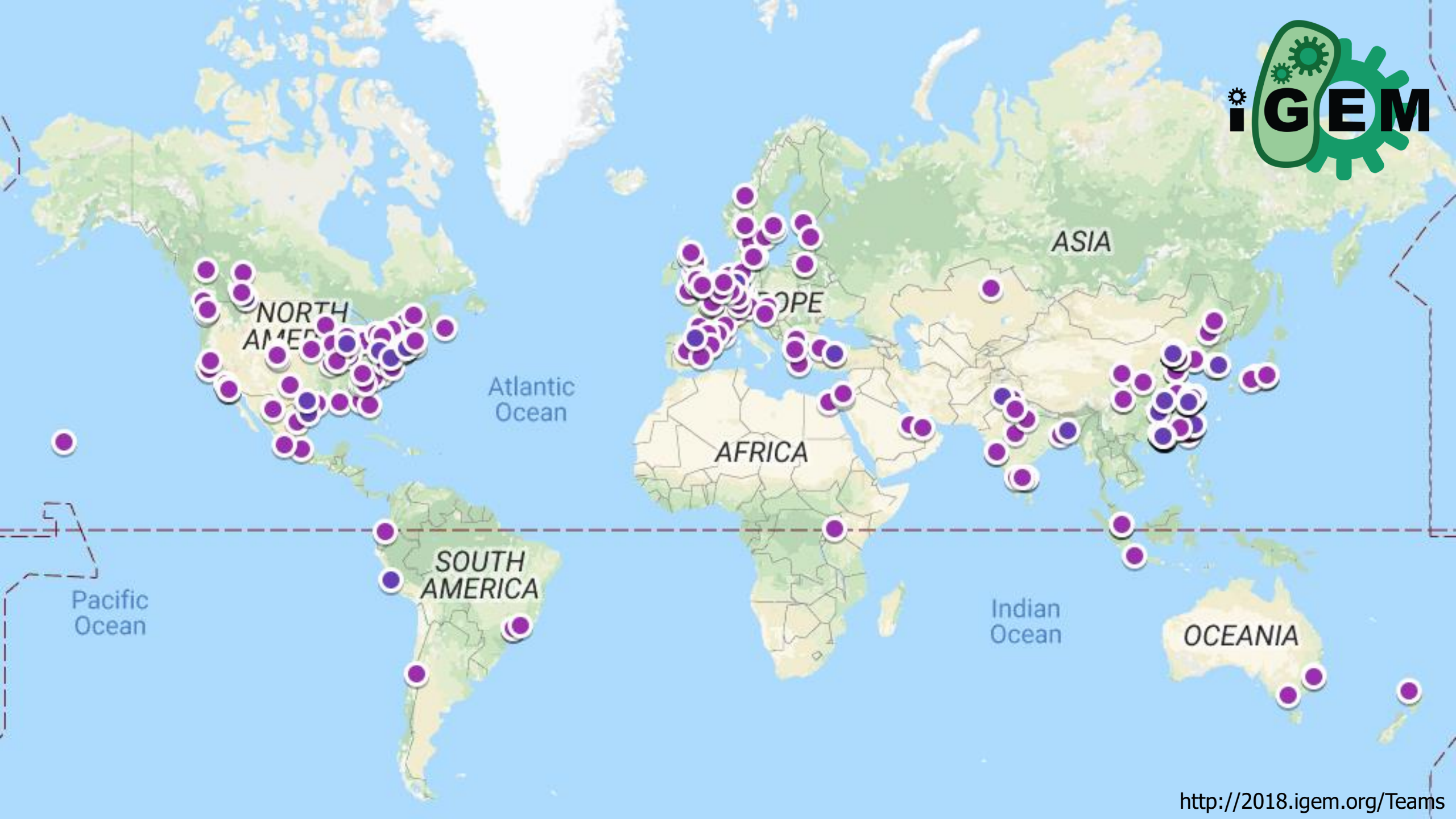
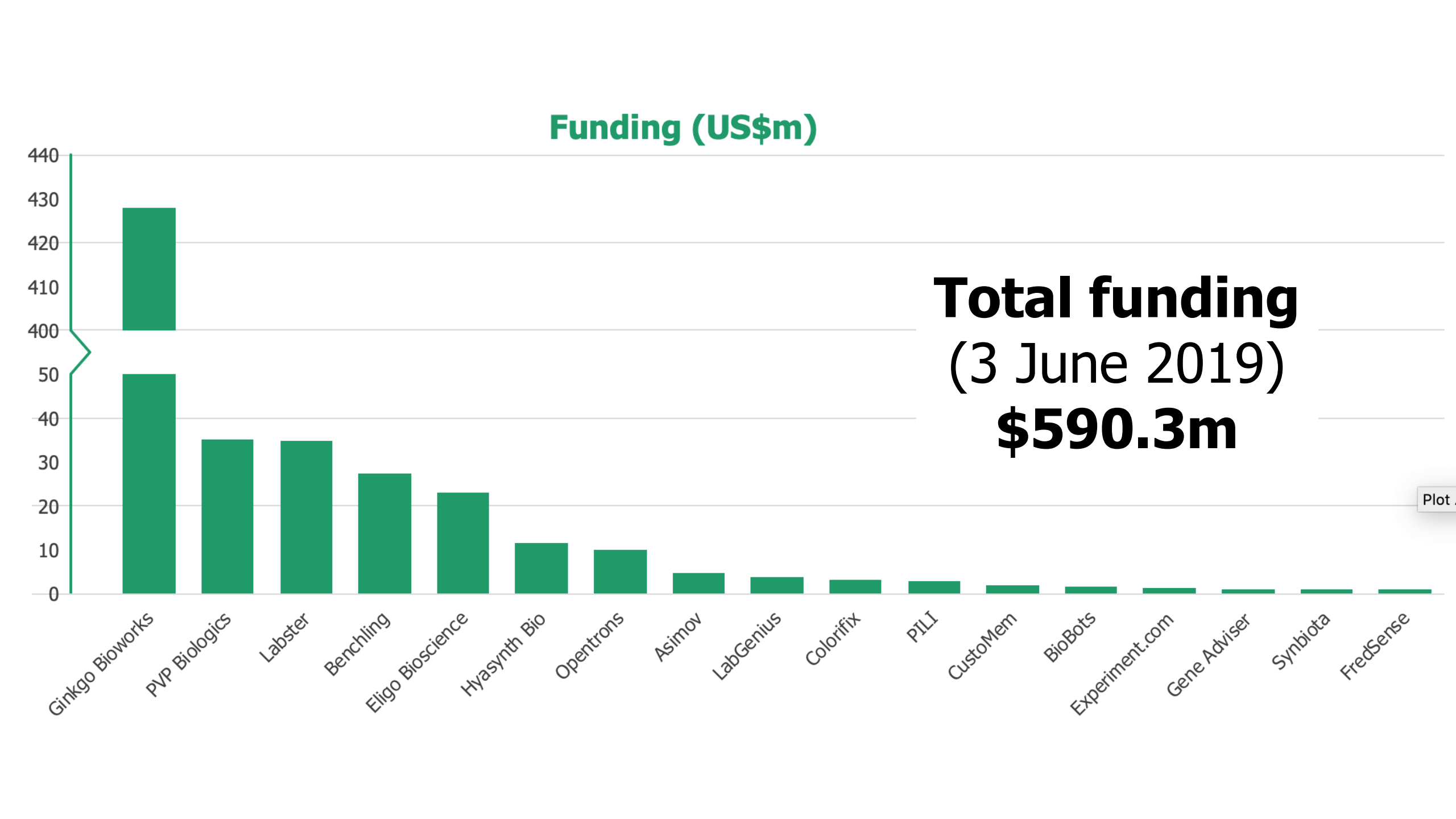

