

Graduating PhD student uses biotechnology to sustainably produce chemicals humans rely on

By Risa Aria Schnebly, ASU News
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Editor's note: This story is part of a series of profiles of notable [fall 2025 graduates](#).

Curbing the effects of climate change means cutting down emissions of carbon dioxide — a greenhouse gas emitted by the burning of fossil fuels. But that's a hard thing to do when so much of modern life relies on using fossil fuels. Beyond fueling your car or generating electricity, we convert fossil fuels to make the chemicals used in everything from pharmaceuticals to T-shirts.

Amanda Godar, who's graduating with a PhD from Arizona State University's microbiology program this fall, spent her degree investigating how to produce those chemicals in more eco-friendly ways, such as using bacteria that can convert sugars derived from crops.

Godar works with strains of bacteria that have been genetically modified to make chemicals that are helpful to humans. In addition to making helpful chemicals, the bacteria are also often modified to do so by fixing carbon dioxide — that gas that we have too much of in our atmosphere already. So if humans switched to using these bacteria to produce the chemicals we need rather than fossil fuels, we could reduce the amount of carbon dioxide released to the atmosphere.

Godar specifically experimented with altering the metabolism — or the process of converting food into energy — of *E. coli* bacteria.

"The analogy I give for a lot of people is that I'm interested in redirecting traffic (in bacterial cells)," Godar explains. "If you think of all the chemical production pathways in the cell as like streets in a city, to increase the flow to a target chemical, you need to close off streets or add new ones, i.e. delete/add/modify genes."

She worked with a strain of E. coli that had been engineered to produce a chemical called succinate, which is used in creating pharmaceutical products, food flavorings and plastics. That strain of bacteria creates succinate by fermenting sugars, a process that requires a lot of carbon dioxide. Scientists like Godar have to deliver that CO₂ to the bacteria in a fixed — or usable — form, like a carbonate salt, which takes a lot of energy to create. So Godar tried creating a less energy-intensive way to make CO₂ usable for the E. coli. She designed a pressurized tool that was able to provide CO₂ to the E. coli cultures at nearly the same concentration as the carbonate salts.

“So it does represent a way of potentially improving CO₂ delivery in the future,” she explains.

Another part of Godar’s dissertation had to do with investigating whether she could genetically engineer E. coli to produce a compound called monoethanolamine, or MEA, which is used to help capture carbon from post-combustion emissions, such as power plants or industrial sites. She was able to get the E. coli to produce MEA at a higher level than any previous researchers — a promising result, though she says there’s a lot more work to be done.

Godar became interested in microbiology while working in bioenergy production at Michigan State University, where she helped design reactors that could convert waste CO₂ into more usable products.

“Over time, I became more interested in what was happening in the reactors versus how to design the reactors,” she said. “Microbiology is just an endlessly fascinating field because there’s so much we don’t know. There are like, tiny little worlds, and I enjoy learning about them.”

Question: Which professor taught you the most important lesson while at ASU?

Answer: It was one of my committee members, [Dr. Rajeev Misra](#). I think in my first year, we were chatting about what it feels like to do research in microbiology, and he described it as always being in a game of chess with bacteria. It’s kind of like a never-ending endgame, where you make a move, then the bacteria makes a counter move that you didn’t see coming. I like thinking about this because it counters a preconception that we can finish a study — there is always more to explore.

Q: What is the best piece of advice you’d give to those still in school?

