

















Takeda and PVP Biologics Announce Development Agreement around Novel Therapeutic for Celiac Disease

OSAKA, Japan & SAN DIEGO & SEATTLE--(BUSINESS WIRE)--Takeda Pharmaceutical Company Limited ("Takeda") (TOKYO:4502) and PVP Biologics, Inc. ("PvP") today announced a global agreement for the development of KumaMax, a novel enzyme designed to break down the immune-reactive parts of gluten in the stomach, thereby avoiding the painful symptoms and damage done in the small intestine from accidental gluten ingestion.

"We are pleased to be partnering with PVP Biologics, a company whose management team has a proven track record of successfully bringing assets that target chronic inflammatory GI diseases through development."



Under the terms of the development agreement, PvP will conduct all research and development through phase 1 proof-of-principle studies per a pre-defined development plan. Takeda will fund \$35 million for PvP's expenses related to the plan in exchange for an exclusive option to acquire PvP following receipt of a pre-defined data package. Upon PvP's successful completion of the development plan, Takeda may exercise its option to acquire PvP by paying an undisclosed fee as well as development and regulatory milestones.

"This agreement with PVP Biologics reinforces Takeda's commitment to developing therapeutics targeting celiac disease. KumaMax could address

a significant unmet need for celiac patients who try, but are unable to completely avoid gluten exposure in their diets, and thus continue to experience debilitating symptoms," said Asit Parikh, head of the gastroenterology therapeutic area for Takeda. "We are pleased to be partnering with PVP Biologics, a company whose management team has a proven track record of successfully bringing assets that target chronic inflammatory GI diseases through development."



PVP BIOLOGICS



DESIGNING KUMAMAX

The KumaMax project got its start in 2011 as an undergraduate project at the University of Washington (UW) for the international Genetically Engineered Machine (iGEM) competition. The iGEM competition is the premiere student team competition in synthetic biology. For iGEM, undergraduate students design, build, and test new biological molecules or systems over the course of the summer, then travel to MIT in the fall to present their work and compete against teams from around the world. The 2011 UW iGEM undergraduate team dreamed of treating celiac disease with an oral therapeutic, using computational protein design software developed at UW.

[Home](#)[About Us](#)[Diesel Production](#)[Gluten Destruction](#)[iGEM Toolkits](#)[Data Page](#)[Protocols](#)[Outreach](#)[Safety](#)

Make It or Break It: Diesel Production and Gluten Destruction, the Synthetic Biology Way

Synthetic biology holds great promise regarding the production of important compounds, and the degradation of harmful ones. This summer, we harnessed the power of synthetic biology to meet the world's needs for fuel and medicine.



Make It: Diesel Production We constructed a strain of *Escherichia coli* that produces a variety of alkanes, the main constituents of diesel fuel, by introducing a pair of genes recently shown to convert fatty acid synthesis intermediates into alkanes.

Break It: Gluten Destruction We identified a protease with gluten-degradation potential, and then reengineered it to have greatly increased gluten-degrading activity, allowing for the breakdown of gluten in the digestive track when taken in pill form.

iGEM Toolkits To enable next-generation cloning of standard biological parts, we built BioBrick vectors optimized for Gibson assembly and used them to create the Magnetosome Toolkit: a set of 18 genes from an essential operon in magnetotactic bacteria which we are characterizing to create magnetic *E. coli*.





We believe that the engineering of biology
will fundamentally change the world

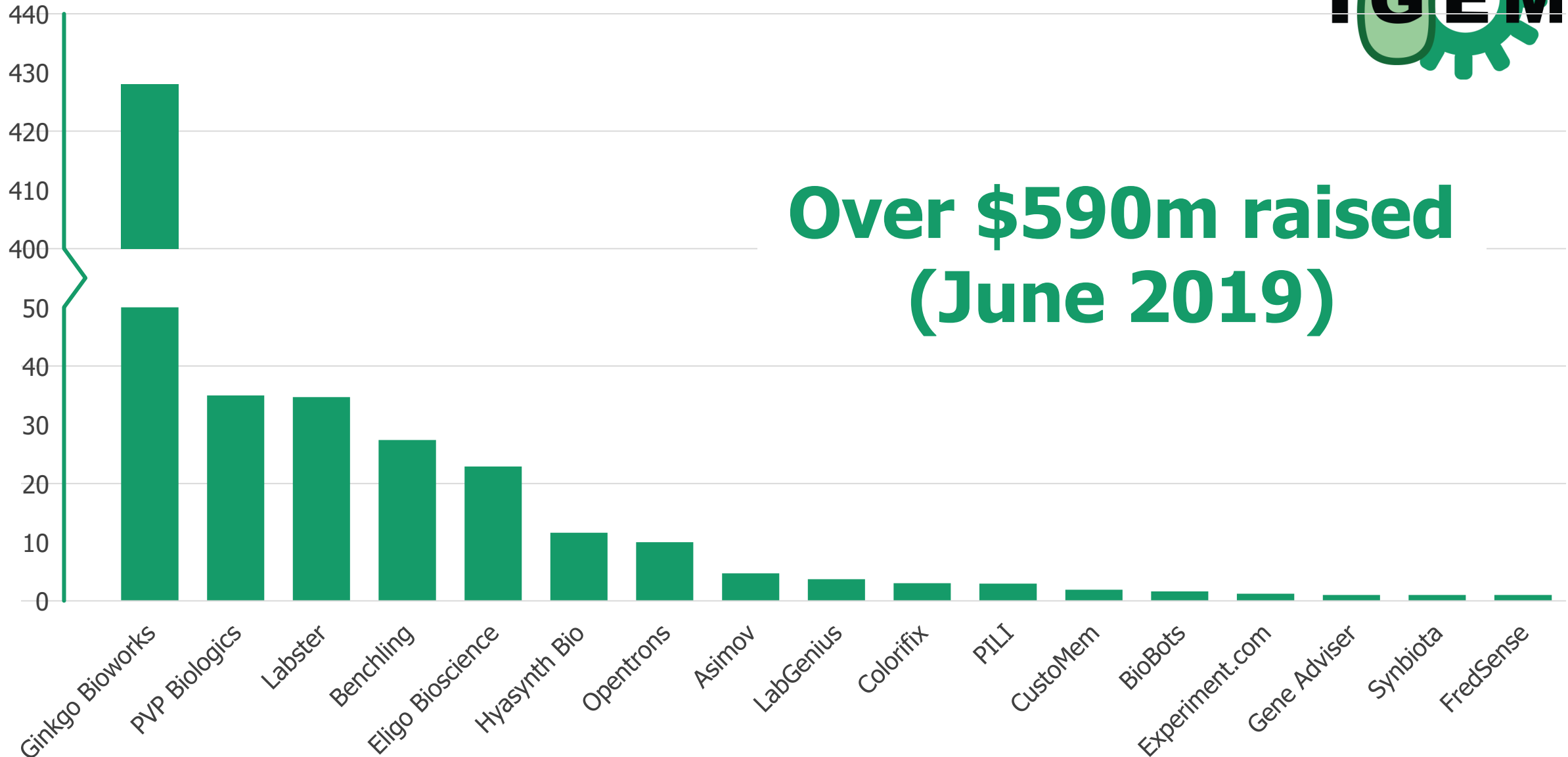
And we are part of this revolution



Funding (US\$m)

