THE WALL STREET JOURNAL.
WSJ.com

PAGE ONE | MAY 13, 2009

In Attics and Closets, 'Biohackers' Discover Their Inner Frankenstein

Using Mail-Order DNA and Iguana Heaters, Hobbyists Brew New Life Forms; Is It Risky?

By JEANNE WHALEN

In Massachusetts, a young woman makes genetically modified E. coli in a closet she converted into a home lab. A part-time DJ in Berkeley, Calif., works in his attic to cultivate viruses extracted from sewage. In Seattle, a grad-school dropout wants to breed algae in a personal biology lab.

These hobbyists represent a growing strain of geekdom known as biohacking, in which do-it-yourselfers tinker with the building blocks of life in the comfort of their own homes. Some of them buy DNA online, then fiddle with it in hopes of curing diseases or finding new biofuels.

But are biohackers a threat to national security?

That was the question lurking behind a phone call that Katherine Aull got earlier this year. Ms. Aull, 23 years old, is designing a customized E. coli in the closet of her Cambridge, Mass., apartment, hoping to help with cancer research.

She's got a DNA "thermocycler" bought on eBay for $59, and an incubator made by combining a styrofoam box with a heating device meant for an iguana cage. A few months ago, she talked about her hobby on DIY Bio, a Web site frequented by biohackers, and her work was noted in New Scientist magazine.

That's when the phone rang. A man saying he was doing research for the U.S. government called with a few polite, pointed questions: How did she build that lab? Did she know other people creating new life forms at home?

The caller said the agency he represented is "used to thinking about rogue states and threats from that," recalls Ms. Aull, a recent Massachusetts Institute of Technology graduate.

The man on the other end of the line was Nils Gilman, a researcher with Monitor 360, a San Francisco company that provides "geo-strategic" research. Mr. Gilman declined to identify his client, saying only that it's a branch of the U.S. government involved in biosecurity. "I think they want to know, is this something we need to worry about?" he said -- particularly, could the biohackers' gadgets and methods, in the wrong hands, create dangerous pathogens?

Mr. Gilman's claim that he is working for the U.S. government couldn't be verified. A Department of Homeland Security official said "it does not appear that we contract with Monitor 360." A spokesman for the Federal Bureau of Investigation declined to comment, and a Department of Defense official said he couldn't find any record of the department hiring Monitor 360 or its parent company, Monitor Group. But he said another arm of Monitor Group has done work for the department in recent years.

Previously, some researchers and law-enforcement officials have raised red flags. In a paper published in Nature Biotechnology in 2007, a group of scientists and FBI officials called for better oversight of so-called synthetic DNA, an ingredient widely used by professional biologists and hobbyists, saying it could theoretically lead to the creation of harmful viruses like Ebola or smallpox, since their genomes are available online. "Current government oversight of the DNA-synthesis industry falls short of addressing this unfortunate reality," the paper said.

Ms. Aull, who lives with a cat and three roommates who are "a little bit weirded out" by her experiments, says the worries are overblown. DIY biologists are trying to "build a slingshot," she says, "and there are people out there talking about, oh, no, what happens if they move on to nuclear weapons?"

Other biohackers argue that Mother Nature is more likely than any home hobbyist to create dangerous new pathogens. They cite the current A/H1N1 "swine flu" virus, which is a made-in-the-wild brew of human, bird and pig influenzas. Mackenzie Cowell, a founder of DIY Bio, says members aim to do good and are committed to working safely.

The movement has made big strides recently thanks to the commercial availability of synthetic DNA. This genetic material, normally found inside the nucleus of cells, can now easily be purchased online. That provides any amateur with the ingredients for constructing an organism.

Dan Heidel, a 32-year-old aerospace employee and former molecular biology student in Seattle, has rented a 300-square-foot space in an old warehouse to make genetically modified algae that he thinks might be useful in producing cheap biofuels. The space is stuffed with $20,000 worth of secondhand lab equipment he bought on eBay, including, he says, centrifuges, a liquid-nitrogen storage unit and "a bunch of stuff for water purification."

"It's frankly a run-down, piece-of-crap warehouse, half falling apart," says Mr. Heidel. But "the landlord basically stays out of everyone's hair as long as they don't burn the building down, which is really pretty ideal."

The easy availability of synthetic DNA is at the heart of some scientists' concerns. The National Science Advisory Board for Biosecurity, a government body, has recommended that companies selling DNA be required to screen all orders for signs that the buyers might have nefarious intent. Some biologists argue that anyone wishing to custom-make new organisms, even if it's just glow-in-the-dark bacteria (a popular trick among biohackers), should have to get a license first.

Currently, regulation of labs like these is murky. It's unclear what agency, if any, is responsible.

So far, most garage biologists playing around with synthetic DNA are simply adding a gene or two to an existing organism, a fairly standard scientific practice involving some test-tube mixing, and not something biosecurity experts are very worried about. But technology promises to allow the creation of entire organisms from scratch -- something academics are aiming to do in university labs -- and that has some experts worried.

A senior official in the FBI's Weapons of Mass Destruction Directorate says the bureau is working with academia and industry to raise awareness about biosecurity, "particularly in light of the expansion of affordable molecular biology equipment" and genetic databases.

George Church, a professor of genetics at Harvard Medical School, says anyone using synthetic DNA should have to have a license, including garage biologists. But he says he's not too concerned by the current home hobbyists. "The younger generation need something they feel they can do, in the same sense that my generation was inspired by NASA and home chemistry kits," he said.

Phil Holtzman, a college student and part-time DJ at dance parties in Berkeley, Calif., is growing viruses in his attic that he thinks could be useful in medicine someday. Using pipettes and other equipment borrowed from his community college, he extracts viruses called bacteriophage from sewage and grows them in petri dishes. Mr. Holtzman's goal: Breed them to survive the high temperatures of the human body, where he thinks they might be useful in killing bad bacteria.

He collects partly treated sewage water from a network of underground tunnels in the Berkeley area, jumping a chain-link fence to get to the source. But Mr. Holtzman says his roommates are "really uncomfortable" with him working with sewage water, so he's trying to find another source of bacteriophage.

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Printed in The Wall Street Journal, page A27