iGEM


ZONE
5
ZONE
5
NTU
SINGAPORE
NTU
SINGAPORE


sappi
WattsAptamer



http://2018.igem.org/Teams


Funding (US$m)
440
430
420
410
400
50
40
30
20
10
0
Ginkgo Bioworks
PVP Biologics
Labster
Benchling
Eligo Bioscience
Hyasynth Bio
Opentrons
Asimov
LabGenius
Colorifix
PILI
CustoMem
BioBots
Experiment.com
Gene Adviser
Synbiota
FredSense
Total funding
(3 June 2019)
$590.3m
Plot

iGEM, data & information

1. Sequence & functional data

iGEM wiki tools search PRODUCTION 2017 SERVER login

Registry of Standard Biological Parts

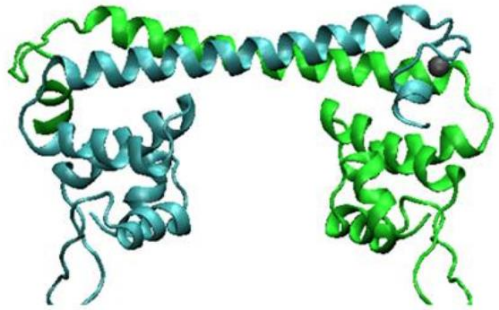
iGEM tools catalog repository assembly protocols help search BBa_

Featured Part

Metal Binding and Sensing Parts

Every year, a number of iGEM teams complete a variety of biosensors and bioremediation projects that involve metal-binding and metal-sensing. Their focus may be on several pollutants or just one. iGEM teams have worked with metals like nickel, mercury, lead, arsenic, copper, amongst others.

We've put together a collection of projects and DNA parts that are responsible for both metal binding and metal sensing.



DNA Synthesis Offer: IDT

IDT is once again generously offering **20 kb of DNA as gBlocks® Gene Fragments** free of charge to each iGEM 2019 team! Click here to go to IDT's partner offers page for more info.

2019 DNA Distribution

The iGEM 2019 DNA Distribution has started shipping to registered and approved iGEM teams! Be sure to read through the 2019 Distribution Handbook for storage instructions and how to use your kit!

Collections

We've **updated** the Registry part collections. Users can discover new parts and collections and build upon what previous iGEM teams and labs have achieved.

- Well Documented Parts
- Frequently Used Parts

Registry Help

Before starting your projects, be sure to read through our help pages. If you can't find an answer to your question, contact **hq (at) igem . org**.

Useful help topics:

- BioBrick Prefix and Suffix
- Assembly Standards

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.

http://parts.igem.org

main page | design | experience | information | part tools | edit

Part:BBa_J04450

Designed by: Tamar Odle Group: iGEM2005 (2005-06-09)

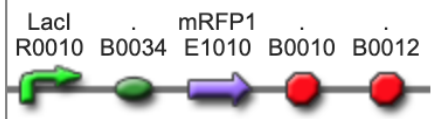
Reporter

Released HQ 2013
Sample In stock
1 Registry Star
66 Uses
8 Twins

Get This Part

RFP Coding Device

Subparts | Ruler | SS | DS **Length: 1069 bp** View plasmid Get part sequence.



Assembly Compatibility: 10 12 21 23 25 1000

The colonies are clearly red in color under natural light after about 18 hours. Smaller colonies are visibly red under UV. The RFP part does not contain a degradation tag and the RBS is strong.

- LacI sensitive
- CAP sensitive

This part is commonly used, but can fail if the system contains LacI or CAP protein.
(--Meagan 15:39, 23 July 2009 (UTC))

Team TU_Munich 2012 improved this part by making it compatible to RFC10 and RFC25 (see: BBa_K801100)
(--VolkerMorath 15:02, 21 October 2012 (UTC))

Team NRP-UEA 2013 improved this part by adding a NdeI restriction site before the RFP gene. (see: BBa_K1041000)

http://parts.igem.org/Part:BBa_J04450

```
>BBa_J04450 Part-only sequence (1069 bp)
caatacgcaaaccgcctctccccgcgcgttggccgattcattaatgcagctggcacgacaggtttcccgactggaaagcgggcagtgagcgcaacgcaat
taatgtgagttagctcactcattaggcaccccaggctttacactttatgcttccggctcgtatgttgtgtggaattgtgagcggataacaatttcacaca
tactagagaaagaggagaaatactagatggcttcctccgaagacgttatcaaagagttcatgcgtttcaaagttcgtatggaaggttccgttaacggtca
cgagttcgaaatcgaaggtgaaggtgaaggtcgtccgtacgaaggtacccagaccgctaaactgaaagttaccaaaggtggtccgctgccgttcgcttgg
gacatcctgtccccgcagttccagtacggttccaaagcttacgttaaacacccggctgacatcccggactacctgaaactgtccttcccggaaggtttca
aatgggaacgtgttatgaacttcgaagacggtggtgttgttaccgttacccaggactcctccctgcaagacggtgagttcatctacaaagttaaactgcg
tggtaccaacttcccgtccgacggtccggttatgcagaaaaaaaccatgggttgggaagcttccaccgaacgtatgtacccggaagacggtgctctgaaa
ggtgaaatcaaaatgcgtctgaaactgaaagacggtggtcactacgacgctgaagttaaaaccacctacatggctaaaaaaccggttcagctgccgggtg
cttacaaaaccgacatcaaactggacatcacctcccacaacgaagactacaccatcgttgaacagtacgaacgtgctgaaggtcgtcactccaccggtgc
ttaataacgctgatagtgctagtgtagatcgctactagagccaggcatcaaataaaacgaaaggctcagtcgaaagactgggcctttcgttttatctgtt
gtttgtcggtgaacgctctctactagagtcacactggctcaccttcgggtgggcctttctgcgtttata
```

http://parts.igem.org/Part:BBa_J04450

Team TU_Munich 2012 improved this part by making it compatible to RFC10 and RFC25 (see: BBa_K801100)
(--VolkerMorath 15:02, 21 October 2012 (UTC))

Team NRP-UEA 2013 improved this part by adding a NdeI restriction site before the RFP gene. (see: BBa_K1041000)
(--holusac 20:46, 14 August 2013 (UTC))

Team Warwick 2015 improved this part by analysing the effect of copy number on gene expression.
(--Lcarroll 20:48, 25 September 2015 (UTC))

Team Leiden 2016 contributed to the characterisation of this part by showing equal functionality in simulated microgravity (0g) as in the normal gravity of the Earth.
(--Valentijn 19:38, 19 October 2016 (UTC))

Team UChicago 2017 contributed to this part by improving/changing the documented sequence through mutagenesis to create blunt-end restriction sites for cloning not within the prefix/suffix region (created BBa_K2428000).
(--pzulueta97 21:14, 25 October 2017 (UTC))

Team Grenoble-Alpes 2017 contributed to the characterisation of this part by testing the time of apparition of fluorescence, in presence of IPTG or not (because the promoter leaks), as well as they contributed to the improvement of this part by using its fluorescence as a detection signal to be able to detect Vibrio Cholerae.
(--NoreenLouis 20:47, 26 October 2017 (UTC))

Team Kingsborough NY 2017 contributed to the characterization of this part by showing decreased fluorescence when expressed either in a higher salt media - such as LB with 3% sodium chloride - or E. coli that lacks tmRNA, the principal component of the cell's ribosome rescue system. View the data on the experience page or visit our Wiki
(--djcamenares 17:56, 27 October 2017 (UTC))