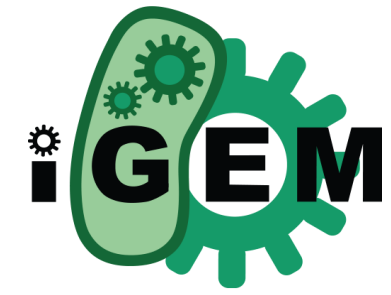


**Over \$590m raised
(June 2019)**



HUMAN PRACTICES

Through Human Practices, iGEM teams consider whether their projects are responsible and good for the world. They engage creatively with issues relating (but not limited) to ethics, sustainability, safety, and security. These issues are complex and don't have simple answers. Teams therefore often conduct public engagement; inviting stakeholder input to shape the direction of their work.



"Human Practices is the study of how your work affects the world, and how the world affects your work." — Peter Carr, Director of Judging



Introduction

Learn about Human Practices and why it is an important part of iGEM.

[READ MORE](#)



How to Succeed

All teams are expected to engage in Human Practices. Check out our tips for teams and the medal and prize criteria.

[READ MORE](#)

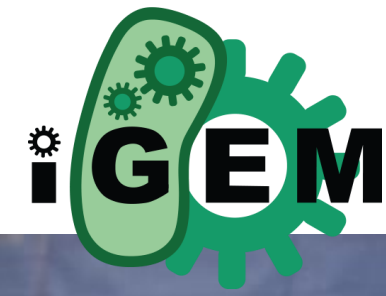


Resources

Getting started? These resources can help you think about how to integrate human practices in your project design

[RESOURCES](#)

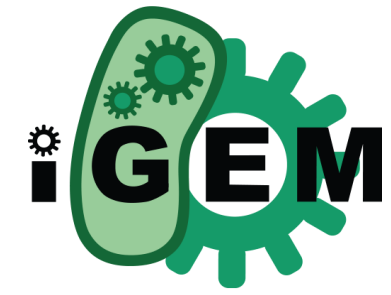
http://2018.igem.org/Human_Practices



**COMPETITION – EDUCATION – TEAMWORK – TECHNOLOGY – SAFETY & SECURITY – ENTREPRENEURSHIP –
RESPONSIBILITY – COMMUNITY – SHARING**

SAFETY AND SECURITY HUB

Welcome to the 2018 Safety and Security Hub!



Introduction

In iGEM, we have clear expectations for teams when it comes to safety and security, including for Project Design, Laboratory Work, and Transfer Practices.

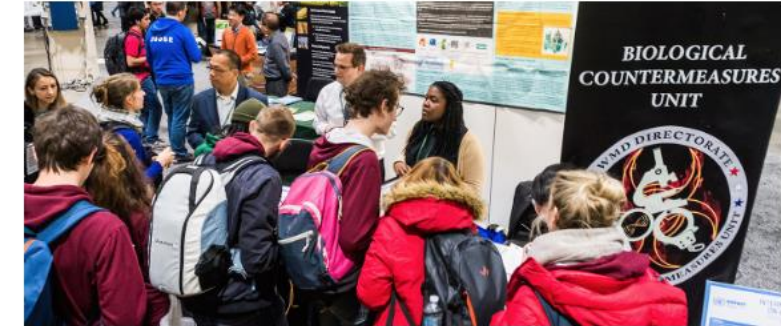
WHAT IS SAFETY & SECURITY



Safety Policies

iGEM has policies on do not release, human experimentation, human subjects research, gene drives, antimicrobial resistance, use of animals, parts from risk group 4 organisms and deletions as modifications.

SAFETY & SECURITY POLICIES



Keep it in the lab

iGEM teams should not release any genetically modified organisms or their products outside the lab (or put them in people). See the Do Not Release policy for more information on complying with laws, being responsible and what constitutes a release.

DO NOT RELEASE



Safety Form



All teams are required to fill the Safety Form.

SAFETY FORM



June 29

An initial version of this form, with as much information as possible, is to be provided by the team.

September 7

A final version of this form must be signed off by the PI.

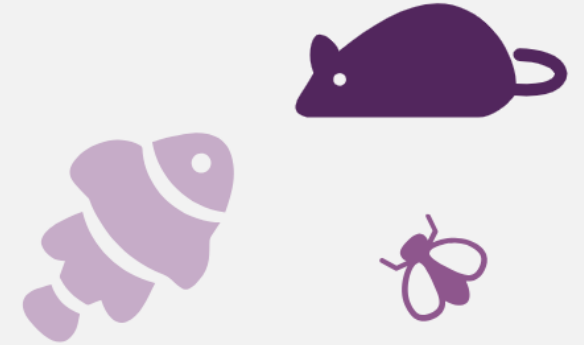
Check-In Form



Any team that plans to acquire or use any organism/part that is NOT on the [White List](#) must submit a Check-In form first. Once the iGEM Safety Committee has approved your Check-In by email, you may begin your work.

CHECK-IN FORM

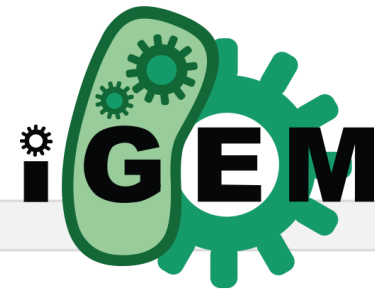
Animal Use Check-In Form



If your team is using any vertebrates (e.g. rats, mice, guinea pigs, hamsters), or higher order invertebrates (e.g. cuttlefish, octopus, squid, lobster) you will need to complete a Check-in form to tell us about any risks associated with your work and how you will be managing them.

