iGEM at the U of L

University iGEM students showcasing the Synbridge makerspace at the U of L.

iGEM Background

Starting in 2003 at the Massachusetts Institute of Technology (MIT), the internationally Genetically Engineered Machine (iGEM) competition is the largest international competition within synthetic biology. Hundreds of student teams from around the world aim to use biotechnology to address real-world problems. This focus requires the students to not only work on the technology itself but also to leave the lab. They need to develop business plans, engage with stakeholders, interview consumers, check the legality/risks of their projects, make life cycle assessments, etc. Finally, thousands of students meet at the end of the year to have their projects judged by a range of judges from academia and industry at the iGEM Jamboree.

In 2007, the University of Lethbridge started a collegiate iGEM team and has been a part of the competition for thirteen consecutive years, having won the Grand Prize (North America) in 2013 with the project FRAMEchanger. In 2012, the Lethbridge High School team was formed from the combination of three different high schools in Lethbridge; Chinook High School, Catholic Central Highschool, and Lethbridge Collegiate Institute, and has been the only high school team in Canada to compete every year. The high school team won the Grand Prize in 2013 that focused on producing a better oxytocin product.

Both the U of L collegiate and high school teams have been high-profile success stories for the institution. They have an excellent success record and consistently receive congratulations from local MLAs and news media (see below). The iGEM program embodies many of the University's goals, particularly with respect to its liberal arts tradition. It is interdisciplinary in the best sense of liberal education. While at its core, it involves advanced biochemistry, teams must also utilize skills associated with computer science, business, art, communication, and marketing. Entrepreneurial activities are greatly encouraged by the iGEM community. The University of Lethbridge has had two teams result in start-up companies – Synbiologica from the 2013 team and Nomadogen from the 2014 team. With the creation of SynBridge in 2016, more teams have space for continued product development on campus following the competition.

The iGEM competition encourages collaboration and the value of working as a team to succeed. Students gain skills in entrepreneurship and innovation, allowing them to become future business developers, investors, and creators. They are exposed to both the theory and technical skills of synthetic biology and bioengineering, in a way that will prepare them for future careers. The hands-on laboratory experience will hopefully encourage a continued interest in science beyond high school and undergrad.

High School students working in the Synbridge at the University of Lethbridge and meeting iGEM CEO at the 2022 Giant Jamboree in Paris.

Impact of iGEM Program on Participants

The iGEM competition encourages collaboration and the value of working as a team to succeed. Students will gain skills in entrepreneurship and innovation, allowing them to become future business developers, investors, and creators. High school and university students will also be exposed to both the theory and the technical skills of synthetic biology and bioengineering, in a way that will prepare them for an undergraduate science or engineering program. The goal is to provide a successful, hands-on laboratory experience that will encourage continued interest in science and engineering. It will also facilitate the understanding that science is not a set of facts, but a way of thinking, a problem-solving process that can be applied to any aspect of life. Science encourages us to ask questions, find answers, and then ask more questions. It is also a safe space for students to fail and learn from their mistakes.

Since 2007, the iGEM program has reached over 400 young people in Alberta, both as members of the high school and university teams and hosting wet lab skills training workshops for other provincial teams. These students gain access to advanced laboratory facilities, mentorship, guidance, and resources to develop their projects and have the chance to collaborate with each other. Going forward, every year both Lethbridge teams would reach 20 students each. Additionally, U of L has hosted the MindFuel iGEM wet lab skills workshop since 2016. This event brings together 40 – 60 students from across the province and showcases the resources available at the U of L for synthetic biology teams.

Integration into Science Curriculum

Investment into the U of L iGEM program would allow for the integration of synthetic biology and iGEM-related concepts into high school and university science curricula. Currently, IDST3200 and BHCM1850 are offered to university and high school students respectively. These courses use the iGEM competition as a framework for understanding synthetic biology, genetic engineering, and project development. A partnership with Lethbridge School District 51 allows high school students to enroll in BCHM1850 free of charge and earn both high school and university credits. Over 70% of students who take this course have gone on to enroll at the U of L and serves as a great introduction to university science courses. University iGEM team members can enroll in IDST3200 and receive course credit for their involvement with the iGEM team and have it recorded on their experiential transcript as well.

