



Students' algae research seeks to turn Nevada into biofuel powerhouse

Noted father of the naturalist movement, John Muir, found Nevada “barren, forbidding and shadeless.” Today, biotechnology graduate student Mark Lemos and biochemistry graduate student Leyla Hernandez-Gomez see a lush garden—ripe for growing algae. At the College of Agriculture, Biotechnology and Natural Resources greenhouses on Valley Road, they are getting a chance to see if this garden will flourish on a large scale.

Under the guidance of John Cushman, biochemistry and molecular biology professor and director of the graduate program in biochemistry, Lemos and Hernandez-Gomez are about to take Nevada’s natural resources—an ample supply of sunlight, geothermal vents and vast tracts of barren land—and leverage them into the emerging field of alternative energy by converting algae into biofuel.

Algae—photosynthetic organisms that vary from the single-celled to large, ocean kelp—boast higher oil productivity when compared to crop-based biofuels, such as those made from corn and soybeans. Some strains of the microalgae—commonly known as pond scum—that would be grown for biofuel can produce as much as 50 percent oil content, according to Rachel Oliver, reporting recently for CNN. Algae are not part of the national food supply and require significantly less water per acre than traditional crops. In addition, they don’t require freshwater, but can flourish off wastewater or saltwater in desert areas, incapable of supporting other crops, Oliver notes. Algae also grows incredibly rapidly: it can double in just hours. For these reasons, algae have attracted interest from venture capitalists and companies like Chevron, Boeing and Airbus. The race to commercialize algae biofuel production is on, and Nevada stands ready to capitalize on its natural resources.

“I came to the University knowing I wanted to study biotechnology,” Lemos says. “Grow-

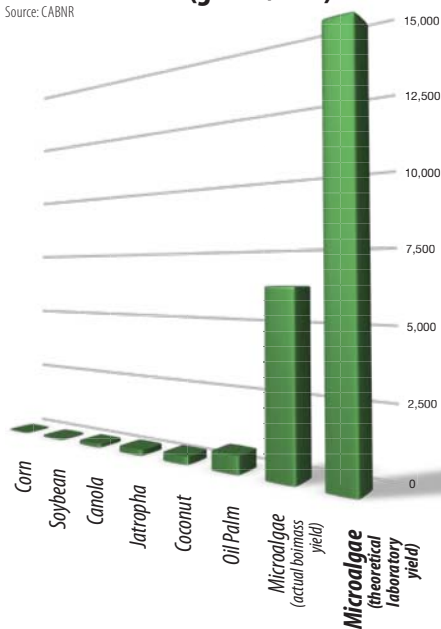
Why microalgae?

- Fastest growing photosynthetic organism.
- 30-times more oil than any other oil crop for making biodiesel.
- Can be grown in waste water, and on non arable lands.
- Does not compete with food.
- Year-round crop production with geothermal.
- Consumes global warming gases (CO₂ and NO_x).

Student Success

Biofuel Oil Yield (gallon/acre)

Source: CABNR



Photos by Theresa Danna-Douglas

ing up in Yerington, I saw how hard my family worked at the geothermal plants. No matter the brilliant suggestions my uncle or my dad made to streamline company resources, they didn't get to capitalize on them. That's how I knew I needed more than scientific knowledge. I wanted to learn about developing a business based on science. Fortunately, Nevada has faculty who were excited about my ideas and wanted to see me succeed."

As an undergraduate, Lemos consulted with Cushman, who guided him toward an accelerated five-year biotechnology program that offers a non-thesis research degree and gives students both a bachelor's and master's degree upon completion. Students in the program are required to do summer research internships in the biotechnology industry.

The graduate program seeks to produce well-trained researchers with theoretical knowledge, technical skills and real-world experience, meeting students' interests in career-directed education. "Upon graduation, our students can find career opportunities as highly skilled researchers in the pharmaceutical and biotechnology industries," Cushman says. "The knowledge and skills they gain put them beyond entry-level positions."

Growing green

Lemos and Cushman made valuable connections with industry executives and government entities interested in their algae

research. Cushman received grant funding from the U.S. Department of Transportation SunGrant Initiative, and with assistance from energy industry consultants, Enegis LLC, has built both pilot- and demonstration-scale algal production ponds at the greenhouse complex. The first large-scale algae crop was harvested in December 2008.

Lemos and Hernandez-Gomez hope to demonstrate that algae can be grown in Nevada in commercial quantities year-round. "It's rare to come across this combination of natural resources," says Hernandez-Gomez, whose focus is to find an ideal algal strain in the lab. "Nowhere else is like Nevada. Other places don't consider algae as viable because they would have to build bioreactors and cover their ponds. Algae need few resources to grow, and we've got them naturally."

"Other researchers have noticed that once strains are cultured in captivity, that they sometimes will grow great in the flask, but not under the regular, large-scale conditions," Hernandez-Gomez continues. "The algae strain that we have chosen to use in the experiment is being sequenced by the U.S. Department of Energy Joint Genome Institute, so we can gain a lot of genetic information. We were worried when we put it in the pilot scale model

and it didn't take off right away. It now seems to be growing as expected—phew!"

"We'll continue to screen algae strains, analyze the oil content and focus on strains that do well outdoors before May," Lemos says. Why before May? Lemos will be graduating with bachelor's and master's degrees this spring. The future is bright for this McNair Scholar.

The Ronald McNair Postbaccalaureate Achievement Program prepares participants for doctoral studies through involvement in research and other scholarly activities. Participants are from disadvantaged backgrounds and demonstrate strong academic potential. Institutions, like Nevada, work closely with participants as they complete their undergraduate requirements. The goal is to increase the attainment of Ph.D. degrees by students from underrepresented segments of society.

"I'm encouraged to look at other universities to diversify my education," says Lemos, and then a smirk came across his face. "However, we had a graduate student from U.C. Berkeley come by a few weeks ago and he was pretty excited by what we're doing here. I just may want to stick around." **N**

—Elizabeth Welsh '99