ANIMAL USE FORM

The iGEM White List



	White List (no Check-In required)	Check-In Required (examples only!)
Whole Organisms (including viral genomes)	<ul style="list-style-type: none"> Risk Group 1 microorganisms (For example: <i>E. coli</i> K-12, <i>S. cerevisiae</i>, <i>B. subtilis</i>, <i>Lactobacillus</i> spp.) 	<ul style="list-style-type: none"> Risk Group 2 microorganisms (For example: <i>Pseudomonas</i> spp.)
	<ul style="list-style-type: none"> Bacteriophages T2, T4, T7, M13, P1, ΦX174 (Phi X 174), and λ (Lambda), unless containing a virulence factor (see below) Phagemids 	<ul style="list-style-type: none"> Other viruses and bacteriophages
	<ul style="list-style-type: none"> Human and primate cell lines that have been tested and certified free of known pathogens (consult your vendor; see FAQ), including for example HEK293 cell lines. Cell lines from plants, fungi, or animals that are not primates (such as CHO cells or plant cells) 	<ul style="list-style-type: none"> All primary isolated cells (that is, cells taken directly from the body of a multicellular organism)
	<ul style="list-style-type: none"> <i>C. elegans</i> (nematodes) <i>Physcomitrella patens</i>, <i>Arabidopsis</i> spp., <i>Nicotiana</i> spp. 	<ul style="list-style-type: none"> Other multicellular organisms (animals, plants, insects, etc.). In addition, permission is required from the Safety Committee for the use of animals in iGEM projects – see the Safety Policy page for more details.
		<ul style="list-style-type: none"> ...and anything not explicitly listed
Parts	All Registry parts, except those with a Red Flag placed by the Safety Committee	Registry parts that have a Red Flag, which looks like this . A complete list of parts with Red Flags can be found here .
		Any part from a Risk Group 3 organism, regardless of its function
	Non-protein-coding parts in the following categories: <ul style="list-style-type: none"> Promoters, RBSes, Terminators Binding sites for transcriptional regulators, endonucleases, and other proteins that bind to DNA Aptamers and catalytic RNAs CRISPR guide RNAs, microRNAs, small interfering RNAs, and short hairpin RNAs that do not target human genes 	<ul style="list-style-type: none"> CRISPR guide RNAs, microRNAs, small interfering RNAs, and short hairpin RNAs that target human genes Other non-protein-coding genes
	Cas9 (and other CRISPR-associated nucleases such as dCas9 and Cpf1), EXCEPT when it is integrated into the genome of a sexually reproducing eukaryotic organism	Cas9 (and other endonucleases, such as dCas9 and Cpf1) integrated into the genome (including through the use of gRNA) of a sexually reproducing organism (including organisms that reproduce both sexually and asexually, such as yeast). ANY team contemplating using Gene Drives needs permission from the Safety Committee – see the Safety Policy page for more details.
	Prions from non-mammalian organisms, such as yeast	Prions from mammals, such as human PrP
	Proteins or protein-coding genes from animals, plants, or Risk Group 1 / Risk Group 2 microorganisms, EXCEPT those in the list of "dangerous categories" on the right	Proteins or protein-coding genes in the following dangerous categories: <ul style="list-style-type: none"> Virulence factors (see FAQ) Factors that help pathogens evade or shut down the immune system Factors that help pathogens halt the host's DNA/RNA replication, transcription, or translation Factors that regulate the immune system, such as cytokines and interferons Proteins that are toxic to humans Enzymes that produce a molecule that is toxic to humans
	Anti-microbial resistance factors and associated sequences in common use as a research tool. For example, ampicillin resistance commonly used as a selectable marker .	Other anti-microbial resistance factors, in particular any sequence associated to resistance against commonly used anti-microbial therapies – see the Safety Policy page for more details. For example see the 2016 UIOslø team worked with a B carbapenemase resistance factor , the spread of which is an increasing public health challenge .



The iGEM Safety Committee

- Works with iGEM participants to strengthen safe and responsible synthetic biology
- Reviews & approves safety forms
- Performs safety checks on Registry parts
- Has the ultimate say on safety issues



biosecu.re

www.biosecu.re | piers@biosecu.re | [@biosec_re](https://twitter.com/biosec_re)

iGEM Project Safety Screening



Developing a Comprehensive, Adaptive, and International Biosafety and Biosecurity Program for Advanced Biotechnology: The iGEM Experience

Applied Biosafety:
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SAGE

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Abstract

Introduction: The international synthetic biology competition iGEM (formally known as the international Genetically Engineered Machines competition) has a dedicated biosafety and biosecurity program.

Method: A review of specific elements of the program and a series of concrete examples illustrate how experiences in implementing the program have helped improved policy, including an increasing diversity of sources for genetic parts and organisms, keeping pace with technical developments, considering pathways toward future environmental release, addressing antimicrobial resistance, and testing the efficacy of current biosecurity arrangements.

Results: iGEM's program is forward-leaning, in that it addresses both traditional (pathogen-based) and emerging risks both in terms of new technologies and new risks. It is integrated into the technical work of the competition—with clearly described roles and responsibilities for all members of the community. It operates throughout the life cycle of projects—from project design to future application. It makes use of specific tools to gather and review biosafety and biosecurity information, making it easier for those planning and conducting science and engineering to recognize potential risks and match them with appropriate risk management approaches, as well as for specialists to review this information to identify gaps and strengthen plans.

Discussion: Integrating an increasingly adaptive risk management approach has allowed iGEM's biosafety and biosecurity program to become comprehensive, be cross-cutting, and cover the competition's life cycle.

Keywords

synthetic biology, biological engineering, biotechnology, adaptive biosafety, iGEM, genetic engineering

Each year, around 6000 students and community lab members form over 300 teams from over 40 countries to compete against each other for medals and prizes based on their advances in synthetic biology design, implementation, and integration into society. This is the world's largest international synthetic biology competition, known as iGEM (the international Genetically Engineered Machines competition), and it has a dedicated Biosafety and Biosecurity Program.¹ Integrating an increasingly adaptive risk management approach has allowed iGEM's program to become comprehensive, be cross-cutting, and cover activities throughout the competition life cycle.

iGEM's program is forward-leaning, in that it addresses both traditional (pathogen-based) and emerging risks both in terms of new technologies and new risks. It is integrated into the technical work of the competition—with clearly described roles and responsibilities for all members of the community. It operates throughout the life cycle of

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⁵ MIT Program on Emerging Technologies, Cambridge, MA, USA

⁶ Center for International Security and Cooperation, Stanford University, Stanford, CA, USA

⁷ Dutch National Institute for Public Health and the Environment, Bilthoven, Netherlands

⁸ Public Health Agency of Canada, Ottawa, Ontario, Canada

⁹ Health Safety and Environment Office, Hong Kong University of Science and Technology, Hong Kong

Disclaimer: The views presented in this publication are those of the author(s) and do not necessarily reflect the positions of the associated institutions.