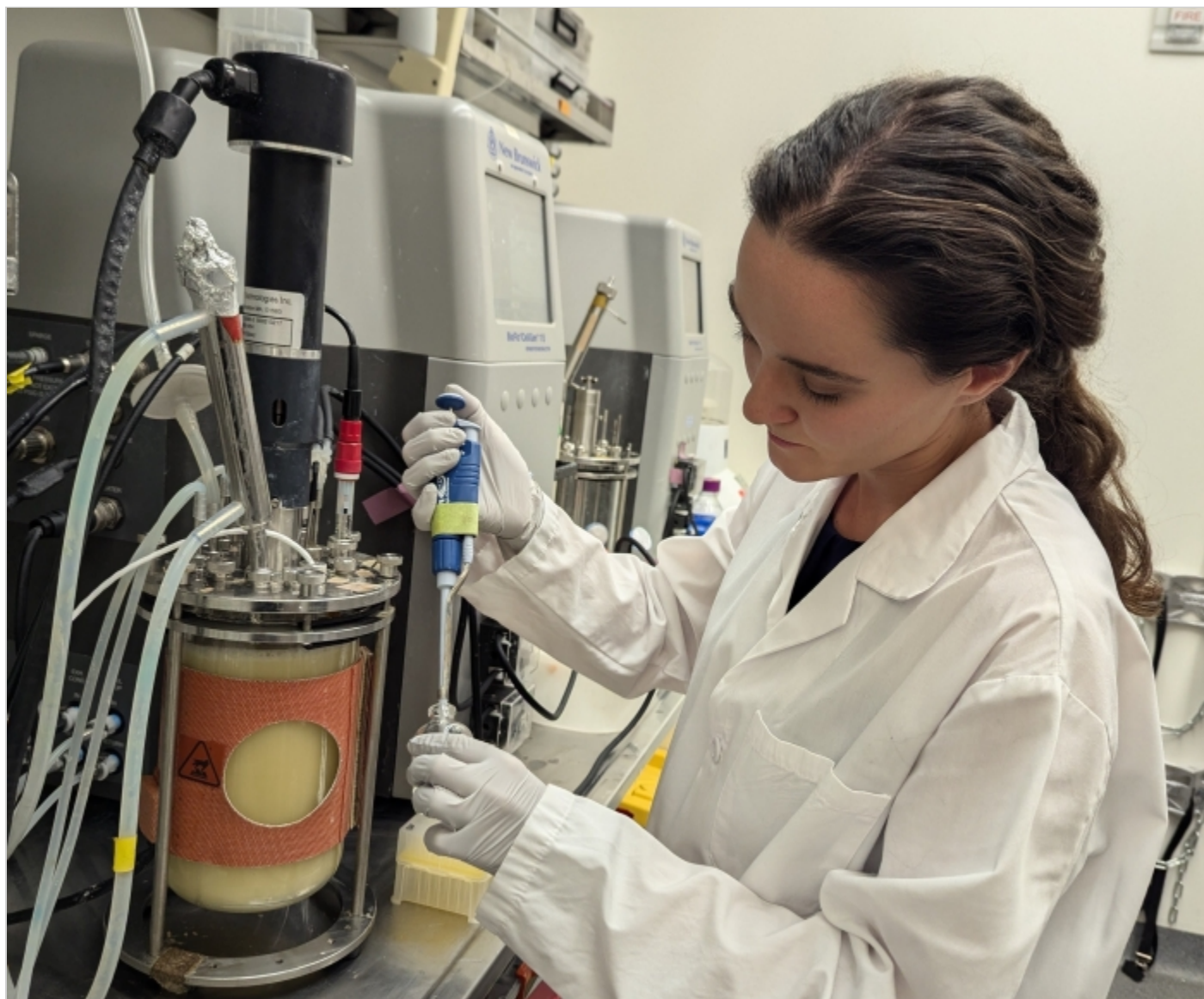
A: I know time is a precious commodity for undergrads, especially between work, school and extracurriculars. But especially at a place like ASU, there is so much cool research going on, and you can be part of it. You don’t have to stick with it your entire undergrad, but try research one semester and see how it goes.

Q: What was your favorite spot on campus, whether for studying, meeting friends or just thinking about life?

A: The Biodesign gardens are really nice. If I have time, I’ll go out there for lunch and read under the palo verde. There’s lots of birds, and foxes and coyotes occasionally, which is really cool. I really enjoy living in the desert, and so it’s like a little piece of that every day.

This story originally appeared on [ASU News](#).

Main image



Graduating ASU PhD student Amanda Godar works with strains of bacteria that have been genetically modified to make chemicals that are helpful to humans. Courtesy photo

Text image(s)



Amanda Godar, courtesy photo