Gene-editing kit stirs up debate over do-it-yourself DNA creations

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BURLINGAME, Calif. — Josiah Zayner is mixing liquids together on his kitchen table in Burlingame, California. His left arm is etched with the tattoo "Build Something Beautiful." He has a shock of dyed hair and ear piercings, and he wears a T-shirt that says "Go Ninja Go." Instead of mixing beverages, however, the 34-year-old molecular biophysicist is working with genes.

Genes are made of DNA, which contains instructions for how each part of the body works and is passed on from parents to children. It works the same way in all living things.

In tiny glass containers, Zayner is cutting, pasting and stirring genes together, just like mixing a drink. Then he slides his new creations onto a refrigerator shelf next to the vegetables.
Some Worry About Amateur Biology

Zayner is packaging and selling his gene-editing method for $120, and says he wants everyone to be able to practice science. He says, "It's a craft. You don't have to be a genius, or go to school." For non-scientists, he offers lab rules, inexpensive equipment and tutorials.

Some people worry about this kind of amateur biology. They fear that if it is unregulated, new bacteria or viruses could be released. Others are more enthusiastic; they imagine a day when anyone could redesign the living world to create cheap drugs or clean fuels.

Moving genes from one living creature to another was once a very specialized task, and later, it was done by more scientists, but only in big, expensive labs. Three years ago, scientists at the University of California, Berkeley, invented a gene-editing tool called CRISPR. It stands for clustered regularly interspaced short palindromic repeats. They are DNA sequences, the order of life’s chemical alphabet in DNA, that read similarly forward and backward. CRISPR is a cheap, fast and precise way to edit genetic sequences, but its use is confined to academic and commercial settings.

Bacteria, Yeast Not Dangerous Yet

Zayner models his kits on CRISPR. He is the first to market a simplified version of the tool to the public, a project that, for now, is not dangerous. The kit has limited applications because Zayner’s altered bacteria and yeast cannot do much except change color or fragrance, or live in inhospitable places for a short time.

This month, Zayner will leave a two-year fellowship at the National Aeronautics and Space Administration (NASA). While at NASA, Zayner worked with synthetic biology, the design and construction of new biological systems and functions not found in nature. His new plan is to work full time with do-it-yourself biology.

Zayner is convinced that citizen scientists can help solve society's big problems, and says, “There are so many brilliant and capable people that I want to show how they can do these things. They can change the face of the world we live in.”

Computer Hobbyists Were Pioneers

He takes his inspiration from the early days of personal computing, when the Homebrew Computer Club and other hobbyists shared what are now legendary ideas. The club was a gathering of computer hobbyists in California in the 1970s. Many members, such as Apple’s Steve Jobs, later became leaders in personal computing.

Jacob Corn, scientific director of the Innovative Genomics Initiative research labs at the University of California, supports Zayner’s kit. Corn says that it could never be used to alter human genes and is a good way to introduce people to the idea of editing genes. He says, "The kit is similar to something that an undergrad at Berkeley might do in a basic biology lab course."
Zayner’s kit does raise concerns about a day when dangerous gene editing could be done without government regulation. The idea is deeply troubling to some experts who say it could be a risk to the environment and human health.

**Scientists Urge Federal Guidelines**

Because of these concerns, several scientists at Stanford University in California have urged federal regulators to create better rules for biological research. They want to reduce the likelihood of creating a tough-to-kill bacteria or virus that might escape from the lab, or be released on purpose.

Dr. David Relman is an infectious disease expert at Stanford University. He worries that the kits will help more people to become familiar with gene editing. Relman says, "They could someday become skilled enough to use advanced tools to introduce less benign genes."

Relman wrote a cautionary report recently in the magazine Science. He is worried about the growing number of labs that are developing new bacteria and viruses for research. For instance, some scientists are creating more contagious versions of the deadly H5N1 bird flu. Others have used a modified respiratory virus to cause cancer in mice.

**Garage Tinkerers Seen As Risky**

The report states that dangerous biological research can be done in small labs. Relman says, "I do not think that we want an unregulated, non-overseen community of freelance practitioners of this technology." Some experts wonder if it is even possible to control gene editing in animals or plants.

Hank Greely, director of Stanford’s Center for Law and the Biosciences, says, “You’ve got guys with B.S. degrees, in a garage.” He passed along the warning at an international summit of the National Academy of Sciences recently.

Zayner would love a garage, but says,"It's way too expensive." In his one-bedroom apartment, shared with two cats, he mixes E. coli bacteria with DNA and other ingredients. E. coli is a type of bacteria that normally live in the intestines of people and animals. Most types are harmless, but some can make people very sick.

Zayner's work is concealed behind a closed blind, so neighbors do not get alarmed.