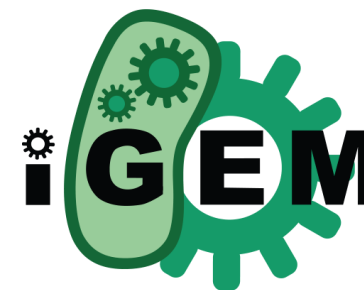
Corresponding Author:

Piers Millett, iGEM Foundation, One Kendall Square, Suite B6104, Cambridge, MA 02139, USA.

Email: piers@igem.org

Catalog

The iGEM Registry has over 20,000 documented parts. The Catalog organizes many of these parts by part type, chassis, function, and more. Browse for parts through the Registry Catalog or use the search menu.



Archetype®

SGIDNA

A Synthetic Genomics, Inc. Company

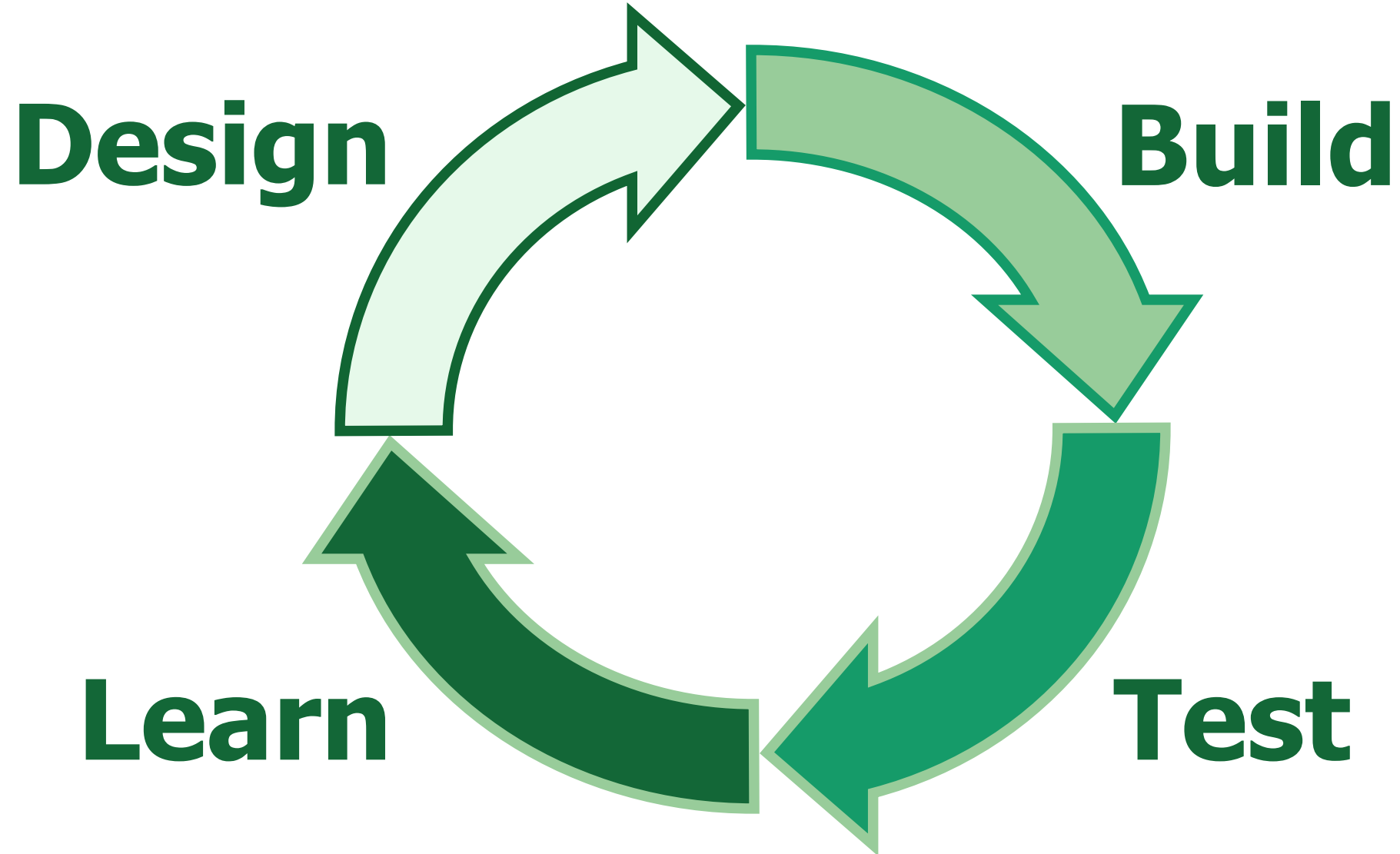
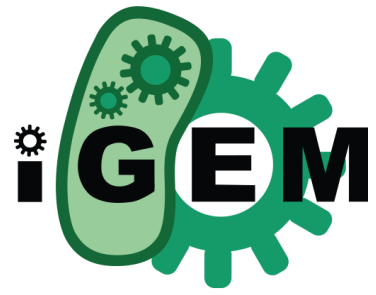


