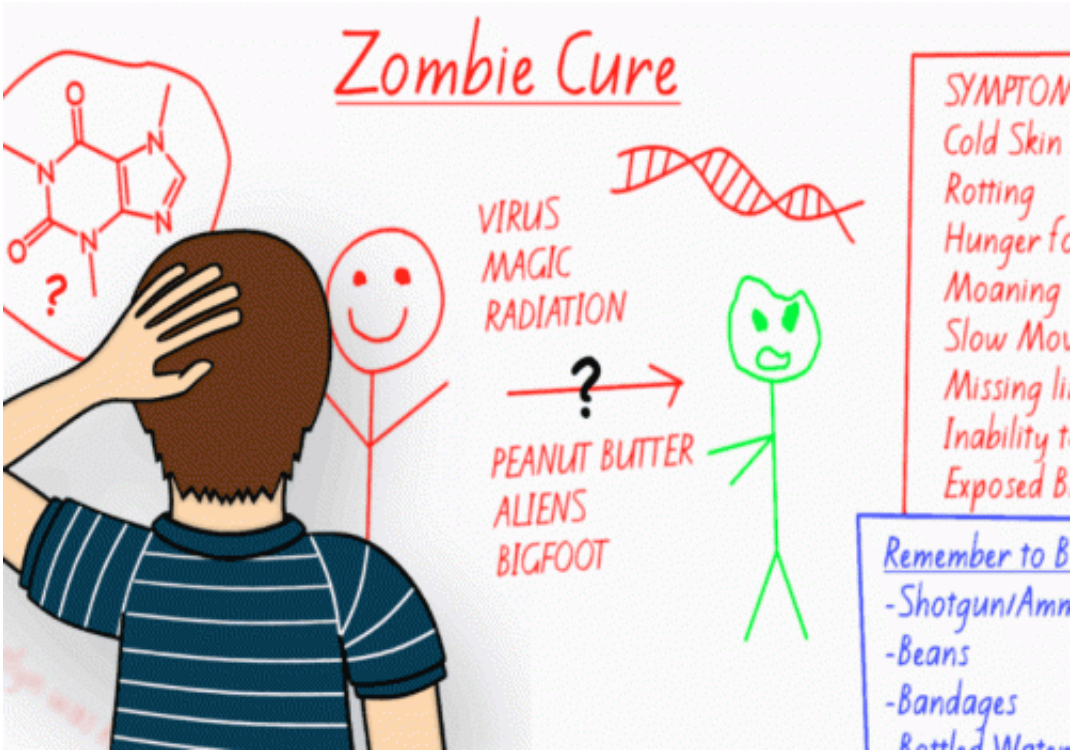

Screenshot from Plasmid Paul game, created by Michigan Synthetic Biology Team

(Phys.org) —Imagine bacterial cells programmed like computers to respond predictably to specific inputs—the cells detect mercury and turn red, or detect and destroy cancerous cells.

Drew Dunham, a microbiology student at the University of Michigan,

helped develop the breakthrough technology with fellow members of the Michigan Synthetic Biology Team, which recently returned from the International Genetically Engineered Machine competition at MIT.

Since beginning in 2006, the MSBT has quietly won multiple awards and advanced to world championships twice, said adviser Marc Ammerlaan, a lecturer in the undergraduate Program in Biology, which is jointly administered by the Department of Ecology and Evolutionary Biology and the Department of Molecular, Cellular, and Developmental Biology.

The student-made microscopic machines earned the MSBT a gold medal this year at the Genetically Engineered Machine regional competition in Toronto, where they were one of the top five North American finalists advancing to the world championships. Though they didn't win at the international competition, Ammerlaan sees that in the team's future.

This year, instead of focusing on one area of synthetic biology, such as health or environmental applications, the U-M team took a holistic approach and made the cells fully customizable, allowing synthetic biologics to modify the cells to fit their research.

"Our project breaks new ground," Dunham said. "Scientists can program the bacteria to use signals in their environment as inputs and express different outputs depending on that input."

There are endless combinations of inputs and outputs, from health applications to environmental cleanup—real-world applications, he said.

"This means the applications truly exceed our imaginations, and future uses will influence various fields," Dunham said.

Unfortunately, cloning—copying genetic information from one organism into another to change its function—is the foundation of synthetic

biology, and has very negative connotations, according to Dunham. To that end, the MSBT developed a computer game called Plasmid Paul, which walks players through the process of cell cloning.

"How are we modifying these organisms? What are the effects of the modifications?" Dunham said.

Surveys reported that 83 percent of players learned something from playing the game and that they enjoyed their time playing, Dunham said.

"To me, that's the best part of it," Ammerlaan said. "I don't tell them the science. I drive the car and they do all the work. They start with a theoretical understanding. By the end when we go to meetings, they critique each other's work as acting scientists."

Provided by University of Michigan