**JGIota: A biofuel breakthrough in anaerobic fungi with Michelle O'Malley and Tom Lankiewicz**

**Allison:** And now, a JGIota, a snippet about JGI-supported science. I'm Allison Joy, your host for this Iota.

To get energy from plants, rather than fossil fuels, we need ways to break plants down — and nature has plenty of ways of doing that. Think of mushrooms decomposing a fallen tree in the forest, or microbes chopping away at food scraps in a compost pile. Both of those processes happen with air, so in the presence of oxygen and overall, lots of these breakdown processes do happen with air.

**Michelle:** We live in an aerobic world where oxygen is kind of abound, and we need oxygen, and all that.

**Allison:** That's Michelle O'Malley, a chemical and biological engineer at the University of California Santa Barbara. So for a long time, the standard presumption in the scientific community has been that if you want to break down all the materials of a plant, you need to have oxygen around — that these breakdowns were strictly aerobic processes.

**Michelle:** Everybody, every researcher is just more programmed to think that way. It's a world that we know, because most of the organisms that we interact with, that's how they live.

**Allison:** But Michelle studies a different kind of fungi. They live in soils or the guts of livestock where they don't have access to air, and so these fungi don't need oxygen. They're called anaerobic fungi, and not needing oxygen could actually make these fungi more useful for converting plants into fuels and chemicals. Here's Tom Lankiewicz , who works with Michelle.

**Tom:** So way down the line, when we're thinking about that on an industrial scale, it's expensive to supply oxygen to a process.Whereas with anaerobes, they don't require that. And so there's some flexibility there, right? We can kind of just set 'em and leave 'em in certain processes.

**Allison:** I mean, 'Set it and forget it,' sounds great to me — but remember, for a long time people have assumed that anaerobic fungi cannot break down all the parts of plants. Some researchers, like Michelle and Tom, suspected otherwise because without the help of oxygen, these anaerobic fungi have to get creative with how they break down materials for energy.

**Michelle:** That means that these fungi have to be like, real scrappy about what they're going to eat, and they have to be real efficient about how they're eating — because they don't actually have the ability, without oxygen being present, to make that much of their

own energy. So that's why you see, in an anaerobic world, that's usually when a lot of degrading is happening.

**Allison:** So Tom and Michelle have been trying to figure out if anaerobic fungi can disassemble the toughest material in plants — lignin. This has actually never been found before, but when they took one particular kind of anaerobic fungi, a rumen fungus found in herbivores,

**Tom:** *Neocallimstix californiae*,

**Allison:** They did find evidence of lignin breakdown. They watched the fungus work its magic on three different kinds of plants: sorghum, switchgrass and poplar.

**Tom:** We can say pretty confidently that lignin is being modified, because there's different bonds that are being broken. It's also being deconstructed to some extent because, as you can imagine, these bonds hold the polymer together, right? So as we clip out specific bonds, it comes apart into, maybe not little pieces, but big pieces.

**Allison:** It will take more research to figure out exactly how these fungi breakdown lignin. The genes IDed by the JGI need to be confirmed responsible for lignin breakdown, as do the enzymes those genes produce.

**Tom:** I think it's important to do science the right way, but you also have to get really lucky to make discoveries, and we got lucky in this case.

**Allison:** So that was Professor Michelle O'Malley and her former graduate student Tom Lankiewicz, sharing a bit about a paper they recently published in the journal *Nature Microbiology*. It's called "Lignin deconstruction by anaerobic fungi."

The researchers behind that work included teams at UCSB, the JGI, the Joint BioEnergy Institute, and the Great Lakes Bioenergy Research Center.

The JGI enabled that work via our Community Science Program. You can find out more about this work and the Community Science Program at the JGI website. There are links in the show notes and an accompanying story as well as a transcript of this episode online.

This episode was written, produced, and hosted by me, Allison Joy. I had production help from Menaka Wilhelm, Massie Ballon, Ingrid Ockert and Graham Rutherford.

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Thanks for tuning in. Until next time.