Genomic Discovery Suite

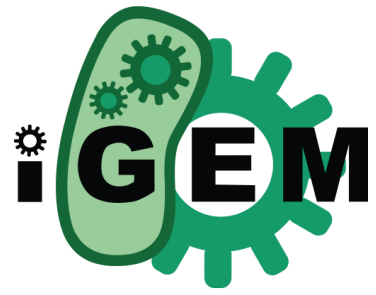
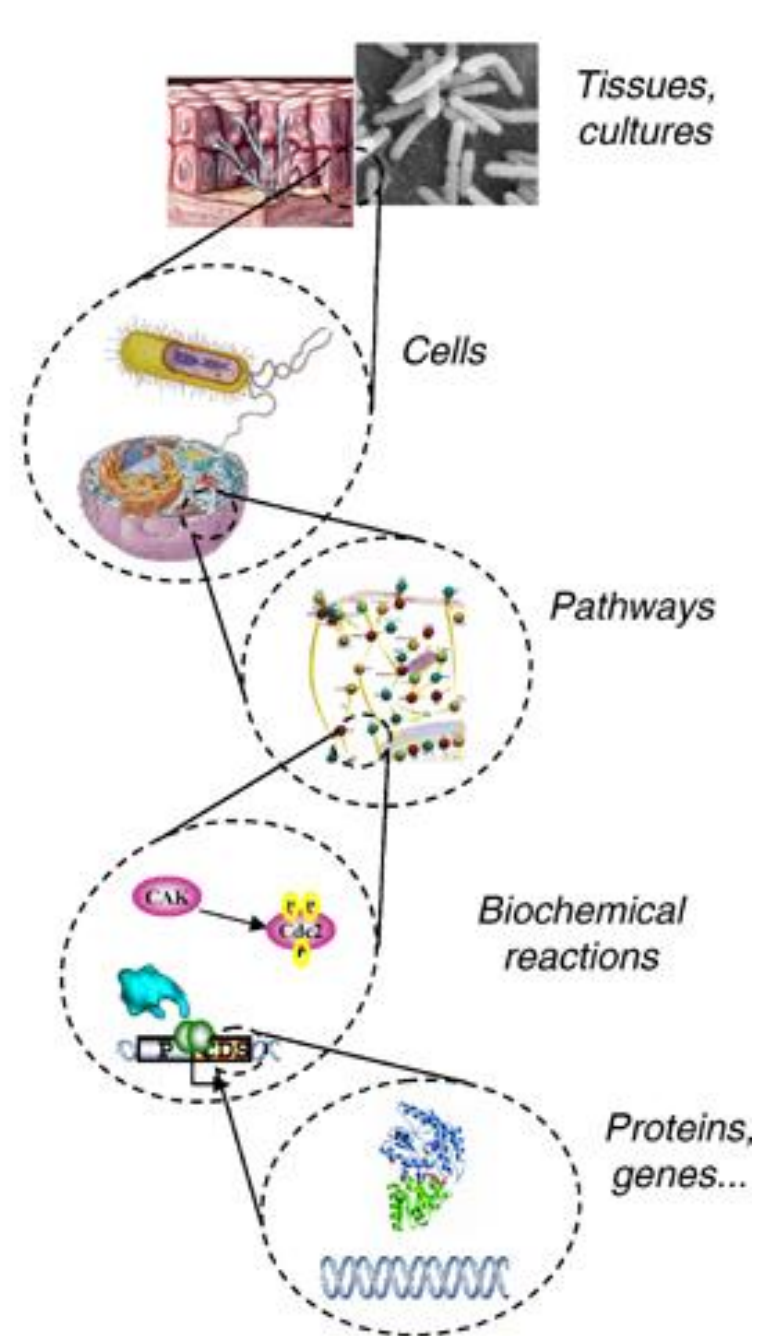
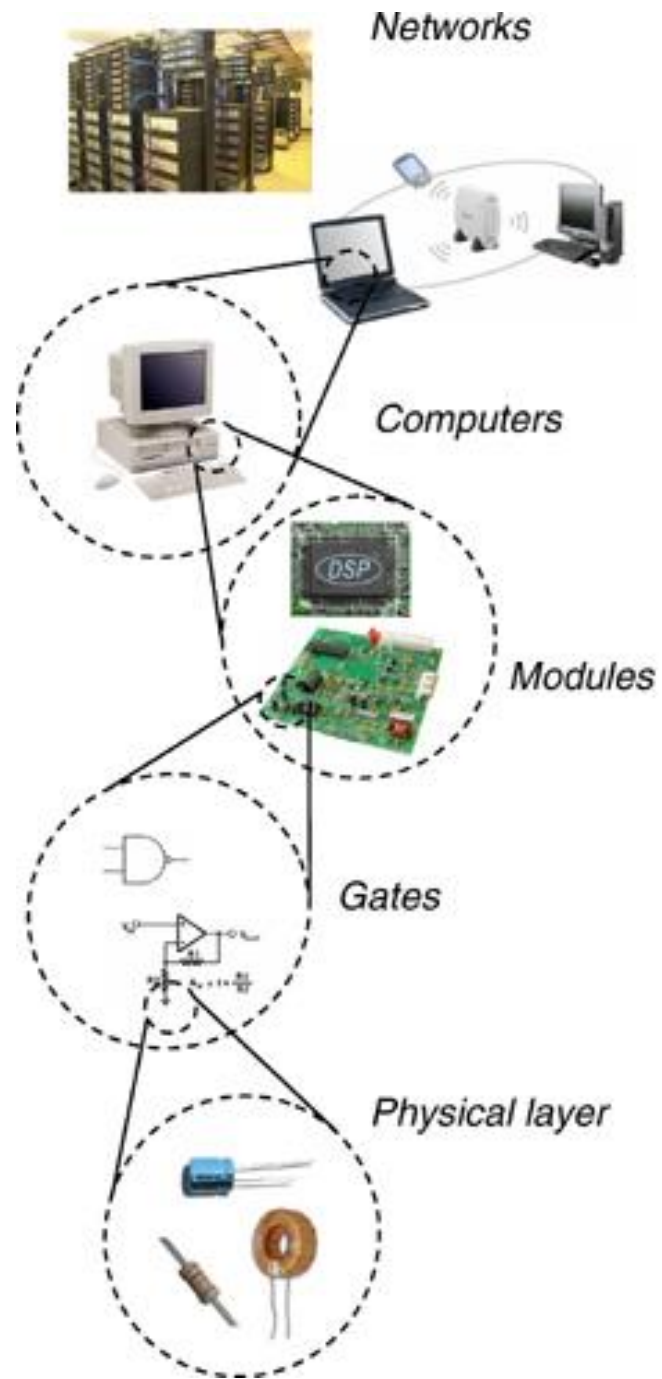
<https://sgidna.com/archetype.html>

<https://doi.org/10.1177/1535676019838075>

Engineering biosecurity



Design



Design

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Fighting the spread of chemical and
biological weapons

Strengthening global security

The Australia Group

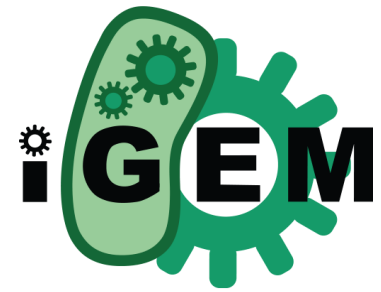
LIST OF HUMAN AND ANIMAL PATHOGENS AND TOXINS FOR EXPORT CONTROL^[1]

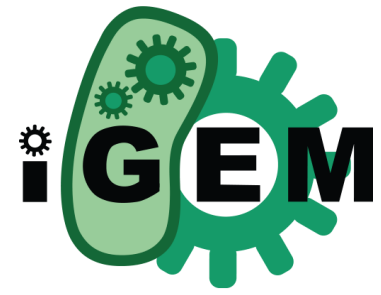
Viruses

28 February 2020

1. African horse sickness virus
2. African swine fever virus
3. Andes virus
4. Avian influenza virus^[2]
5. Bluetongue virus
6. Chapare virus
7. Chikungunya virus
8. Choclo virus
9. Classical swine fever virus (Hog cholera virus)
10. Crimean-Congo hemorrhagic fever virus
11. Dobrava-Belgrade virus
12. Eastern equine encephalitis virus
13. Ebolavirus: all members of the Ebolavirus genus

iGEM Independent Contractor Agreement-
TA-200728-SENT.odt





Design

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Fighting the spread of chemical and
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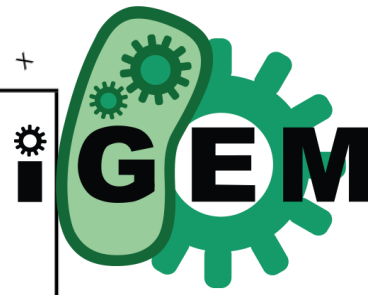
Genetic Elements and Genetically-modified Organisms ^[1]:

