



plants that could not make FT at all. The FT/GFP protein, but no mRNA, moved across the graft junction and through the mutant plant, they report.

Finally, when they attached two *GFP* genes to the *FT* gene, the resulting protein was too big to travel beyond the leaf—and in those plants, no flowers formed. Thus, the researchers could rule out both RNA and the existence of a signal activated by FT.

“The evidence is convincing, especially

the grafting experiments,” says Ayre. And, strengthening the case, several other researchers are preparing to publish similar results.

But not everyone agrees. Lifschitz calls the evidence in both reports “circumstantial.” He, Nilsson, and Miguel Blázquez of the Polytechnic University of Valencia, Spain, point out that neither group tested whether GFP moves through the plant on its own accord. And Lucas doesn’t think the

authors adequately demonstrated that FT gets into the growing tip from the leaf. For example, in *Arabidopsis*, one leaf promoter used turns on genes elsewhere in the plant, so it could have turned on *FT* outside the leaf, Lucas points out. Even Ayre is still cautious. “Florigen has a long history of disappointing people,” he says. “We’re getting there, but the race is intense, and we need to keep cool heads.”

—ELIZABETH PENNISI

OIL RESOURCES

The Looming Oil Crisis Could Arrive Uncomfortably Soon

The world’s production of oil will peak, everyone agrees. Sometime in the coming decades, the amazing machinery of oil production that doubled world oil output every decade for a century will sputter. Output will stop rising, even as demand continues to grow. The question is when.

Forecasts of peak oil production have ranged from Thanksgiving weekend 2005 to somewhere beyond 2050. But at the annual meeting of the American Association of Petroleum Geologists (AAPG) in Long Beach, California, early this month, the latest answer emerged: World oil production could stop growing as early as 2020—too soon to avoid a crisis—or it could hold off until 2040. “The peak in world oil production is not imminent,” oil information analyst Richard Nehring of Nehring Associates in Colorado Springs, Colorado, said at the meeting, but it is “nevertheless foreseeable.”

Predictions of the timing of peak oil have been all over the map (*Science*, 18 November 2005, p. 1106). So-called peakists favor gauging future production by judging how much oil Earth still holds and how much has already been produced. They come up with a peak in the next few years, certainly before 2020. At the other extreme, major oil companies draw on in-house expertise about how much oil remains and how fast it will be produced. They see no end to rising production as far out as they look, usually not beyond 2030.

Nehring took a different tack, in two ways. First, he conducted an informal survey of experts by organizing a meeting, a prestigious Hedberg Conference, under the auspices of AAPG last November and inviting

75 experts from 19 countries to consider the world’s oil resources. There he pressed them for their best estimates of everything from how much oil might be left to discover to how much might be wrung from existing oil fields and how much might come from unconventional sources such as Canadian tar sands.

From the meeting’s discussions, Nehring came up with low, medium, and high estimates of all the oil likely ever to be produced. But as he said at the meeting, the ultimate resource is not the only constraint. Politics

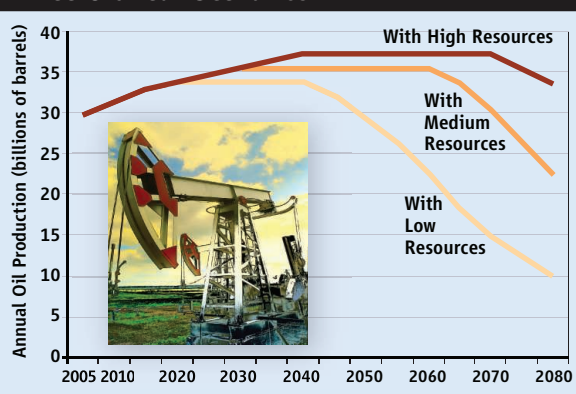
created three scenarios with successively higher peaks beginning in 2020, 2030, and 2040. He then compared the amount of effort it would take to achieve each scenario with the world oil industry’s past performance. “The only scenario we’re quite sure of is the low one” producing a 2020 peak, he says. Conference participants were confident that at least the low estimate of ultimate oil resource is actually out there, he says. And the world oil industry has managed to add the needed production capacity as fast as a 2020 peak would require.

Holding the peak off until 2040, however, would require both a high—and much less certain—total oil resource and adding more production each year than ever before, despite having already produced the world’s most easily extractable oil. “We can’t behave now like we’re going to have the high scenario,” Nehring concludes.

Nehring is getting some attention but not many converts. “Richard did a good service in holding this Hedberg Conference,” says oil assessment specialist Donald Gautier of the U.S. Geological Survey

in Menlo Park, California. But there’s so much uncertainty, Gautier says, from when Arctic ice might melt out of the way to when needed new technology can be developed, that predicting the peak may not be worthwhile. A decade or so could tell. —RICHARD A. KERR

Three Oil Peak Scenarios



Sooner or later. The less oil left to be pumped from the ground, the earlier world production reaches a peak. In a new analysis, only the earliest, low-resource peak looks reliable.

and social unrest can limit how fast those resources can be exploited, as is happening today in Venezuela, Iraq, and Nigeria. And technological challenges, as in the still-icebound Arctic, can slow extraction as well.

So for his second innovation, Nehring