Kendrick Taylor looks over the WAIS drill.

That, at least, is the theory. But temperature can be exchanged between the poles through other channels, including the atmosphere, which moves heat faster than ocean currents do, says Bo Vinther, a postdoc at the University of Copenhagen, who has worked on coring projects in Greenland and Antarctica. If palaeoclimatologists see long lags between temperature changes at the poles when they stack the WAIS cores up against those from Greenland, that evidence would suggest a lead role for the ocean in the bipolar seesaw. But a shorter lag would suggest a more prominent role for the atmosphere.

The CO₂ record will help to answer this question, too: CO₂ from deep in the ocean, where large masses of organic matter have decomposed, has a different isotopic signature from terrestrial or atmospheric CO₂. Heavier CO₂ in the WAIS record would suggest that ocean circulation bringing up deep water was largely responsible for the bipolar seesaw.

With about a kilometre of ice left to pull up, Taylor is hopeful that the core will be complete by the end of the next drilling season. But the final metres can be the toughest to dig up because the drill's descent grows longer with each segment of extracted core.

"We can get it all done next season if everything goes perfectly," he says. "But this is Antarctica. Every day is a surprise."

Chaz Firestone

1. Mischler, J. A. et al. *Glob. Biogeochem. Cycles* **23**, GB4024 (2009).
2. Blunier, T. & Brook, E. J. *Science* **291**, 109–112 (2001).
3. EPICA Community Members *Nature* **444**, 195–198 (2006).

For more images from the camp, see go.nature.com/eansoG.

TROUBLED WATER

The failure to save European fish stocks.

go.nature.com/hhutTO

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ISTOCKPHOTO.COM

Altered microbe makes biofuel

In a bid to overcome the drawbacks of existing biofuels, researchers have engineered a bacterium that can convert a form of raw plant biomass directly into clean, road-ready diesel.

So far, biofuels have largely been limited to ethanol, which is harder to transport than petrol and is made from crop plants such as maize (corn) and sugarcane, putting vehicles in competition with hungry mouths. In this week's *Nature*, researchers from the University of California, Berkeley, and the biotech firm LS9 of South San Francisco, California, among others describe a potential solution: a modified *Escherichia coli* bacterium that can make biodiesel directly from sugars or hemicellulose, a component of plant fibre (see page 559). The method can be tailored to produce a host of high-value chemicals, including molecules that mimic standard petrol, and could be expanded to work on tougher cellulosic materials, the researchers say.

The work identifies a potentially cost-effective way of converting grass or crop waste directly into fuel, filling gas tanks without raising global food prices or increasing hunger and deforestation in far-flung locales. Moreover, the process is much more climate friendly than manufacturing ethanol from maize, and produces higher-energy fuels that are interchangeable with current petroleum products. The next step is to scale the process up and adapt it to cellulose, which makes up the bulk of plant material.

"It's a nice milestone in the field of biofuels, and it has a lot of promise for actually being commercialized," says

James Liao, a metabolic engineer and synthetic biologist at the University of California, Los Angeles.

LS9's calculations, performed with the help of the Argonne National Laboratory in Illinois, show that the biodiesel that it is preparing to market reduces greenhouse-gas emissions by 85% compared with standard diesel. That calculation is based on using Brazilian sugarcane, which is a much more efficient feedstock than maize; LS9 says that the shift from sugars to biomass as a feedstock would reduce greenhouse gases even further.

The company has been working to convert sugars into tailored molecules for several years, says co-author Stephen del

Cardayre, LS9's vice-president for research and development. However, their university collaborators went two steps further, eliminating the need for additives and then folding in the

ability to use hemicellulose as a feedstock. "This paper is a representation of the types of efforts that are going to move us to biomass," he says.

The researchers basically amplified and then short-circuited *E. coli*'s internal machinery for producing large fatty-acid molecules, enabling them to convert precursor molecules directly into fuels and other chemicals. The team then inserted genes from other bacteria to produce enzymes able to break down hemicellulose. In all, the authors report more than a dozen genetic modifications.

The results could buoy LS9, says Mark Bünger, a research director at business consultancy Lux Research in San Francisco. Like its competitors, including Amyris of Emeryville, California, and South San

Francisco-based Solazyme, LS9 struggled for funding in 2008 and early 2009 because of the drop in oil prices and the economic downturn, Bünger says.

But LS9 made it through, securing US\$25 million in new funding from various sources, including a strategic partnership with oil giant Chevron last September. The company plans to open a commercial-scale demonstration plant later this year.

Jeff Tollefson

"The process has a lot of promise for actually being commercialized."

Switch grass could be made into diesel cleanly and quickly.

PVSTOCK.COM/ALAMY