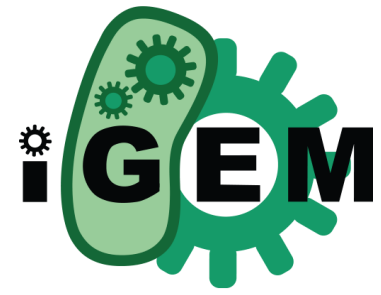
Any genetically-modified organism which contains, or genetic element that codes for:

1. any gene or genes specific to any listed virus; or
2. any gene or genes specific to any listed bacterium ^[3] or fungus, and which
 - a. in itself or through its transcribed or translated products represents a significant hazard to human, animal or plant health, or
 - b. could endow or enhance pathogenicity^[4]; or
3. any listed toxins or their sub-units.

Design

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	VARV-BRZ	VARV-SLN	VARV-SAF	VARV-KUW	MPXV-WR	MPXV-ZAI	Q	R	SPPV-TU	S	GTPV	T	U	V	W	X	
A																																	
B	37.4																																
C	40.1	41.2																															
D	40.3	41.3	79.0																														
E	40.2	45.5	51.9	52.2																													
F	26.4	28.3	31.1	31.3	30.5																												
G	25.6	27.9	30.3	30.6	30.1	65.0																											
H	26.8	29.2	34.5	34.6	34.6	44.1	43.1																										
I	28.4	31.5	36.6	36.8	37.5	41.8	40.9	70.2																									
J	28.4	31.5	36.6	36.8	37.5	41.8	40.9	70.3	98.0																								
K	28.5	31.5	36.6	36.8	37.5	41.8	41.0	70.3	97.4	97.7																							
L	28.3	31.4	36.5	36.7	37.3	41.9	41.0	70.3	96.6	97.0	98.0																						
M	28.5	31.4	36.6	36.8	37.4	41.8	41.0	70.3	97.0	97.2	98.3	98.7																					
N	28.5	31.5	36.6	36.8	37.5	41.8	41.0	70.3	97.0	97.3	98.3	98.8	99.2																				
O	28.4	31.4	36.5	36.7	37.4	41.9	41.0	70.2	96.7	97.1	97.7	97.4	97.4	97.6																			
P	28.5	31.4	36.5	36.7	37.1	42.0	41.1	70.5	95.8	96.2	96.8	96.5	96.6	96.7	98.1																		
VARV-BRZ	28.4	31.3	36.4	36.6	37.2	42.0	41.1	70.4	96.0	96.4	97.0	96.7	96.8	96.9	98.2	97.3																	
VARV-SLN	28.4	31.3	36.4	36.6	37.2	42.0	41.1	70.5	96.0	96.4	97.0	96.8	96.9	96.9	98.1	97.3	99.8																
VARV-SAF	28.4	31.3	36.4	36.6	37.2	42.0	41.1	70.5	96.0	96.4	97.0	96.7	96.8	96.9	98.2	97.3	99.7	99.7															
VARV-KUW	28.4	31.3	36.4	36.6	37.2	42.0	41.1	70.5	96.0	96.4	97.0	96.7	96.8	96.9	98.1	97.3	99.7	99.7	99.9														
MPXV-WR	28.3	31.2	36.5	36.8	37.2	42.0	41.2	70.2	96.1	96.4	97.2	96.6	96.9	96.9	96.5	95.6	95.8	95.9	95.9	95.9													
MPXV-ZAI	28.4	31.3	36.6	36.8	37.2	42.1	41.2	70.6	96.0	96.3	97.1	96.4	96.7	96.7	96.3	96.0	95.6	95.7	95.7	95.7	98.9												
Q	28.5	31.5	36.6	36.8	37.3	41.9	41.0	70.6	95.7	95.9	96.2	95.6	95.9	95.9	95.7	95.3	95.1	95.1	95.1	95.1	95.2	95.5											
R	27.2	28.8	34.9	35.2	34.1	43.4	42.4	58.8	55.7	55.8	55.8	55.8	55.8	55.9	55.7	56.2	56.0	56.0	56.0	56.0	56.1	56.2	56.0										
SPPV-TU	27.5	28.9	34.6	34.9	34.2	43.3	42.1	58.0	54.7	54.7	54.7	54.8	54.8	54.8	54.7	55.1	54.9	54.9	55.0	55.0	54.7	55.0	55.0	67.0									
S	27.7	29.1	34.8	35.2	34.5	43.2	42.0	57.8	54.6	54.7	54.6	54.7	54.7	54.7	54.6	55.0	54.8	54.9	54.9	54.9	54.6	54.9	54.9	67.0	97.6								
GTPV	27.6	28.9	34.6	35.0	34.3	43.2	42.1	57.9	54.6	54.7	54.6	54.7	54.7	54.7	54.6	55.0	54.8	54.9	54.9	54.9	54.6	54.9	54.9	67.0	97.2	98.0							
T	27.7	29.4	34.7	35.0	34.7	43.8	42.7	59.1	56.1	56.2	56.2	56.2	56.2	56.2	56.2	56.6	56.4	56.4	56.4	56.4	56.2	56.5	56.4	67.9	70.3	70.3	70.3						
U	28.2	29.5	35.4	35.8	35.0	43.0	42.0	57.8	54.8	54.9	54.9	54.9	54.9	55.0	54.8	55.2	55.1	55.1	55.1	55.1	54.9	55.1	55.1	64.6	68.0	67.7	67.9	67.7					
V	28.7	29.8	35.9	36.3	35.8	41.9	40.8	55.5	53.1	53.2	53.2	53.3	53.3	53.3	53.2	53.6	53.4	53.5	53.5	53.5	53.2	53.5	53.4	62.3	65.6	65.4	65.5	65.1	81.0				
W	31.7	32.5	39.4	40.1	39.1	39.8	38.6	51.5	51.0	51.0	51.0	51.0	51.1	51.1	51.0	51.3	51.1	51.1	51.1	51.1	50.9	51.2	51.3	59.3	60.6	60.7	60.6	60.3	60.3	59.3			
X	30.7	31.6	38.2	38.8	37.9	40.3	39.3	52.5	51.4	51.4	51.4	51.4	51.5	51.6	51.4	51.7	51.5	51.6	51.5	51.5	51.4	51.7	51.7	60.2	61.7	61.8	61.8	61.4	61.3	60.0	87.7		





Build

English | Français | Español | 中文 | العربية | Русский | Deutsch

Fighting the spread of chemical and
biological weapons

Strengthening global security

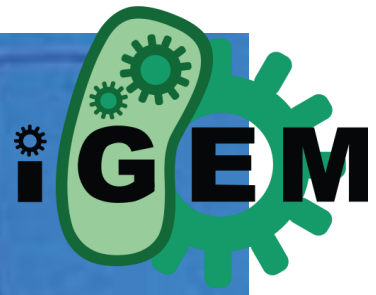
The Australia Group

Genetic Elements and Genetically-modified Organisms ^[1]:

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1. any gene or genes specific to any listed virus; or
2. any gene or genes specific to any listed bacterium ^[3] or fungus, and which
 - a. in itself or through its transcribed or translated products represents a significant hazard to human, animal or plant health, or
 - b. could endow or enhance pathogenicity^[4]; or
3. any listed toxins or their sub-units.

