

Fuel for the Future

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Students Win Prestigious EPA Grants



L-R: IHAB FARAG, PROFESSOR OF CHEMICAL ENGINEERING AT UNH; BRIAN MCCONNELL '13 OF PEABODY, MASS.; GINA CHAPUT '13 OF MERRIMACK.

As gas and diesel prices rise and world supplies of fossil fuels dwindle, more and more people are beginning to wonder about the resources that will be available to fuel our future. But while most of us can do little more than raise the question, two UNH undergraduates are among the many bright minds searching for an answer.

For the past three years, Gina Chaput '13 and Brian McConnell '13 have been working in the lab of Ihab Farag, professor of chemical engineering, on research projects examining green algae as a source of biodiesel. In November, the two juniors received prestigious Greater Research Opportunities (GRO) fellowships of nearly \$50,000 from the United States Environmental Protection Agency, thanks in part to their algae research. These generous, two-year grants—two of just 40 awarded nationwide—will provide a tremendous boost to the budding scientists as they pursue their research projects through spring 2013.

A genetics major and a chemical engineering major, respectively, Chaput and McConnell are researching different but related aspects of growing algae as a source material for the production of biofuel. Together with Kyle Charmanski '12, Chaput has been examining how manipulating the presence of two key metabolic components—nitrates and carbon dioxide—affects the proliferation of algae in wastewater. A chemical engineering major, McConnell has focused his research on growing microalgae in wastewater inside of high-tech bags that can float on the surface of salt

water bodies—a particularly promising concept given the abundance of “growing area” available around the globe.

Algae biodiesel has emerged in recent years as one of the most viable sources of “alternative” fuel, a niche today dominated by ethanol. Unlike ethanol fuel, however, which is derived from corn, algae biodiesel does not compete with food crops. Algae also requires significantly less land area to cultivate than biofuels such as vegetable oil and animal fats, and the organism is highly adaptable: it can be grown in seawater, wastewater, freshwater and on land not suitable for growing food crops.

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Chaput says she’s been interested in biofuels since her days at Merrimack (NH) High, though her path to Farag’s lab wasn’t exactly direct. “I’d learned about Dr. Farag’s biodiesel group when I came on a UNH tour in high school, but when I first enrolled my plan was to be pre-med,” she explains. A chance conversation with Farag in the library her first semester got her involved in his research group, and her academic interests gradually shifted from biology to genetics and then to plant genetics. Working with Farag and her major adviser, Estelle Hrabak, associate professor of plant biology and genetics, Chaput’s ultimate goal is to genetically modify algae to yield higher amounts of oil with less biomass.

Oil extraction is the name of the game, and at the end of the algae growth cycle McConnell and Chaput both put in serious hours at the lab, each using a different technique to separate the lipids—the oil—from the algae. At the same time, they balance demanding courseloads that for Honors Program student McConnell this semester comprises five science classes, including a chemical engineering lab and organic chemistry, and for Chaput includes physics and bioinformatics.

Farag, who accompanied McConnell and Chaput to Phoenix, AZ, to present their research at the 2012 National Energy and Environment Conference in January, says the apparent ease with which the two manage their academic and research obligations speaks to the talents and qualities that make them such suitable candidates for the EPA GRO grants. “Brian and Gina are both incredibly disciplined and accomplished students,” he says. “They are both very deserving recipients of these prestigious fellowships.”

This summer, the duo will be working for the EPA as part of the GRO fellowship program. They will learn next month to which of 78 potential projects they will be matched, but McConnell, at least, isn’t ready to look much farther than that down the many paths his work could take him.

“My interests are still evolving,” he says. “I’ve been fortunate to have so many great opportunities, and I still have some time to decide.”

True scientists, both Chaput and McConnell hope to see their laboratory advances find their way to the larger world, even if large-scale algae biofuel production is years off. Farag says his students’ discoveries are the real deal. “Brian and Gina’s research commitment, project dedication, collaboration with other students, and work ethic have advanced our microalgae biodiesel studies here at UNH to a higher level,” he says.

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University of New Hampshire

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