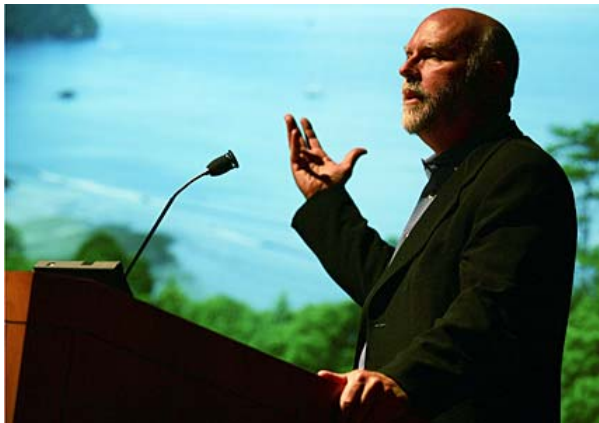



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July 30, 2008

## 10 Big Questions for Maverick Geneticist J. Craig Venter on America's Energy Future



(Photograph by Michael Nagle/Getty Images)

**Independent geneticist J. Craig Venter** raced an international consortium of scientists to map the human genome in the 1990s. Now he's putting the same cutting-edge science to work on today's energy crisis, engineering a whole new generation of biofuels. In a rare in-depth interview, we talked to Venter recently about his latest project to save the world, as well as historical flubs, today's presidential candidates and the future of genetics. —*Chris Ladd*

**So how did you get from mapping the human genome to creating biofuels?** We considered the biggest issues facing society that we thought we could impact. What's happening to [the environment](#) and getting weaned off oil and coal are the biggest issues out there.

### Is it similar to the genome project? More daunting?

Nobody thought that such a massive project as sequencing the human genome could be undertaken by a single team, like we did. But that challenge is minor compared to trying to replace the 30 billion barrels of oil that we use globally each year, and the 3 billion tons of coal. The scale of that is beyond my imagination.

I think the real challenge won't necessarily come from biology, because biology is infinitely scalable, but from engineering. [If we can overcome that,] we have the potential to stop using oil and coal hopefully within the next 10 to 20 years, and even start reducing the CO<sub>2</sub> concentrations in the atmosphere.

### How do you plan to do that?

We're working on what we call second-, third- and fourth-generation fuels. Like corn-based ethanol, a first-generation biofuel, our second- and third-generation fuels start with sugar as the feedstock. But unlike it, we're making fuels that have very high energy content, don't mix with water and have very low freezing points—well under 100 degrees below centigrade. They have the potential of working in high-altitude aircraft.

### And the fourth-generation fuels?

We're using a unique type of algae that we've genetically engineered to turn sunlight and CO<sub>2</sub> into C<sub>8</sub> and C<sub>10</sub> and larger lipids. The people that initially grew algae viewed it as farming—you know, you grow a bunch of algae and then you harvest it. But it's totally different if the algae are chemical factories. Ours continuously secrete these molecules, so we get constant production of something that can basically be used right away as biodiesel.

### So they perform better than traditional biofuels—but will they actually be better for the environment?

Because we actually have to feed them concentrated CO<sub>2</sub>, we can take CO<sub>2</sub> streams from power plants, cement plants and other places. People view CO<sub>2</sub> as a contaminant—they want to bury it in the ground or pump it into wells to hide or sequester it. We want to take all that waste product and convert it into fuel.

### When do you hope to have these fuels in people's cars?

Our goal is to have multiple things on the market within five years. We're looking now at how to scale this up. Our molecules are much higher energy density [than ethanol], but even so we need to produce hundreds of billions of gallons if we're really going to make a dent in oil use.

This is national [security](#). We seem to be fighting wars at least in part over oil, we're sending most of our money to the Middle East and other places, and we're investing as a nation almost nothing in alternatives.

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Since the 1970s oil crisis, a number of policies have been enacted to increase energy independence.

**Do you think they've been effective?**

Had we followed intellectually where we were back in the Carter era, we wouldn't have a lot of the problems we do today. We've had a lot of short-term thinking from administrations that basically trades off the health of the planet for economic gain for the business community—and for their own re-election. We don't reward our leaders for making long-term beneficial decisions for society. It's like the stock market—all that matters is the next quarter, not where you are 10 years from now.

**Do you think there's potential for change with the current presidential candidates?**

I think either candidate would be orders of magnitude better than what we had in this administration, but I think Obama would be a few orders of magnitude better than McCain. Although McCain has been a longtime supporter of changes in the CAFE standards—trying to get higher-mileage cars—and has consistently been shouted down by his colleagues.