Team iTesla SoundBio 2017 contributed to the characterization of this part by analyzing the rate of false positives when using the coloring of transformed colonies as a red/white screen for determining experimental success.
(--gladish 01:26, 28 October 2017 (UTC))

Team Grenoble-Alpes 2018 contributed to the characterisation of this part by testing the delay before apparition of fluorescence directly after transformation and the intensity of the leak, in three different E. Coli strains.
(--perrine 15:06, 9 October 2018 (UTC))

Team H14Z1_Hangzhou 2018 contributed to the characterisation of this part by testing the fluorescence idensity in different condition(e.g.temperature,medium volume, IPTG concentration) ,in two different E. Coli strains.
(--ericxu 09:32, 17 October 2018 (UTC))

Team SKLMT-China 2018 improved this part by replacing the induced promoter lacI with the strong constitutive pf-5 promoter PampC.(see: BBa_K2569029)
(--DDY 16:47, 17 October 2018 (UTC))

Part:BBa_J04450:Experience

Reporter

Released HQ 2013
Sample In stock
1 Registry Star
66 Uses
8 Twins
Get This Part

Designed by: Tamar Odle Group: iGEM2005 (2005-06-09)

This experience page is provided so that any user may enter their experience using this part.
Please enter how you used this part and how it worked out.

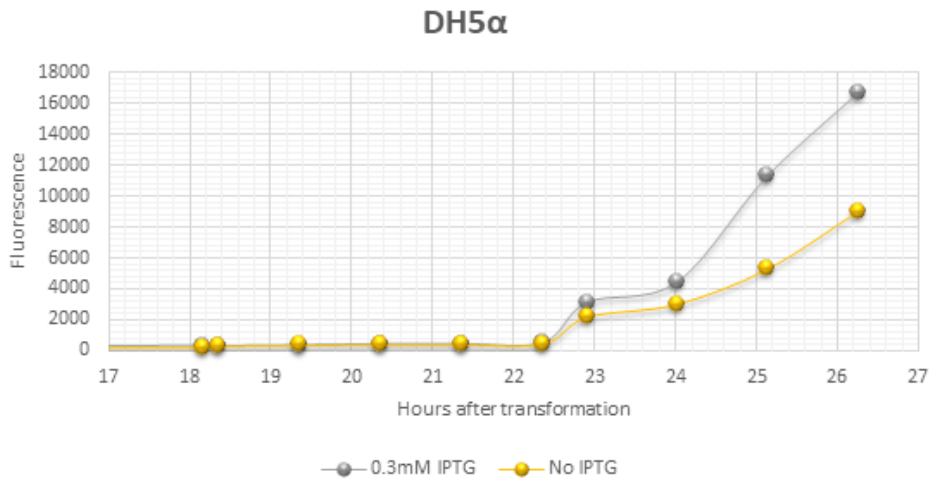
Team Grenoble-Alpes 2018: Delay before fluorescence apparition and leaky expression after transformation in three *Escherichia coli* strains [edit]

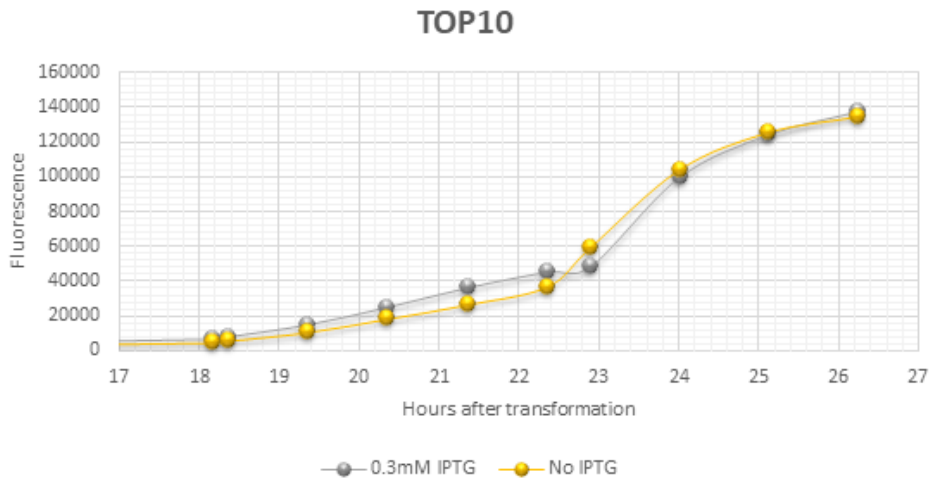
The main goal of this characterisation was to find out which *E. Coli* strain was the most effective among three different strains (TOP10, DH5α and BL21), to obtain a rapid and high red fluorescence with pSB1C3-BBa_J04450.
We also studied the influence of adding 0.3mM of IPTG on the RFP expression in these three strains to see if the leak was different between host strains.
Indeed, former iGEM teams had described a leaky expression of fluorescence with this biobrick, which means there was no need to induce expression with iPTG to obtain a high rate of fluorescence.

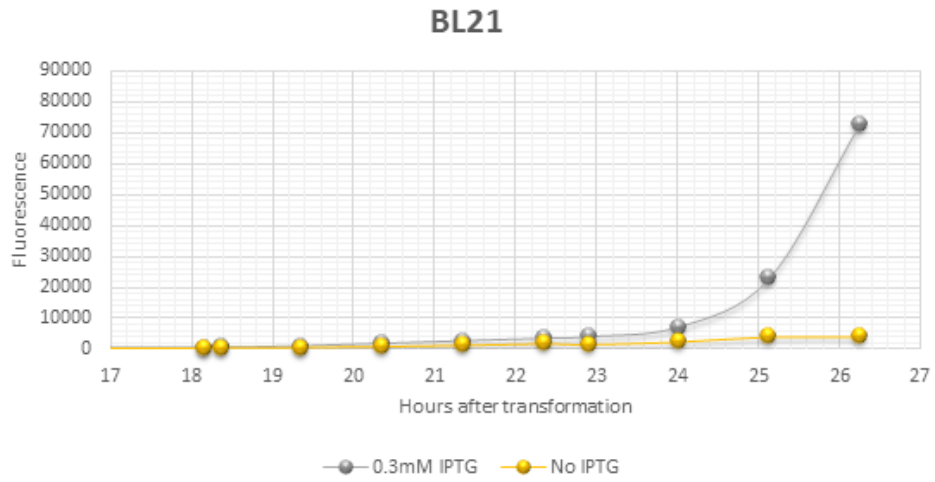
As we raised the question in the context of our project, we thought it might be useful to know which *E. Coli* host strain is the better to use depending on the conditions you want. For instance, you might want to strictly control RFP expression and so you will need to reduce the leaky expression at most. On the contrary, you may want to have the highest leak as possible to avoid using IPTG, a need our team encountered for the using of our automated system.

http://parts.igem.org/Part:BBa_J04450

Fluorescence observed after heat-shock transformation of pSB1C3-BBa_J04450 in three E. Coli strains with different induction conditions (0,3mM IPTG or not) – Close-up to study the leaky expression