The iGEM program contributes to the modernization of hands-on teaching experiences in several ways:

1. Students receive training with state-of-the-art laboratory equipment, beyond what is available through typical course-based teaching labs and replicate real-world scientific practices.
2. iGEM projects require students to apply their theoretical knowledge in a practical setting. They engage in hands-on experimentation, design and implementation of their projects, enhancing their understanding of synthetic biology and strengthening their problem-solving skills.
3. The program encourages mentorship by and collaborations with researchers, professionals, and experts. These interactions provide students with guidance, insights, and exposure to the latest research and industry practices, enriching their learning experience.

Availability at Comparator University

While the iGEM program has been adopted by many institutions within Alberta, Lethbridge offers a very unique program. The U of L is the only university that has both collegiate and high school teams. The Lethbridge high school team is especially unique as it is the only Canadian team to compete internationally continuously since 2012. Additionally, the high school team is a community team as it is not tied to one individual school but draws students from all the local high schools.

SynBridge is a supervised maker space for synthetic biology and bioengineering, the first of its kind in Alberta. Having received over $1.1 million in funding through the Western Diversification Program, the SynBridge facility opened in 2016 at the U of L. It houses state-of-the-art equipment and serves as a dedicated space for project development and testing by the iGEM teams. This partnership is extremely unique even outside of Canada. Our teams are very fortunate to have this support from the university.

At the University of Calgary, they have a great advantage as they provide co-op and stipend funding for their iGEM team members. This means that students participating in the

program have the opportunity to receive financial support during their involvement. While we, unfortunately, don't currently have the same level of funding available, we are committed to exploring alternative ways to support our team members in their iGEM journey. We believe in the value of this program and are actively seeking partnerships, sponsorships, and other opportunities to provide resources and mentorship to our dedicated students.

Leveraging Student Recruitment

Promote iGEM Participation: Highlight the benefits of participating in the iGEM program to attract students. Emphasize the opportunity to gain hands-on experience in synthetic biology, collaborate with peers globally, and showcase their skills at international competitions. Advertise the program through university newsletters, science departments, student clubs, and online platforms.

Showcase Success Stories: Highlight success stories of previous iGEM teams or individual participants from your institution. Share their achievements, awards, and the impact their projects had within the scientific community. Feature these success stories on the U of L website, social media platforms, and during information sessions to inspire potential recruits.

Alumni Engagement: Engage iGEM program alumni from U of L to actively participate in recruitment efforts. They can share their experiences, provide guidance to new participants, and serve as mentors. In the past, we have encouraged alumni to participate in iGEM-related events, such as guest lectures, workshops, and panel discussions.

Targeted Outreach: Work with local high schools, science teachers, guidance counselors, or career advisors to introduce the iGEM program and its benefits to students. Encourage student enrollment in BCHM1850 dual credit course. Highlight the iGEM program as a potential pathway for these students to continue their research at university.

Scholarships and Incentives: Consider offering scholarships or incentives specifically for high school students interested in joining the university's iGEM team. This can help attract talented individuals who may be considering multiple institutions. Promote these opportunities through our website, social media channels, and partnerships with high schools.

Since the high school team’s inception, more than 60% of students went on to enroll at the U of L in an undergraduate program. This translates to over $3.7 million (100 students x $4700 x 8 semesters) in total revenue since 2012.

Sources of Support

Source	Amount	In-Kind?	Notes
SynBridge, U of L	$4000	Yes	Wet lab space for iGEM teams to use to complete experiments
Chem & Biochem Department, U of L	$40,000	Yes	Instructor salary for team mentorship

MindFuel – Tech Futures Challenge	$5000	No	$2500 / team for seed funding
Agility, U of L	$2000	Yes	Entrepreneurial consultations/workshops, access to Innovation Zone's prototyping equipment
IDT	$1000	Yes	DNA construct synthesis
GoFundMe	$1000	No	Typical amount raised through community donations
Total	$53,000		

Both the high school and university teams have been awarded several grants over their lifespan. From 2010 to 2012, the university team was awarded $65,000 in grants from ConocoPhillips. Until 2018, Alberta Innovates supported both teams with grants of up to $20,000 for expenditures as part of their Tech Futures program. More recently, in 2022, Alberta Women in STEM Network donated $5000 to the high school team to support travel by an underprivileged female team member. Additionally, in 2021 the teams received $10,000 as part of the Institutional Support of Entrepreneurship Education (ISEE) from Alberta Innovates.