**What about McCain's recent pledge to offer a \$300 million prize for a better electric car battery?**

Industry is very motivated to make new batteries. Whoever makes a better battery is going to make a fortune, and having a government incentive to do that doesn't necessarily move it along. In fact, if it's like the human genome project, it could just slow it down.

**Where do you see the science of genetics going in the near future?**

I see it as parallel to the electronics industry in the 1940s and '50s, a stage when all of the things that enabled [computers](#) came out of just a few handfuls of components—resistors, transistors, capacitors—and people were pretty much limited only by their imagination. My team has discovered more than 20 million new genes, so we're in a biological universe. There are no fundamental limits. I think we're going to see the next 25 years as some of the most innovative in the history of science.

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##### 9. RE: 10 Big Questions for Maverick Geneticist J. Craig Venter on America's Energy Future

Website: [www.nationalalgaeassociation.com](http://www.nationalalgaeassociation.com)

We hope J. Craig Venter can genetically map different algae strains for higher oil content. It may lead to higher extraction rates.

##### 8. RE: 10 Big Questions for Maverick Geneticist J. Craig Venter on America's Energy Future

isn't what he is proposing a sort of a perpetual motion device?

##### 7. RE: 10 Big Questions for Maverick Geneticist J. Craig Venter on America's Energy Future

Why do people think they need to "burn" some type of fuel to get power? Why don't we focus on storing electric energy, that has been created by wind or solar power? That way we don't pollute the earth with more hydrocarbon waste.

##### 6. RE: 10 Big Questions for Maverick Geneticist J. Craig Venter on America's Energy Future

I favor the let a 100 flowers bloom approach, and Venter's algae sounds like a great addition to the mix. Washington DC should enable the possibilities (see flex fuel mandate for cars) not pick winners. Watch for politicians trying to shift money to their donors. To me, pluggable hybrid, wind, shale oil, drill-drill-drill, nuke power, and better thermal design of houses all look good; and economic (no subsidies needed) at these oil prices. Notice what is seldom mentioned; some of these solutions come on fast and some will take longer to engineer and build. This means there is room for many solutions working together.

##### 5. RE: 10 Big Questions for Maverick Geneticist J. Craig Venter on America's Energy Future

Mr. Venter, are you aware of deep bore findings of bacteria living deep in the earth's mantle, that eat rock and produce methane? Could these be potential bio-factory contenders?

##### 4. RE: 10 Big Questions for Maverick Geneticist J. Craig Venter on America's Energy Future

"Because we actually have to feed them concentrated CO<sub>2</sub>, we can take CO<sub>2</sub> streams from power plants, cement plants and other places. People view CO<sub>2</sub> as a contaminant—they want to bury it in the ground or pump it into wells to hide or sequester it. We want to take all that waste product and convert it into fuel." This idea is flawed. Mining hydrocarbons from the earth, combusting them in a power plant, harvesting the waste CO<sub>2</sub> and recombining it with sunlight, and then combusting it again leaves you with the same CO<sub>2</sub> waste product. Unless you close the system and never allow this CO<sub>2</sub> to exhaust into the atmosphere, this proposal will not avert disaster.

##### 3. RE: 10 Big Questions for Maverick Geneticist J. Craig Venter on America's Energy Future

Website: [www.brightfuture.us](http://www.brightfuture.us)

Glad to see someone pushing the algae avenue for biofuels. A much better option than corn, sugar, palm, soy, etc... These require intensive agricultural production that can be environmentally harmful and put pressure on food production. Algae is also way more efficient, with an acre producing 10,000+ gallons of biofuel per year in comparison to 20-50 for the other mentioned sources: [http://www.brightfuture.us/new/index.php?option=com\\_content&task=view&id=183&Itemid=27](http://www.brightfuture.us/new/index.php?option=com_content&task=view&id=183&Itemid=27)

##### 2. RE: 10 Big Questions for Maverick Geneticist J. Craig Venter on America's Energy Future

Algae or other fast-multiplying biological 'stuff' is the future of fuel. But will it be viable before a temporary downturn in oil prices? Experience shows incredibly short-term thinking rules the alternative energy realm. Which is why prizes are a good idea in general. Assuming battery = any energy storage device, McCains idea has merit. There is vast interest in the profits from the incumbents, but what a prize does is encourage the 'left field' breakthroughs which are more likely to revolutionize the industry. This doesn't just involve nutters in sheds, it's grad schools etc.

##### 1. RE: 10 Big Questions for Maverick Geneticist J. Craig Venter on America's Energy Future

Website: <http://www.suelange1@verizon.net>

I considered Venter unrealistic when I first read about him, but then, you know what happened. If it wasn't for his input and energy in the human genome project, it would not be where it is today. I have to take his unbelievable optimism to heart.

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