Better beer: College team creating anticancer brew

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College students often spend their free time thinking about beer, but a group of Rice University students are taking it to the next level. They're using genetic engineering to create beer that contains resveratrol, a chemical in wine that's been shown to reduce cancer and heart disease in lab animals.

Rice's "BioBeer" will be entered in the International Genetically Engineered Machine (iGEM) competition Nov. 8-9 in Cambridge, Mass. It's the world's largest synthetic biology competition, a contest where teams use a standard toolkit of DNA building blocks -- think genetic LEGO blocks -- to create living organisms that do odd things.

Notable past iGEM creations include sheets of bacteria that behave like photographic film and bacteria that smell like mint while they're growing but like bananas when they stop growing. Rice's student-led iGEM team -- the Rice BiOWLogists -- are returning for a third year. Their entry last year, a bacterial virus that fought antibiotic resistance, was well-received but finished out of the prize running.

"After last year's contest, we were sitting around talking about what we'd do this year," said junior Taylor Stevenson. "(Graduate student) Peter Nguyen made a joke about putting resveratrol into beer, but none of us took it seriously."

But when the team began looking in earnest for a new project this spring, they discovered a good bit of published literature about

modifying yeast with resveratrol-related genes. When they looked further, they found two detailed accounts by teams that had attacked both halves of the metabolic problem independently.

"That was when we said, 'You know, we could actually do this,'" said junior Thomas Segall-Shapiro.

Ironically, most of the team's undergraduate members aren't old enough to legally drink beer. But the reality is that with less than a month to go until the competition, the team has yet to brew a drop. All their work to date has gone into creating a genetically modified strain of yeast that will ferment beer and produce resveratrol at the same time. While the team does plan to brew a few test batches in coming weeks, these will contain some unappetizing chemical "markers" that will be needed for the experiments.

"There's no way anyone's drinking any of this until we get rid of that, not to mention that there's only one genetically modified strain of yeast that's ever been approved for use in beer, period," said Segall-Shapiro. "In short, it will be a long time before anybody consumes any of this."

So why would someone want to make beer with resveratrol in the first place? It's a naturally occurring compound that some studies have found to have anti-inflammatory, anticancer and cardiovascular benefits for mice and other animals. While it's still unclear if humans enjoy the same benefits, resveratrol is already sold as a health supplement, and some believe it could play a role in the "French paradox," the seemingly contradictory observation that the French suffer from relatively low rates of heart disease despite having a diet that's rich in saturated fats.

"I have seen some studies where it's been shown to activate the same proteins that are known to play a role in extending the life span of lab animals that are kept on low-calorie diets," said junior David Ouyang.

Ouyang said the team is working with a strain of yeast that's used commercially to make wheat beer. They got a sample of the yeast from Houston's Saint Arnold Brewing Company, and they are modifying it with two sets of genes. The first set allows the yeast to metabolize sugars and excrete an intermediate chemical that the second set can later convert into resveratrol.

"One set of genes gets you from A to B, and the other gets you from B to C," said Stevenson. "We've already created a strain that has the B-to-C genes, but our genes for the A-to-B part are still on order."

With some luck and hard work, the team said it will finish the full A-to-C yeast in time to get some data before heading to Cambridge. But even if they don't have this final piece of the puzzle, they're confident they'll have plenty of data from other experiments and computer models.

Faculty adviser Jonathan Silberg said the iGEM competition provides a unique educational experience for undergraduates.

"In terms of education value, the great thing about synthetic biology research is that it stimulates undergraduate creativity and gives them an opportunity to work collaboratively at an early stage of their science and engineering education," said Silberg, assistant professor of biochemistry and cell biology. "While students work collaboratively in other undergraduate research endeavors, they typically are not given the pie-in-the-sky opportunity to pursue their own ideas."

Regardless of how the BiOWLogists fare with BioBeer, they are already looking ahead to next year. Team members recently filed the necessary paperwork to create the Rice Synthetic Biology Club. Ouyang said the official recognition will help ensure Rice's annual presence at iGEM, even after the current team members graduate.

Source: Rice University