Heat-shock transformation with 23ng plasmid, 25uL bacteria
LB broth-chloramphenicol

http://parts.igem.org/Part:BBa_J04450

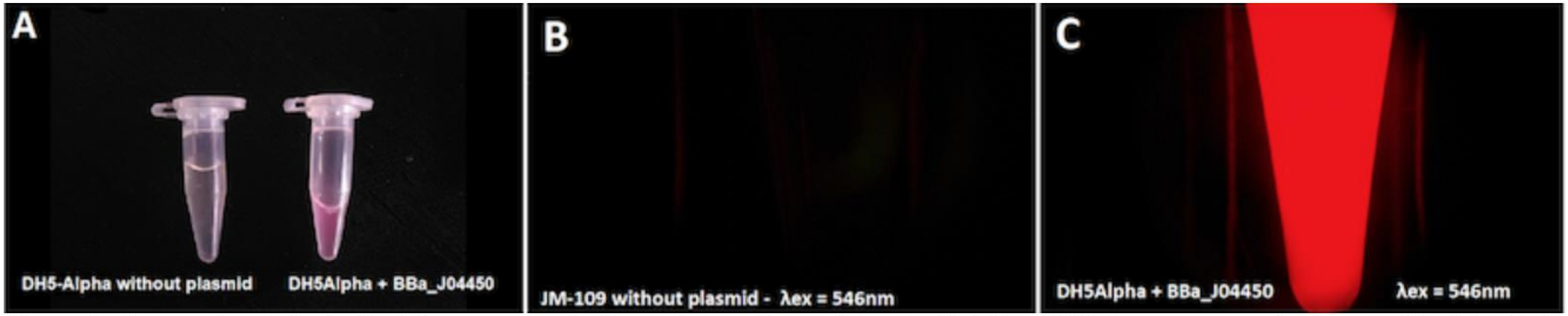
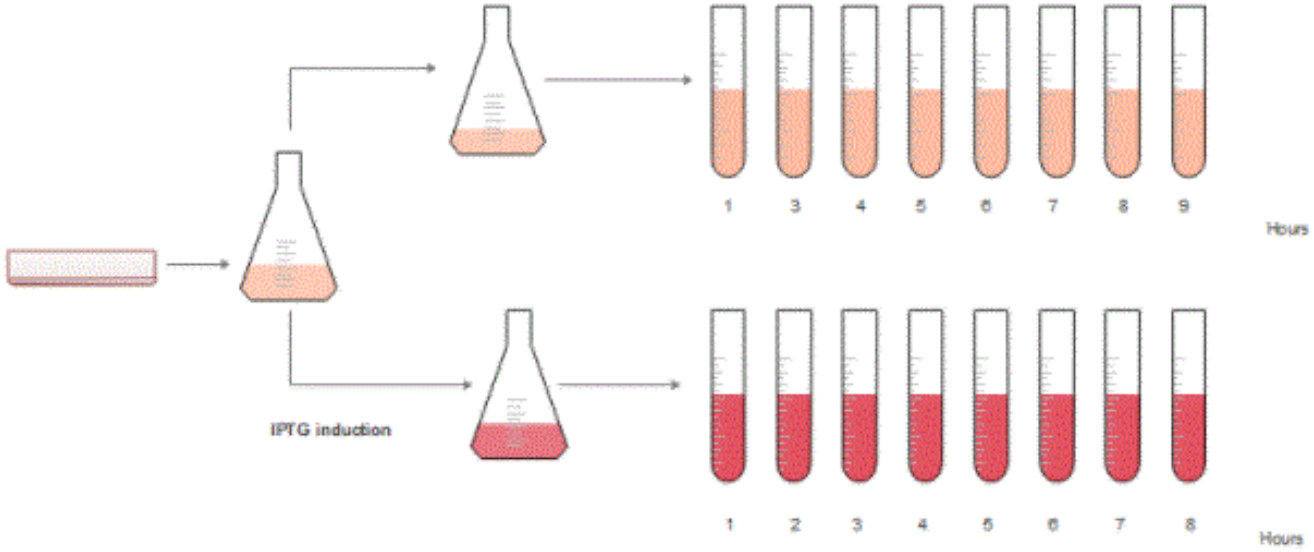
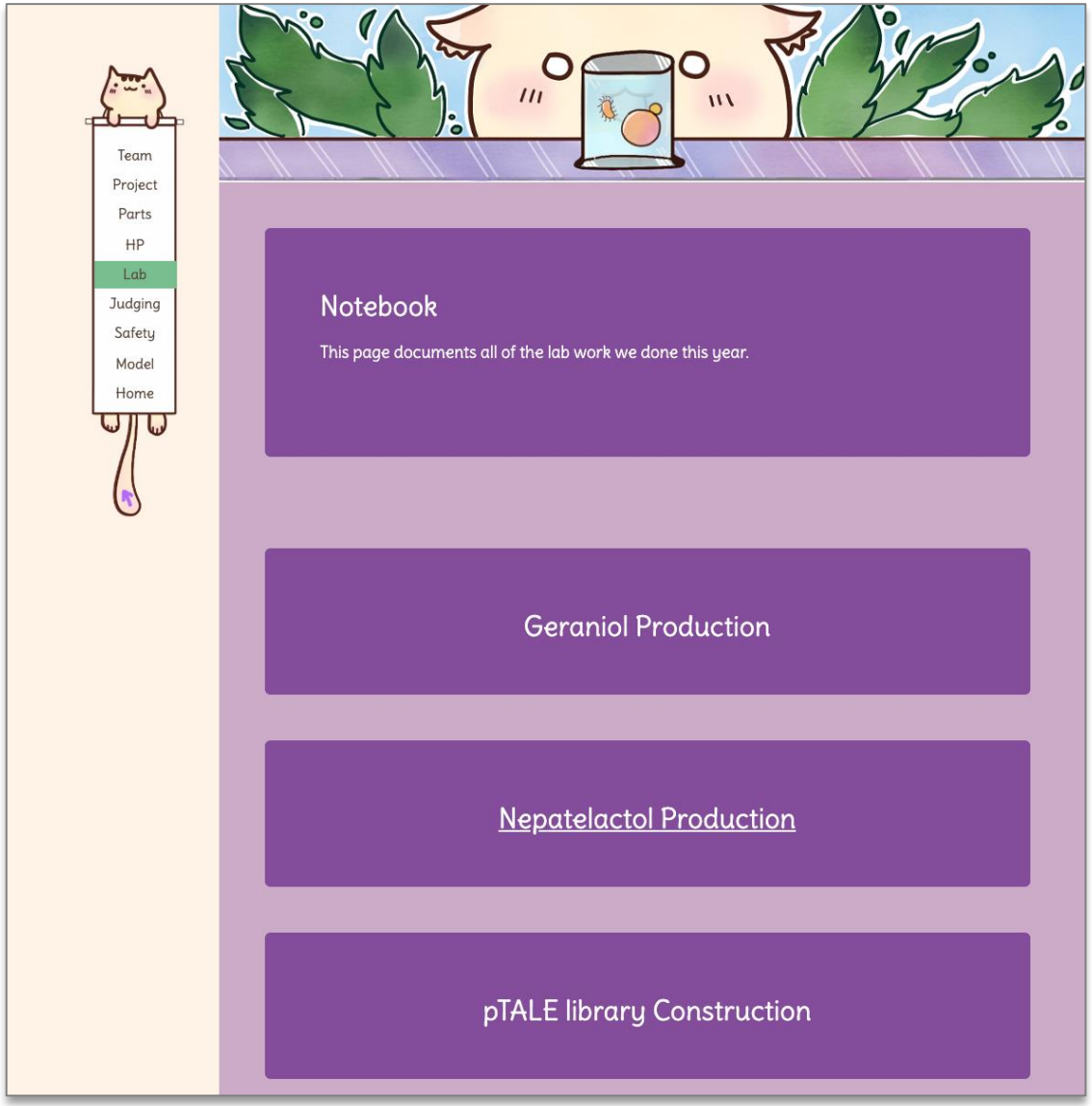


Figure 1: Observation of the leak of the promoter. A : Bacteria transformed or not with BBa_J04450 sequence, naked eye, white light. B. Bacteria without mRFP1 gene, excited at 546nm. C. Bacteria with mRFP1 gene, excited at 546nm. Red fluorescence is notable.