Build



Salmonella enterica serovar Typhi

https://microbewiki.kenyon.edu/index.php/Salmonella_enterica_serovar_Typhi

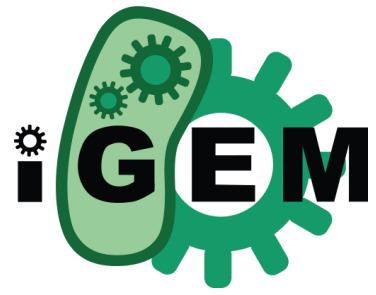
Build



Salmonella enterica serovar Enteritidis

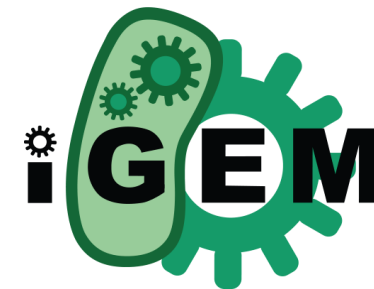


International
Gene Synthesis
Consortium



Test

**Where Gene Synthesis
and Biosecurity Align**



<http://www.genesynthesisconsortium.org>

Test

Harmonized Screening Protocol[©] v2.0

Gene Sequence & Customer Screening to Promote Biosecurity

19 November 2017

<https://genesynthesisconsortium.org/wp-content/uploads/IGSCHarmonizedProtocol11-21-17.pdf>

