

# Strange Crude

Thanks to next-generation versions that won't require new infrastructure, biofuels are the next big thing—again

**T**he biofuel industry has had a bumpy few years: Ethanol is still a Department of Energy golden child, but recent studies raise serious questions about its viability. Production could eat up half of America's corn crop this year, potentially causing food shortages, and some say that ethanol manufacturing uses more energy than it produces. What's more, the fuel's corrosiveness makes it unsuitable for distribution via existing petroleum pipelines. But two new biotech companies believe biofuels can leapfrog past these problems, and they're each engineering fuels that are virtually identical to the gasoline and diesel we use today.

"We said, 'What does nature make that looks like a fuel?'" explains Kinkead Reiling, cofounder of Amyris Biotechnologies in Emeryville, California. Every living organism efficiently converts sugar from food into fat to store energy, and fats are chemically similar to the hydrocarbons that make up fuels. So by tinkering with a few genes, scientists at Amyris and San Carlos, California, biotech firm LS9 have designed bacteria that eat almost any type of plant—mostly sugarcane, corn, and other forms of cellulose—digest it, and convert it into "fuel."

The companies' plans are feasible because of how quickly and cheaply scientists can now sequence and synthesize genes. It took thirteen years and \$3 billion to order the first human genome, but last year, Nobel Laureate James Watson had his own sequenced in two months for less



than \$1 million. Amyris and LS9 isolated and arranged the genes necessary to make petroleum-like fuels in 2005 and 2007, respectively, and introduced those genes into bacteria, creating billions of live biofuel factories for a fraction of what it would have cost five years earlier. "Because we have this genetic control over the organisms, we can really tailor the set of molecules that come out the other side," says Greg Pal, LS9's senior director of corporate development.

Amyris and LS9 are producing fuels that are slightly different from one another. Amyris is making gasoline and diesel similar enough to conventional forms that they can be pumped through

**LS9 aims to ship its biocrude to refineries in 2011.**

existing pipelines and directly into cars. In doing so, the company, which raised \$20 million in 2006 and another \$70 million last year, could bypass one of biofuel's biggest problems in the short term: distribution.

Whereas Amyris is creating a product similar to conventional refined fuels, LS9 is touting the real deal. "If you took all the constraints off, what would you make?" Pal asks. The answer: crude oil. LS9, which secured \$15 million in phase two funding last year and was recognized by the World Economic Forum as one of the 39 Technology Pioneers of 2008, is engineering bacteria to make crude that can be shipped directly to refineries.

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