http://parts.igem.org/Part:BBa_J04450

2. Experimental data



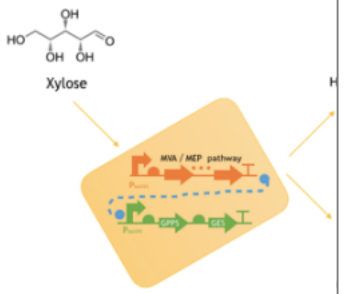
http://2018.igem.org/Team:GreatBay_China/Notebook

mCATNIP

Project: Geraniol Production

Team: GreatBay_China

Date: 2018-4-28 to 2018-10-15



mCATNIP

WEDNESDAY, 2018-6-6

1. **PCR amplification of GPPS, LS, and pSB1C3.**

This experiment is to verify pJBEI6409 is proper for Limonene synthesis

Fragment	Primers F	Primers R
GPPS 1	GPP F1	GPP R1
GPPS 2	GPP F2	GPP F2
LS	LSF	LSR
pSB1C3	pSB1C3 F1	pSB1C3 R

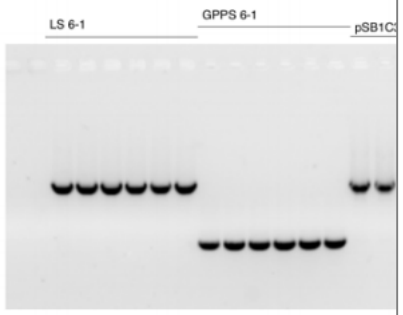
In gel electrophoresis, none of the parts have clear bands, exc

presented a dull band, yet wrong.

mCATNIP

THURSDAY, 2018-6-7

1. **Gradient PCR of GPPS, LS and pSB1C3**



All correct bands of LS, GPPS and pSB1C3 are shown clearly, provi

Gel extraction is applied.

2. **Gibson assembly & Transformation of pSB1C3-LS-GPPS**

Gibson assembly system follows GBC protocol and all content is tra

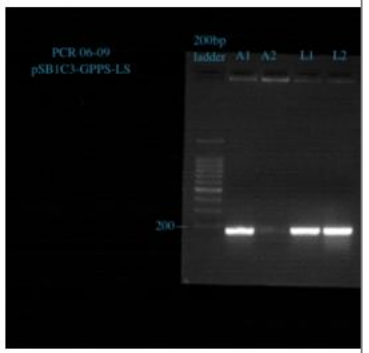
competent cell. Plated on LB dishes with chloramphenicol.

SATURDAY, 2018-6-9

1. **Colony PCR of DH5α containing pSB1C3-LS-GPPS**

Both two dishes has only 2 colonies grown in total, but we still carried Colony PCR on them.

mCATNIP



Only primer dimers appear in the gel, suggesting the foul method o

Gibson design.

2. **Gibson assembly & Transformation of pSB1C3-LS-GPPS.**

We redid the experiment with a slight change of Gibson system:

Gibson Mix	20 μ
1.33x gibson mix	15 μ
pSB1C3	0.8 μ
GPPS	1 μ
LS	1 μL
ddH2O	2.2 μL

mCATNIP

WEDNESDAY, 2018-6-13

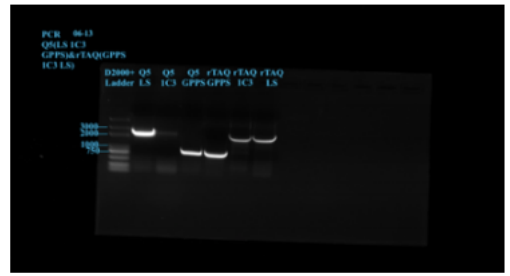
1. **Construction of pSB1C3-LS-GPPS**

No colony was grown on the dishes of last trial. So the experiment is repeated.

We used 2 types of DNA polymerase (Q5&rTaq).

rTaq Mix	50 μL
rTaq 2x mix	25 μL
Primer F	2.5 μL
Primer R	2;5 μL
template	2 μL
ddH2O	18 μL

Q5 Mix	50 μL
Q5 2x mix	25 μL
Primer F	2.5 μL
Primer R	2;5 μL
template	2 μL
ddH2O	18 μL



All rTaq products had bands appeared, though not as distinct in contrast of Q5. Despite of this pSB1C3 was not clearly shown in Q5 system. We therefore draw out the conclusion that rTaq is of better practicability than Q5.

We used Gibson assembly to assemble, followed by transformation.

http://2018.igem.org/Team:GreatBay_China/Notebook

3. Published data & information

Welcome to iGEM 2019!

Your team has been approved and you are ready to start the iGEM season!

Before you start

Please read the following pages:

- Competition Hub
- Wiki Requirements page
- Template documentation

https://2019.igem.org/Team:Example2

PRINTERIA

TEAM PROJECT RESULTS PARTS HUMAN AWARDS PRESS & CONTACT

Welcome to a new approach to SynBio. Precise, accessible and time-saving.

Welcome to Printeria

Find out more in our Project Description >

http://2018.igem.org/Team:Valencia_UPV

Safety Form

All teams are required to fill the Safety Form.

Due Date: June 28, 11:59PM EDT
An initial version of this form, with as much information as possible, is to be provided by the team.

Due Date: September 13, 11:59PM EDT
A final version of this form must be signed off by the PI.

SAFETY FORM

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

https://2019.igem.org/Safety

4. Measurement data

Introduction

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

INTRODUCTION

How to Succeed

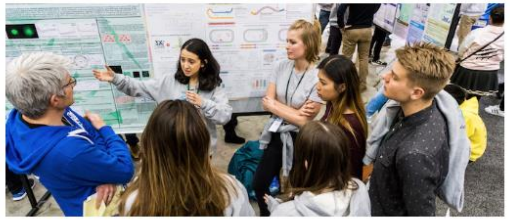
Careful measurement practices are a hallmark of successful iGEM projects. Check out our tips for taking successful measurements in synthetic biology.

READ MORE

Resources

Getting started? These resources can help you think about how to integrate good measurements in your project design.

RESOURCES



Measurement Protocols

Good protocols are key to measurement. This year, teams can use **Protocols.io** to describe and share their protocols. Find out how you can make the most of this tool, and see existing iGEM measurement protocols you can use.

Exemplary Projects

Teams approach the measurement aspects of their projects in many thoughtful and creative ways. Here are some exemplary projects.

EXAMPLES

Committee

Measurement efforts at iGEM are guided by this committee.

COMMITTEE

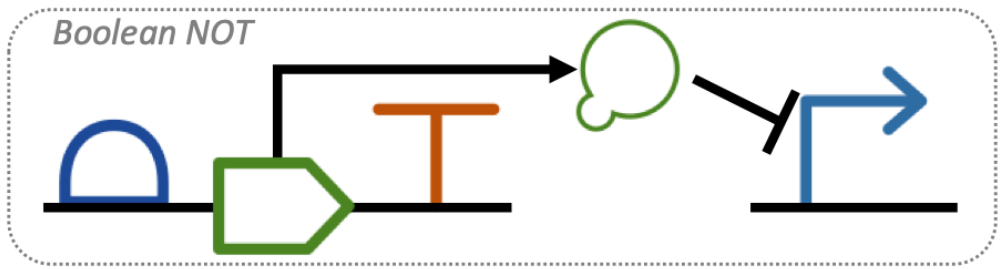
https://2019.igem.org/Measurement

Layers of Data Sharing Challenges

Raytheon BBN Technologies

Systems

Predictable Design



Devices

Calibrated flow, plate → IO Range, SNR, … ???