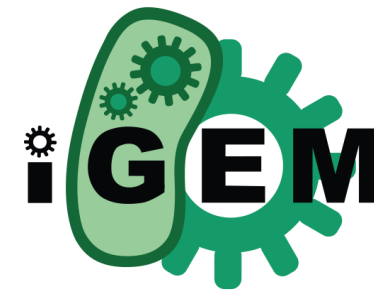
Lethbridge

20

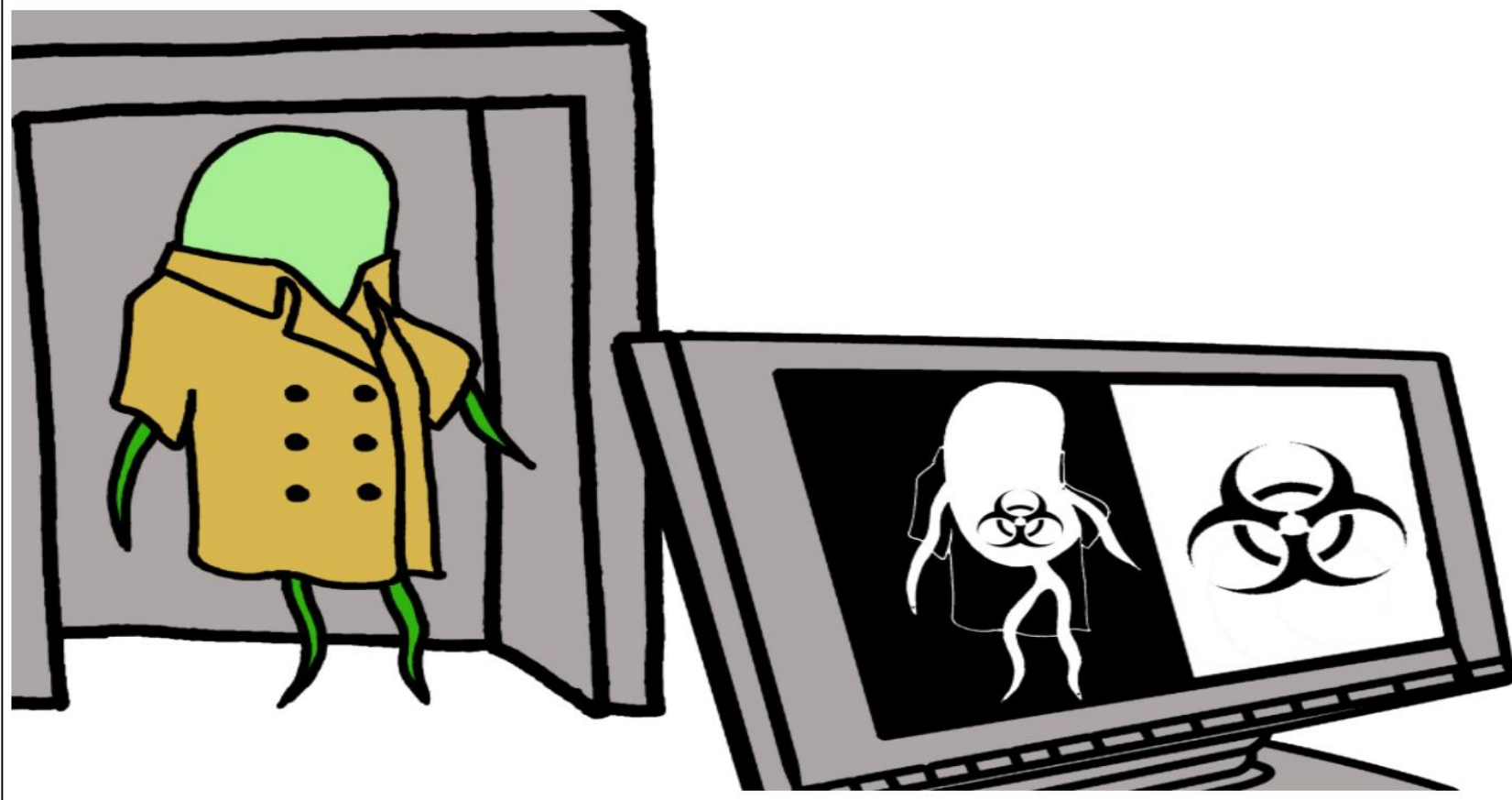


13

iGEM

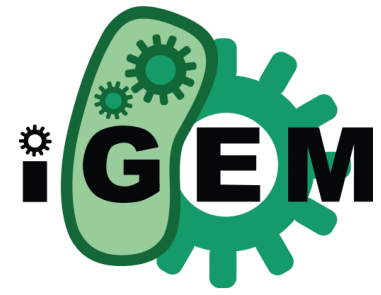


Test



<http://2013.igem.org/Team:Lethbridge>

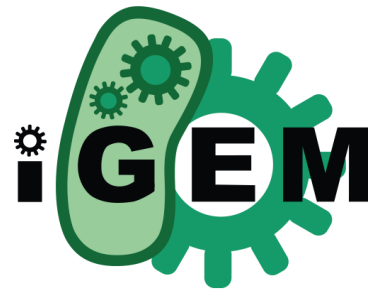
Test

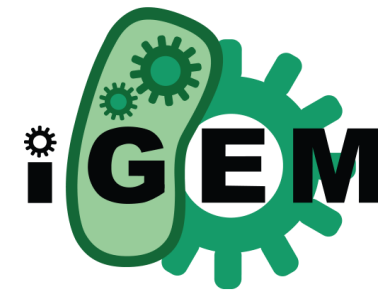


	Unencrypted Sequences (n=2)		Encrypted Sequences (n=10)	
Sequence Identity	Green Fluorescent Protein (n=1)	Conotoxin (n=1)	Green Fluorescent Protein (n=5)	Conotoxin (n=5)
Company 1	100% ($\pm 0\%$)	100% ($\pm 0\%$)	0% ($\pm 0\%$)	0% ($\pm 0\%$)
Company 2	100% ($\pm 0\%$)	100% ($\pm 0\%$)	0% ($\pm 0\%$)	0% ($\pm 0\%$)
Company 3	100% ($\pm 0\%$)	100% ($\pm 0\%$)	0% ($\pm 0\%$)	0% ($\pm 0\%$)
Company 4	100% ($\pm 0\%$)	100% ($\pm 0\%$)	0% ($\pm 0\%$)	0% ($\pm 0\%$)
Company 5	100% ($\pm 0\%$)	100% ($\pm 0\%$)	0% ($\pm 0\%$)	0% ($\pm 0\%$)

<http://2017.igem.org/Team:Lethbridge>

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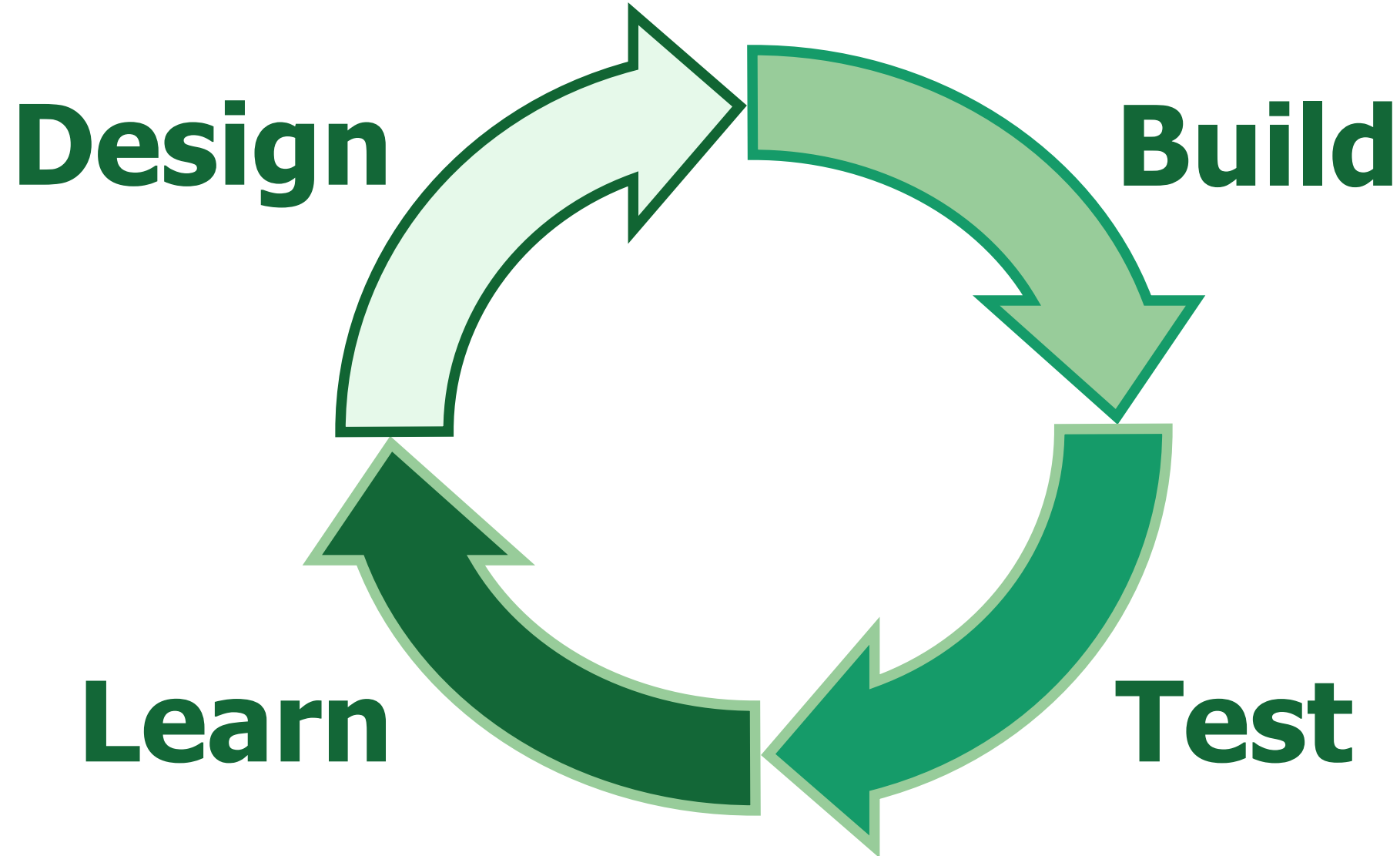
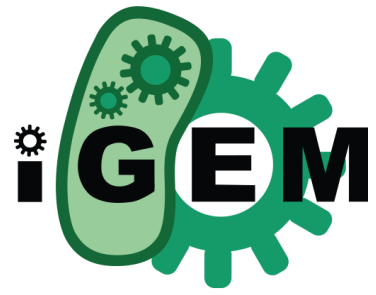


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http://2018.igem.org/Team:Bielefeld-CeBiTec/Public_Engagement

Engineering biosecurity



Our sincere thanks to our funder:

