University of Lethbridge News Release

For Immediate Release — Thursday, November 5, 2015

# Gold-medal winning University of Lethbridge iGEM team may have answer for widespread agricultural problem

The University of Lethbridge's incomparable iGEM program achieved a gold medal standing at iGEM 2015 recently, debuting a project that may soon eradicate a widespread agricultural problem.

It was the ninth time that a U of L team participated in the annual International Genetically Engineered Machine (iGEM) competition in Boston, Mass., which invites the world's brightest university and high school students to showcase innovative new biologically-engineered systems that solve real-world challenges. Over those nine years, the University has achieved eight gold medals, more than any other Canadian team.

"Given the fact that we are a small place without an engineering school, I think we're sitting in a very good spot in terms of our performance over the years," says Dr. Hans-Joachim Wieden, chemistry and biochemistry researcher, Alberta Innovates Technology Futures Strategic Chair in Bioengineering, and iGEM supervisor. "I think we're in the top five per cent of all Canadian teams that attend iGEM, and worldwide, we are clearly seen as a contender. Nobody asks us where Lethbridge is anymore."

This year's project is especially intriguing in that it was arrived upon through consultation with Agriculture and Agri-Food Canada and tackles an issue of local, regional and global relevance – how to combat the fungal species Fusarium graminearum (Fg).

Affecting crops such as corn and wheat, Fg fungi infection results in millions of dollars in economic losses. Current methods of controlling outbreaks include the use of broad-spectrum fungicides, biological control agents, crop rotation and the planting of Fg resistant wheat strains. Each of these methods has its limitations, from building up resistance in Fg, to difficulties of application, effecting off-target species and bioaccumulation.

"Currently there are no really good treatments for it," says iGEM team member Graeme Glaister, a fourth-year neuroscience student who was competing in his third iGEM competition. "There is a fungicide but you can only spray it once per year because it

builds up resistance and is extremely toxic, so you have to be a certain distance from bodies of water. We wanted to find a new approach to this that would not bioaccumulate like a lot of pesticides, and would be species specific."

The group looked to the insect world and the work that had been done developing RNA-based insecticides. In that instance, double-stranded RNA is introduced to insect species, with a goal of knocking down a specific essential gene within the insect. It's called RNA interference (RNAi) and allows the pesticide to be species specific, selectively taking out genes in the targeted insect. Its specificity means other insects, with a different RNA makeup, are not affected, nor are there toxicity or bio accumulation concerns.

"Based on that, we decided to see if we could expand on RNA-based insecticides and make it for fungicide use," says Glaister.

Targeting specific regions within an essential gene of Fg, the group was able to knock down the pigment they were aiming at, successfully proving the concept of their approach.

Part two of their project was to find a way to optimize the process and make it cost-effective to produce a fungicide using this technique.

"It's hard to make a lot of RNA, in fact it's far more expensive than making a pesticide because people generally just study RNA, so it isn't made in large quantities," says Glaister.

The group tackled this problem by developing a bacterial chassis (a harmless bacterial strain of E. coli) for expression of RNA, then created a novel purification scheme to harvest the product.

"We've shown it works, which is really cool, so now we need to optimize it and make it more efficient so that it actually reduces costs," says Glaister.

With funding from the University's new AGILITY program, designed specifically for enhancing innovation and entrepreneurship activities such as these, the team has the makings of a marketable product.

"What we're seeing here is a great example of how the innovation pipeline works. Knockdown and RNAi, we did not invent that, that was a basic researcher on a lab bench who discovered that machinery not too long ago," says Wieden. "But the knowledge transfer, that's for people like our students, that's why we have to expose them to the current developments in basic research so that they can pick these ideas up and then move them into the marketplace."

For team member Rhys Hakstol (BASc ’14), a first-year master’s in biochemistry student, the opportunity to take the group’s lab work to market and benefit the local community is especially gratifying.

“With our local approach motivating this, we saw there was a problem facing farmers and were able to develop a potential solution to it,” he says. “I think being able to take our research and potentially apply it in a real-world scenario in the future is super exciting for us as a team and also for the University.”

Aside from the indispensible support of the Alberta RNA Research and Training Institute at the U of L, Alberta Innovates Technology Futures, through its GeekStarter program, provides financial support for programs such as iGEM, helping to create future innovators and entrepreneurs who will drive the economic diversification of our province.

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Contact:

Trevor Kenney, News & Information Manager
403-329-2710
403-360-7639 (cell)
trevor.kenney@uleth.ca