Parts

BioBricks → GG, MoClo, BASIC, …

```
ttgatggctagctcagtcctaggtacaatgctagctaga...
```

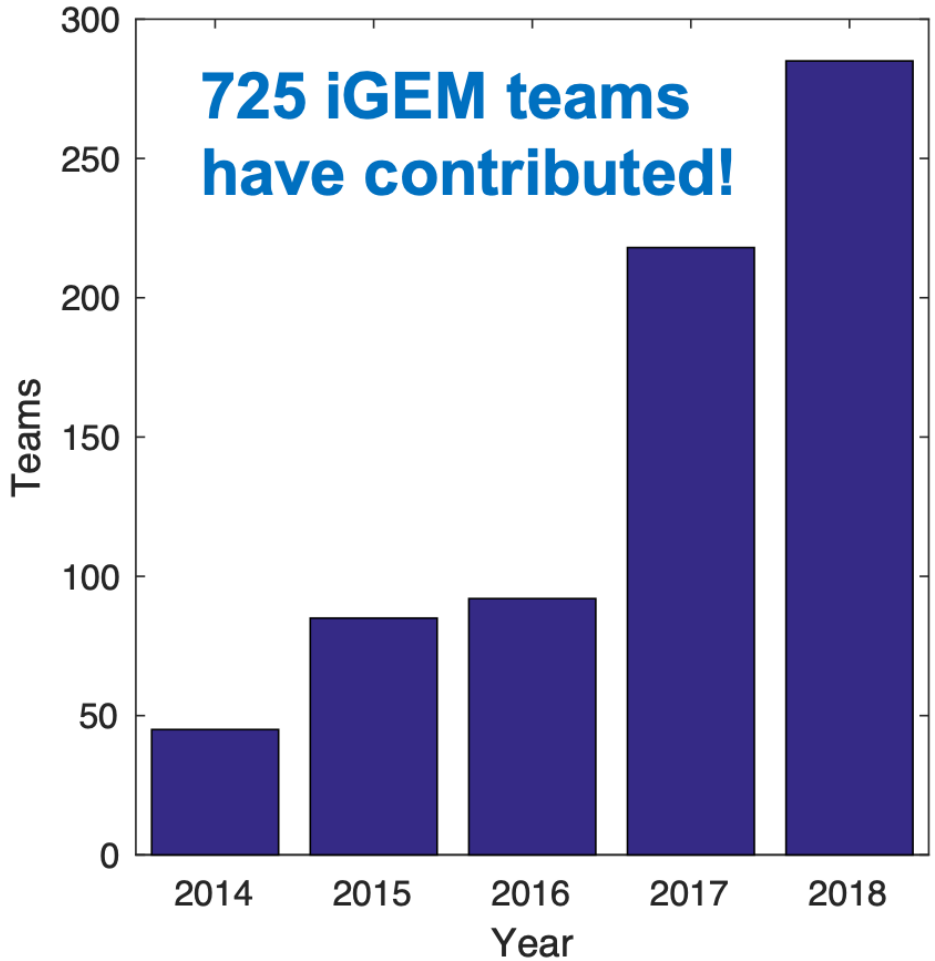
DNA

iGEM has been a leader in parts standardization & assembly, now moving to devices

[Beal et al., TIBTECH '18]

iGEM Interlabs: 2014 → 2018

Raytheon BBN Technologies



- 2014: What can teams measure?
- 2015: Precise, comparable measurements
- 2016: Independently calibrated units
- 2017: Improved plate reader measures
- **2018: Standard flow & plate units (MEFL)**
- *2019: No interlab: change focus to adoption*

- Two publications with ~1000 iGEM authors, 27 citations so far; another in prep
- Adoption of iGEM calibration protocols by other projects

Working with Hazardous Materials

Human subjects research

Dual Use & Biosecurity

Release into the environment

Risk

Human Experimentation

Anti-Microbial Resistance

Gene Drives

Samples from outside the lab

Animal Use

Safety and Security Hub

We expect everyone involved with iGEM to **act responsibly** throughout the competition. Considering safety and security is an important component of responsible research and innovation.

Working safely and securely

Find our more about safety and security in project design, laboratory work, and transfer practices.

WORKING SAFELY

Safety and Security Rules

Find out the safety and security rules all teams must follow.

SAFETY & SECURITY RULES

Safety and Security Policies

Find out about iGEM's policies on the use of humans, animals, anti-microbial resistance, gene drives, and more

SAFETY & SECURITY POLICIES

http://2019.igem.org/Safety

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

http://2019.igem.org/Safety/Responsibility

biosecu.re

www.biosecu.re | piers@biosecu.re | @biosec_re

iGEM Project Safety Screening

Original Article

ABSA INTERNATIONAL

Applied Biosafety:
Journal of ABSA International
2019, Vol. 24(2) 1-8

DOI: 10.1177/1535676019838075
journals.sagepub.com/home/apb
SAGE

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

Piers Millett[1], Thomas Binz[2], Sam Weiss Evans[3], Todd Kuiken[4], Ken Oye[5], Megan J. Palmer[6], Cécile van der Vlugt[7], Kathrina Yambao[8], and Samuel Yu[9]

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.

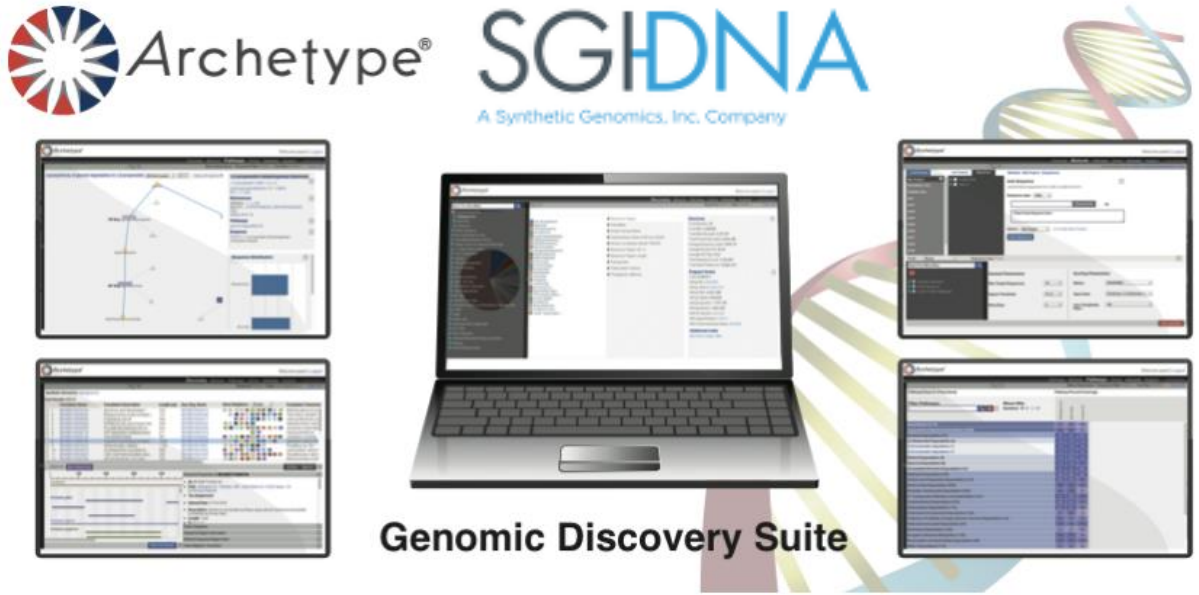
iGEM's program is forward-leaning, in that it addresses both traditional (pathogen-based) and emerging risks both in terms of new technologies and new risks. It is integrated into the technical work of the competition—with clearly described roles and responsibilities for all members of the community.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

