Soft cell. Chapple's work in poplar suggests a cheaper source of ethanol.

PROFILE: CLINT CHAPPLE

How to Make Biofuels Truly Poplar

Clint Chapple has long reveled in the details of plant biochemistry. Now he's finally getting his hands dirty

A master of the biochemical minutiae of plants, Clint Chapple never expected to conduct research requiring a diesel excavator and a greenhouse for growing trees.

But that's where Chapple now finds himself as he explores whether poplar trees could replace corn as a crop for making ethanol for fuel. Over the past 15 years, Chapple, a plant biochemist at Purdue University in West Lafayette, Indiana, has redrawn the map of a key metabolic pathway in plants—work that has won him a solid reputation among academic researchers. Yet plant scientists such as him have long remained second-class citizens in the life sciences funding game. Now, however, with the government embracing biofuels, basic researchers such as Chapple are finding themselves thrust out of their academic cloisters and into the spotlight.

"It's like they say—the right place at the right time," says Chapple, 47. But Chapple's onetime mentor Chris Somerville, a biochemist at Stanford University in Palo Alto, California, says Chapple is being modest. In fact, Somerville says, Chapple has continually exploited unanticipated influences on his career—$70-a-barrel crude oil being only the latest. A fascination with plants' "amazing chemical repertoire" led to graduate work in biochemistry for Chapple, who arrived at Somerville's lab in 1990 with no training in genetics. But he quickly learned enough to create mutants of the model species *Arabidopsis* and develop a promising metabolic method of characterizing polysaccharides in the cell wall (*Science*, 20 August 1993, p. 1032).

A related side project led to a discovery in the pathway that creates lignin, a crucial cell wall stiffener and, behind cellulose, the second most abundant polymer on Earth. That find, a description of the enzymatic step that leads to both straight and branched forms of lignin, helps explain why certain plants break down more easily than others. Over the next 15 years, Chapple uncovered key genetic mutations and steps in the pathway, amounting to a "huge" contribution, says chemist and colleague John Ralph of the University of Wisconsin, Madison.

Lignin is a nuisance to ethanol makers, as it blocks enzymes from getting at the cellulose to break it down to make ethanol. So the U.S. Department of Energy wants Chapple to see how cells modified to make different kinds or amounts of lignin could help poplar compete economically with corn as a feedstock. The first step in the 3-year, $1.4 million project is for Chapple to create the DNA tools with which lignin deposition can be modified. Next, Purdue's Richard Meilan, a transgenic tree expert, will generate transgenic tree saplings, and chemical engineer Michael Ladisch will evaluate the difficulty of recovering cellulose from each. "It dovetails so nicely with the work I've done," Chapple says.

The applied nature of the work is a new twist for Chapple, who says he "always assumed someone else would do it." Experts say the research is not groundbreaking in terms of basic science, but it does carry risks. Chief among them is whether the public will reject transgenic trees. Researchers are buoyed by widespread U.S. acceptance of modified food crops, now common in U.S. grocery products. But remaining European resistance and Greenpeace U.S.A.'s belief that transgenic trees are a "danger in the woods" make supporters such as biochemist Shawn Mansfield of the University of British Columbia in Vancouver, Canada, believe it could be "a hard sell."

One part of Chapple's answer is to find metabolic fingerprints for the transgenic varieties the team grows. That information might enable researchers to find similarly valuable trees in nature and breed them. But that points to another challenge: the "nightmare," as Meilan puts it, of teasing apart the myriad peaks on chromatograms to nail down which part of the fingerprint corresponds to the handful of critical metabolites out of thousands that plants make.

Colleagues say Chapple has the right makeup for the job, and he's included in the project consultations with experts on the societal and ethical impacts of the work. Despite Chapple's limited experience in working with industry partners, for example, Meilan says Chapple wisely addressed concerns of visiting company officials by emphasizing Purdue's experience with government regulators.

Regardless of how effectively Chapple's team overcomes the obstacles to making poplar a legitimate fuel crop, one thing is clear: Plant scientists are being lavished with newfound attention and cash. Just as gratifying, says Chapple, are the shifting attitudes of his department's graduate students, who he says have usually viewed research on plants as less attractive than biomedical pursuits. "I never considered plant sciences before," says Anton Iliuk, a first-year Purdue graduate student in biochemistry. "All of a sudden it feels very exciting." **–ELI KINTISCH**

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