

UBC iGEM Backgrounder

The motivation:

The **International Genetically Engineered Machines** competition (iGEM, http://2008.igem.org/Main_Page) was started by MIT as a way to answer the following question:

Can simple biological systems be built from standard, interchangeable parts and operated in living cells? Or is biology simply too complicated to be engineered in this way?

The iGEM competition facilitates the answering of this question by providing a library of standardized parts (we call these parts *BioBricks*) to students, and asking them to design and build genetic machines with them. Of course, students are welcome (and encouraged!) to make their own BioBricks as well.

Information about BioBricks, and a toolkit to make and manipulate them, is provided by the Registry of Standard Biological Parts, or simply, the [Registry](#). This is a core resource for the iGEM program, and one that has been evolving rapidly to meet the needs of the program.

Beyond trying to answer the question above, our broader goals include:

- To enable the systematic engineering of biology
- To promote the open and transparent development of tools for engineering biology
- And to help construct a society that can productively apply biological technology

Are we any closer to finding an answer to our question? In just three years, iGEM teams managed to partially or completely build a variety of systems, from biosensors to biological photographic film, so it's looking positive that engineering biology *is possible*.

The format:

Teams of undergraduate students (comprised of 7-10 students from a wide variety of disciplines) begin working in May on their projects and must complete their work by mid-October, when a submission to the iGEM wiki is due. The Jamboree, held annually in mid-November at MIT, is the conference at which the teams present their work and the winner is announced.

Why UBC?

The University of British Columbia is a world leader in molecular biology, genetics, computational biology, and microbiology, and seeks to become a leader in the emerging field of synthetic biology. Current efforts underway at UBC include the recent

formation of the Centre for High-Throughput Biology (ChiBi) and the recruitment of faculty into this centre. High-throughput biology, broadly defined, seeks to develop tools and techniques for the rapid discovery and measurement of the biological systems within single cells. Other recent initiatives include the formation of the Centre for Drug Research and Discovery (CDRD), whose mission includes the discovery of promising drug candidates and the transition of such candidates from research to industrial production. Synthetic biology is a natural method for increased production of biological therapeutics; as such, efforts including the iGEM competition will develop techniques that CDRD can leverage in their work.

Most importantly, Vancouver and the Lower Mainland are home to a wide variety of biotechnology industries and research organizations. Such organizations, such as the Genome Sciences Centre and various companies that have grown out of research conducted at UBC, seek to discover and develop new therapeutics and diagnostic techniques. A critical challenge for any such company is to scale production of promising lead candidates to the scales required of clinical trials and then wide distribution. Synthetic biology techniques developed at UBC will be available for immediate use in such industrial sectors. Finally, industrial partners are always seeking new talent, and UBC is a major supplier of such talent locally. iGEM will increase the exposure of our most brilliant students to this emerging field, and as such will further enhance the scientific talent available in Vancouver and the Lower Mainland.

The advantages to academia and industry:

As the premiere undergraduate teaching program in Synthetic Biology, iGEM attracts the current and future leaders in the field. The competition format is highly motivating and fosters hands-on, interdisciplinary education. Biology students learn engineering approaches and tools to organize, model, and assemble complex systems, while engineering students are able to immerse themselves in applied molecular biology. Involvement from industrial partners both enables the learning as well as increases contact between industrial partners and the excellent students they want to hire.

What is required for this to work?

The major roadblock to any scientific endeavor involving biology is funding. Other requirements include wet lab space, scientific support, and administrative support. Listed below is a brief breakdown of the anticipated costs of sponsoring an iGEM team at UBC. Lab space will be provided by the Michael Smith Laboratories, the main UBC sponsor of this team. The Advanced Molecular Biology Laboratory (AMBL) within MSL provides students with top-flight wet lab space and centralized facilities to culture bacteria, perform cloning and transformation, and the other techniques needed to complete their project (read: lots of PCR!).

The majority of most teams' budgets are spent on (in order of decreasing magnitude): summer stipends for students, travel & lodging for the Jamboree, DNA sequencing/synthesis & Lab Supplies, and competition fees.

Here is breakdown of expenses for an average iGEM team comprised of 7 students and 3 advisors.

expense	cost / unit	units	total
summer stipends	\$4,000 / student	7 students	28,000
iGEM Team Fee	\$1000 / team	1 team	1000
Jamboree Fee	\$100 / student	7 students	700
Jamboree Fee	\$250 / advisor	3 advisors	750
flights to Jamboree	\$500/person (roundtrip)	10 people	5000
Hotels near Jamboree	\$250 / night; 2 people / room . 5 rooms x 3 nights		3750
			\$39200

Additionally, some teams need funds for DNA sequencing, synthesis, and basic lab reagents. Last year the DNA synthesis company GENEART provided 4kb of free synthesis to iGEM teams, and a similar arrangement is in the works for 2008. Nonetheless, some teams budget several thousand dollars for sequencing (for error checking! Important!) and synthesis.

Other costs for the UBC team will include the costs of various reagents needed for the work. Such reagents include, but are not limited to:

expense	cost / unit	units	total
PCR kits	\$400/kit	10 kits	\$4000
Cloning kits	\$500/kit	10 kits	\$5000
DNA synthesis	\$5000	1	\$5000
DNA sequencing	\$5000	1	\$5000
			\$19000

Thus, the total amount of funding we require is around \$60000. We have in-kind funding donated from the following industrial and academic partners:

- Michael Smith Laboratories, use of AMBL facilities and MSL centralized facilities

We would appreciate your organization's help in starting and supporting an iGEM team at UBC. If you would like more information or have questions, please contact Eric Lagally at (604) 827-4274 or lagally@mssl.ubc.ca

Thanks!



Eric Lagally