Program Expenditures

Expenditure	**Estimated Amount**	**Notes**
iGEM Team Registration	$14,780	$5500 USD per team
iGEM Jamboree Registration	$8055	$3000 USD per team
Flights	$40,000	$2000 CAD per person * 10 people * 2 teams
Accommodations	$10,000	$5000 per team
Wet lab materials	$2500	Lab consumables, enzymes, chemicals, etc.
Lab space and equipment usage	$4000	SynBridge lab usage
Instructor	$40,000	Two instructors as team faculty advisors
Total	$119,335	

The U of L is already very supportive of the iGEM programs by providing access to SynBridge in-kind and having faculty advisors dedicated to supporting the teams. In the past, the teams have asked for members to pay their own way to the jamboree, which can unfortunately disadvantage some individuals. Funding from the Faculty of Arts and Science Dean's Office has supported participation in the Jamboree for the last few years.

Contacts

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Media Recognition

Lethbridge School District 51 Recognition https://www.lethsd.ab.ca/our-district/news/post/division-students-playing-key-role-in-high-school-igem-team-once-again

iGEM Impact Grant Winners https://competition.igem.org/sponsorships/impact-grant

Student's raise funds to go to Paris https://lethbridgeherald.com/news/lethbridge-news/2022/08/31/igem-students-raising-funds-for-paris-jamboree/

iGEM Impact Grant Winners https://2021.igem.org/Teams/Grants/Impact

Virtual iGEM Giant Jamboree sees University of Lethbridge-supported teams garner silver and bronze, UNews, Dec 8, 2020
https://www.uleth.ca/unews/article/virtual-igem-giant-jamboree-sees-university-lethbridge-supported-teams-garner-silver-and#.YA8F_OjYqUk

iGEM 2020 Continues Despite University Shut Down, Lethbridge Herald, May 8, 2020
https://lethbridgeherald.com/news/lethbridge-news/2020/05/08/lethbridge-igem-students-use-zoom-to-complete-their-seasons/

University of Lethbridge iGEM team wins gold for oral insulin research, Global News, November 22, 2019 https://globalnews.ca/video/6208162/university-of-lethbridge-igem-team-wins-gold-for-oral-insulin-research/?fbclid=IwAR1wBfewT0ROGandnPM6i7MwVJW5hTXbYfHZVbZKcmXxnYC_7xXOpVGL4Mo

University of Lethbridge iGEM team earns gold for project that designs oral insulin delivery system, UNews, November 21, 2019
https://www.ulethbridge.ca/communications/university-lethbridge-igem-team-earns-gold-project-designs-oral-insulin-delivery

iGEM culture the real driver of student success, UNews, November 21, 2019
https://www.ulethbridge.ca/unews/article/igem-culture-real-driver-student-success#.YTpKEJ3YqUl

iGEM 2019 Results, Global News, November 10, 2019
https://globalnews.ca/video/6208162/university-of-lethbridge-igem-team-wins-gold-for-oral-insulin-research/?fbclid=IwAR02yyJDjBqvN9XeowrkIoxQfjfmSsi34i8f51FPhAgCl2knjyvQ1kMW9aI

Lethbridge iGEM teams hit the ground running, UNews, June 5, 2019
https://www.ulethbridge.ca/unews/article/lethbridge-igem-teams-hit-ground-running#.YTpJ3J3YqUm

SynBridge hosts province-wide iGEM skills workshop, UNews, March 7, 2019
https://www.ulethbridge.ca/unews/article/synbridge-hosts-province-wide-igem-skills-workshop#.YTpJSJ3YqUn