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NEWS & INSIGHTS

On The Brink Of Artificial Life

Craig Venter says success is near, but critics blast efforts to patent synthetic organisms

First he succeeded in reading humanity's genetic code. Now gene pioneer J. Craig Venter believes he is within weeks or months of creating the world's first free-living artificial organism in his laboratory. It won't be much to look at—a tiny bacterium with only a few hundred genes. But if it's truly feasible, he says, "it will be one of the bright milestones in human history, changing our conceptual view of life."

It also could be lucrative. Venter's company, Synthetic Genomics Inc., has already filed controversial patents on synthetic bugs, which could make fuels such as ethanol or hydrogen. And on June 13 it announced a deal with energy giant BPPLC to find and modify naturally occurring microbes that can turn coal or oil below the earth's surface into cleaner fuel. Microorganisms "have the potential to provide all the transportation fuel we need in the U.S.," says Venter. "I joke that I'm going from the gene king to the oil king."

SWARM OF RIVALS

In this emerging field of synthetic biology, though, Venter has plenty of competitors. Amyris Biotechnologies adds suites of genes to yeast or bacteria to make an antimalaria drug and novel biofuels. Dozens of so-called gene foundries, including a Massachusetts Institute of Technology spin-off called Codon Devices Inc. in Cambridge, Mass., have sprung up to sell synthetic strands of DNA and other products. One company, EraGen Biosciences in Madison, Wis., even makes DNA from basic building blocks not found in nature, opening the door wider to new types of life. And many academics are trying to fashion free-living organisms from scratch. So far, they have synthesized such simpler microbes as the polio virus and the 1918 flu virus.

The benefits of such research could be enormous: not just drugs and fuels but also bugs that clean up pollution or flash when they detect explosives, plus a far deeper understanding of the basic mechanisms of biology. Venter imagines creating organisms worth billions or trillions of dollars.

But the pitfalls could be huge as well. What's to stop terrorists from buying pieces of DNA and fitting them together into a vicious pathogen, frets David C. Magnus, director of Stanford University's Center for Biomedical Ethics. "There are plenty of people lying awake worrying about this," he says.

Magnus and others have been working with DNA foundries, suggesting measures to reduce the chances of dangerous organisms being unleashed, purposely or inadvertently. One idea: use software to spot purchases of DNA sequences that could be used as weapons. Another is to have "biosafety" officials oversee research to ensure that pathogens created in labs are kept under control. Such measures are still voluntary. "We've essentially made a gamble that the science will keep us one step ahead of any nefarious uses," Magnus says.

Even if synthetic biology can be kept out of the hands of terrorists, some scientists and activists worry that it could be locked up for commercial gain. In early June, the ETC Group, a watchdog organization based in Canada, launched a campaign against Venter's patent application. His synthetic organism will be a much bigger deal than Dolly, the cloned sheep, predicts ETC's Jim Thomas. He charges that Venter's company aims to be the "Microbesoft" of synthetic biology.

LESS SPECIAL

Venter is not surprised by the attacks on his work. "Patents are a hot word," he says, "and people are afraid of synthetic organisms." He has won kudos for convening panels of bioethicists, religious leaders, and biowarfare experts to study the issues. They've concluded the research shouldn't be stopped—though synthetic organisms must be controlled and contained. Environmental groups should be "ecstatic about what we are doing, since we provide one of the clear alternatives to burning oil and coal," Venter says.

Within weeks, his team expects to publish a paper showing how they have leapt many of the technical hurdles to creating synthetic life. But overcoming objections may not be as easy. While creating new life may not be playing God, says Arthur L. Caplan, director of

the Center for Bioethics at the University of Pennsylvania, "it has revolutionary implications for how we see ourselves. When we can synthesize life, it makes the notion of a living being less special." And there's a perception that synthetic biologists may be "manipulating nature without knowing where they are going," he says. "There are arrogant scientists, and our friend Venter may be one of them."

By John Carey

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