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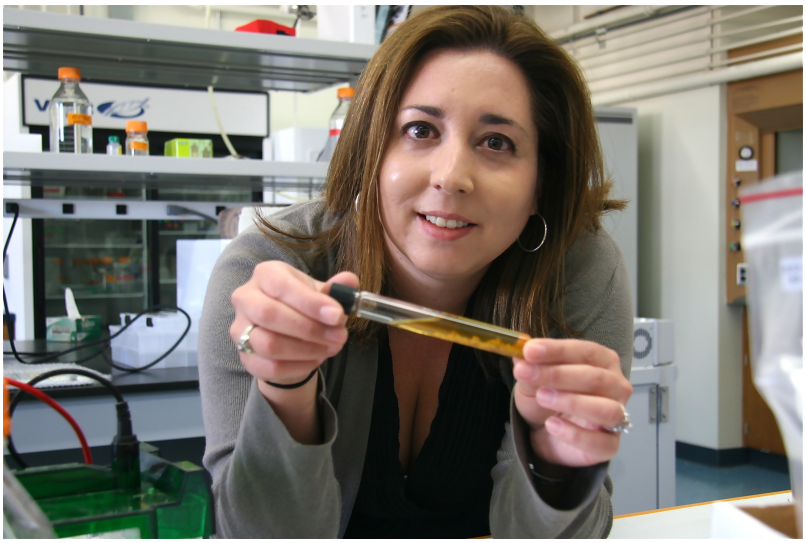
Horse Gut Fungus Converts Cellulose into Biofuels



NEWS RELEASE

(Santa Barbara, CA --) It's a new kind of horsepower: At the recent National Meeting & Exposition of the American Chemical Society (ACS), UC Santa Barbara chemical engineer Michelle O'Malley reported that fungi in the intestinal tracts and feces of horses could be the key to producing biofuels from non-food plants, unlocking a new source of energy from material previously discarded or overlooked.

?Nature has made it very difficult and expensive to access the cellulose in plants. Additionally, we need to find th e best enzyme mixture to convert that cellulose into sugar,? O?Malley said. Cellulose, she explained, is an ener gy-rich material that can be broken down into sugars for fermentation into alcohol for fuel. Crops like corn, wheat, and sugarcane are typically used in the production of bioalcohols like ethanol, because the cellulose in these energy crops is more readily accessible ? surrounded by less of a tough biopolymer called lignin that is fo und in plant cell walls.

A drawback to fuel production from these energy crops is that they compete for space with crops grown for food. However, using non-food plants, or the parts of food plants with denser lignin networks for fuels is costly and energy-consuming.

?We have discovered a fungus from the digestive tract of a horse that addresses both issues ? it thrives on lign in-rich plants and converts these materials into sugars for the animal. It is a potential treasure trove of enzymes for solving this problem and reducing the cost of biofuels,? said O'Malley. These fungi, which grow in the di gestive systems of large herbivores like horses and cows, grow invasively into the plant material and secrete enzymes that break down cellulose into sugar. By genetically engineering these lignin-loving fungi into yeasts, it would be possible to access and break down the cellulose trapped in non-food plants and convert it into biofuel using already proven production technology.

"We are all very excited about Professor O?Malley?s pioneering work. The field of biofuels needs a completely new idea in order to take off and make a meaningful contribution to our renewable energy needs. Her research on enzymes in gut fungi holds great promise of being that idea,? commented Professor Michael Doherty, Chair of th

e UCSB Chemical Engineering department.

The research for this study, in collaboration with researchers from the Broad Institute of the Massachusetts Institute of Technology and Harvard University, consisted of isolating the anaerobic gut fungus from horse feces and identifying the genetic material involved in manufacturing enzymes and other proteins. It is also one of the relatively few forays into the investigation of gut fungi as a means of producing biofuel. Research has been focused more often on lignocellulose-digesting enzymes from bacteria.

?There was relatively little scientific knowledge about fungi in the digestive tracts of these large animals. They ar e there, but in very low numbers, making it difficult to study. The low concentrations also fostered a misconception that fungi must be unimportant in digestion of cellulose. And it is extremely difficult to isolate and grow these fungi to study their enzymes,? said O'Malley.

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Story and photography by Sonia Fernandez, UCSB

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