[1] iGEM Foundation, Cambridge, MA, USA
[2] Swiss Federal Office of Public Health, Berne, Switzerland
[3] Program in Science, Technology, and Society, Tufts University, Medford, MA, USA
[4] Genetic Engineering and Society Center, North Carolina State University, Raleigh, NC, USA
[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

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.



https://sgidna.com/archetype.html

https://doi.org/10.1177/1535676019838075

Biosecurity lessons from iGEM data sharing

Increasing digitization of biology enables sharing and collaboration: offering greater benefits but also potential loss of control

https://www.selectagents.gov/

JOURNAL OF VIROLOGY, Feb. 2001, p. 1205–1210
0022-538X/01/$04.00+0 DOI: 10.1128/JVI.75.3.1205–1210.2001

Vol. 75, No. 3

Expression of Mouse Interleukin-4 by a Recombinant Ectromelia Virus Suppresses Cytolytic Lymphocyte Responses and Overcomes Genetic Resistance to Mousepox

PNAS
Proceedings of the National Academy of Sciences of the United States of America

Analyzing a bioterror attack on the food supply: The case of botulinum toxin in milk

Science Home News Journals Topics Careers

Characterization of the Reconstructed 1918 Spanish Influenza Pandemic Virus

Terrence M. Tumpey[1,*], Christopher F. Basler[2], Patricia V. Aguilar[2], Hui Zeng[1], Alicia Solórzano[2], David E. Swayne[4], Nancy J...

PLOS ONE

Construction of an infectious horsepox virus vaccine from chemically synthesized DNA fragments

Ryan S. Noyce, Seth Lederman, David H. Evans

Published: January 19, 2018 • https://doi.org/10.1371/journal.pone.0188453

nature
International journal of science

Experimental adaptation of an influenza H5 HA confers respiratory droplet transmission to a reassortant H5 HA/H1N1 virus in ferrets

Masaki Imai, Tokiko Watanabe, Masato Hatta, Subash C. Das, Makoto Ozawa, Kyoko Shinya, Gongxun

Science Home News Journals Topics Careers

REPORT

Airborne Transmission of Influenza A/H5N1 Virus Between Ferrets

Sander Herfst[1], Eefje J. A. Schrauwen[1], Martin Linster[1], Salin Chutinimitkul[1], Emmie de Wit[1,*], Vincent J. Munster[1,*], Erin ...
+ See all authors and affiliations

The Journal of Infectious Diseases

EDITOR'S CHOICE

A Novel Strain of *Clostridium botulinum* That Produces Type B and Type H Botulinum Toxins

FREE

Jason R. Barash, Stephen S. Arnon

The Journal of Infectious Diseases, Volume 209, Issue 2, 15 January 2014, Pages 183–191, https://doi.org/10.1093/infdis/jit449
Published: 07 October 2013 **Article history**

Activities

Activities on the White List (left column) can be carried our without being checked-in. Teams require permission in advance from the **Safety and Security Committee** some activities, such as the examples provided below (right column). Permission should be requested by completing a **Check-In Form** **before** carrying out these experiments.

	White List (no Check-In required)	Check-In Required (examples only!)
Activities	Anything not explicitly listed	Experiments likely to bias the inheritance frequency of a genetic marker in an organism's progeny, such as through the creation of a **gene drive**.
		Experiments likely to render a vaccine ineffective.
		Experiments likely to confer resistance to the World Health Organization's **list of Critically Important Antimicrobials** ⇗.
		Experiments likely to make hazardous biological agents more hazardous, such as enhancing the virulence or transmissibility of a human, plant, or animal pathogen, or altering its host-range.
		Experiments likely to result in a novel hazardous biological agent, such as by rendering a non-pathogen virulent, or conferring degradation of, or the ability to damage, important materials (such as electronics, plastics, etc.).
		Experiments likely to enable a hazardous agent (such as pathogens or organisms capable of damaging important materials) to evade common diagnostic or detection tools.
		Experiments likely to make a biological agent or toxin more suitable for use as a weapon.

https://2019.igem.org/Safety/White_List

Current biosecurity regimes struggle to deal with biological data and information

PharMARSy

A Simple Pharmaceutical Protein Production & Purification System on Mars

"In order to truly explore space, astronauts will need the capability to produce needed medications during their mission" - Virginia Wotring (Adjunct Associate Professor, Center for Space Medicine and Department of Pharmacology and Chemical Biology, Baylor College of Medicine).

The race to the Red Planet has started and colonization could be in the near future! To make the colonization of Mars possible the first people will, of course, need to be able to survive and be self-sustaining in a place far from Earth. Astronauts will need access to medicine, but bringing it from the Earth is unsustainable. With our project, we aim to make a Portable Protein Production and Purification System that will solve the astronauts need for pharmaceutical protein by letting them produce their own medicine on site - no need to depend on the supply from Earth!

Achievements

- Gold Medal from iGEM Competition 2018
- Nomination for Best Poster from iGEM Competition 2018
- Judges Award from Nordic iGEM Conference 2018
- iGEMers Choice Award from Nordic iGEM Conference 2018

http://2018.igem.org/Team:UCopenhagen

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

Fighting the spread of chemical and biological weapons

Strengthening global security

The Australia Group

- Home
- What's New
- Introduction
- AG Participants
- AG Adherents
- Origins of the AG
- AG Objectives
- AG Activities
- AG and the CWC
- AG and the BWC
- AG and Trade
- AG Common Control Lists
- Control List Handbooks
- AG Guidelines
- AG Membership
- Publications

The Australia Group (AG) is an informal forum of countries which, through the harmonisation of export controls, seeks to ensure that exports do not contribute to the development of chemical or biological weapons.

Coordination of national export control measures assists Australia Group participants to fulfil their obligations under the Chemical Weapons Convention and the Biological and Toxin Weapons Convention to the fullest extent possible.

Contact us

Australia Group Secretariat
RG Casey Building
John McEwen Crescnet
BARTON ACT 0221
Australia

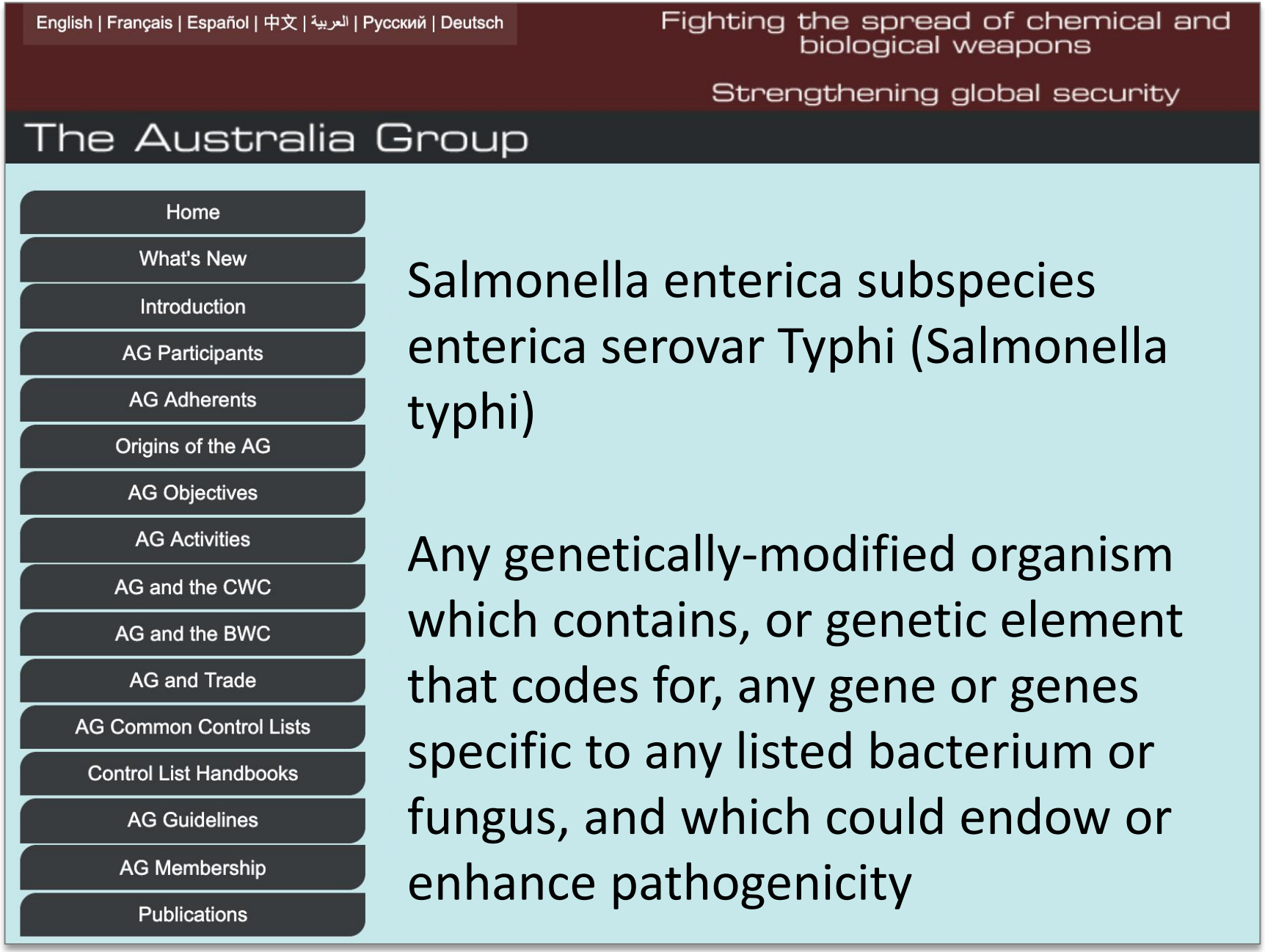
Tel: +61 2 6261 9399

Fax: +61 2 6261 2151

Email: wais_dfat@bigpond.com

Head of the Secretariat: Mr Michael Gregory

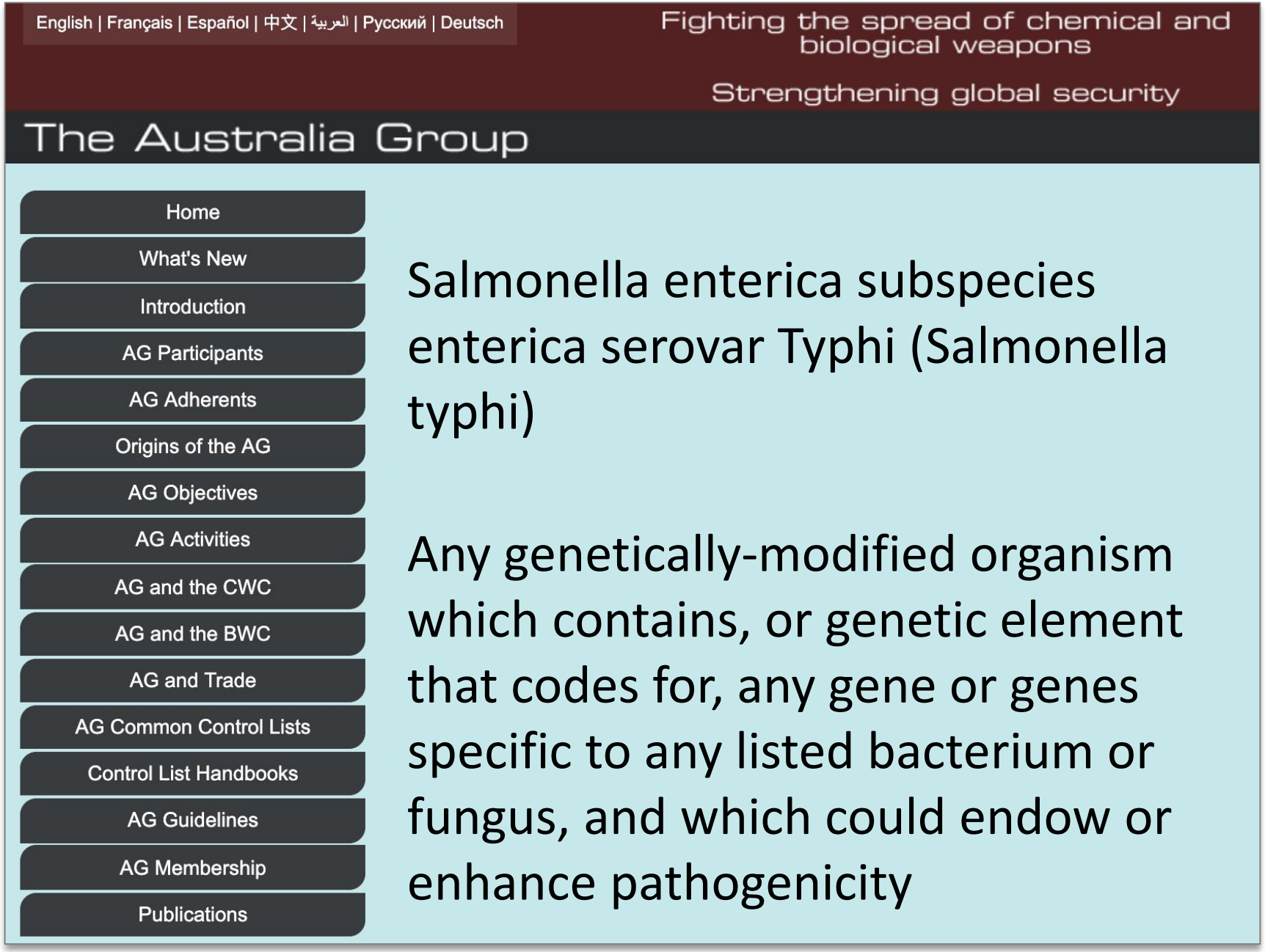
https://australiagroup.net/en/



https://australiagroup.net/en/

Interpretation of the Australia Group Rules

- In Canada, export control governed by Global Affairs Canada
  - May consult with the Centre for Biosecurity from the Public Health Agency of Canada (PHAC), as required
- PHAC's interpretation:
  - Only *Salmonella* Typhi is covered
  - Other *Salmonella enterica* serovars would not be restricted
  - SPI-1 and SPI-2 are common to both serovars (Enteritidis and Typhi) and high sequence homology is probable
  - Unclear if the Australia Group rules apply



https://australiagroup.net/en/

Increasing digitization of biology will compound some biosecurity risks

Risk Analysis
AN INTERNATIONAL JOURNAL
An Official Publication of the Society for Risk Analysis

Perspective | Open Access

Information Hazards in Biotechnology

Gregory Lewis, Piers Millett, Anders Sandberg, Andrew Snyder-Beattie, Gigi Gronvall

First published: 12 November 2018 | https://doi.org/10.1111/risa.13235

….biological *information*, rather than the corresponding biological *materials*, is increasingly the object of greatest security concern. These are *information hazards*, defined as "a risk that arises from the dissemination of (true) information that may cause harm or enable some agent to cause harm"

https://onlinelibrary.wiley.com/doi/full/10.1111/risa.13235

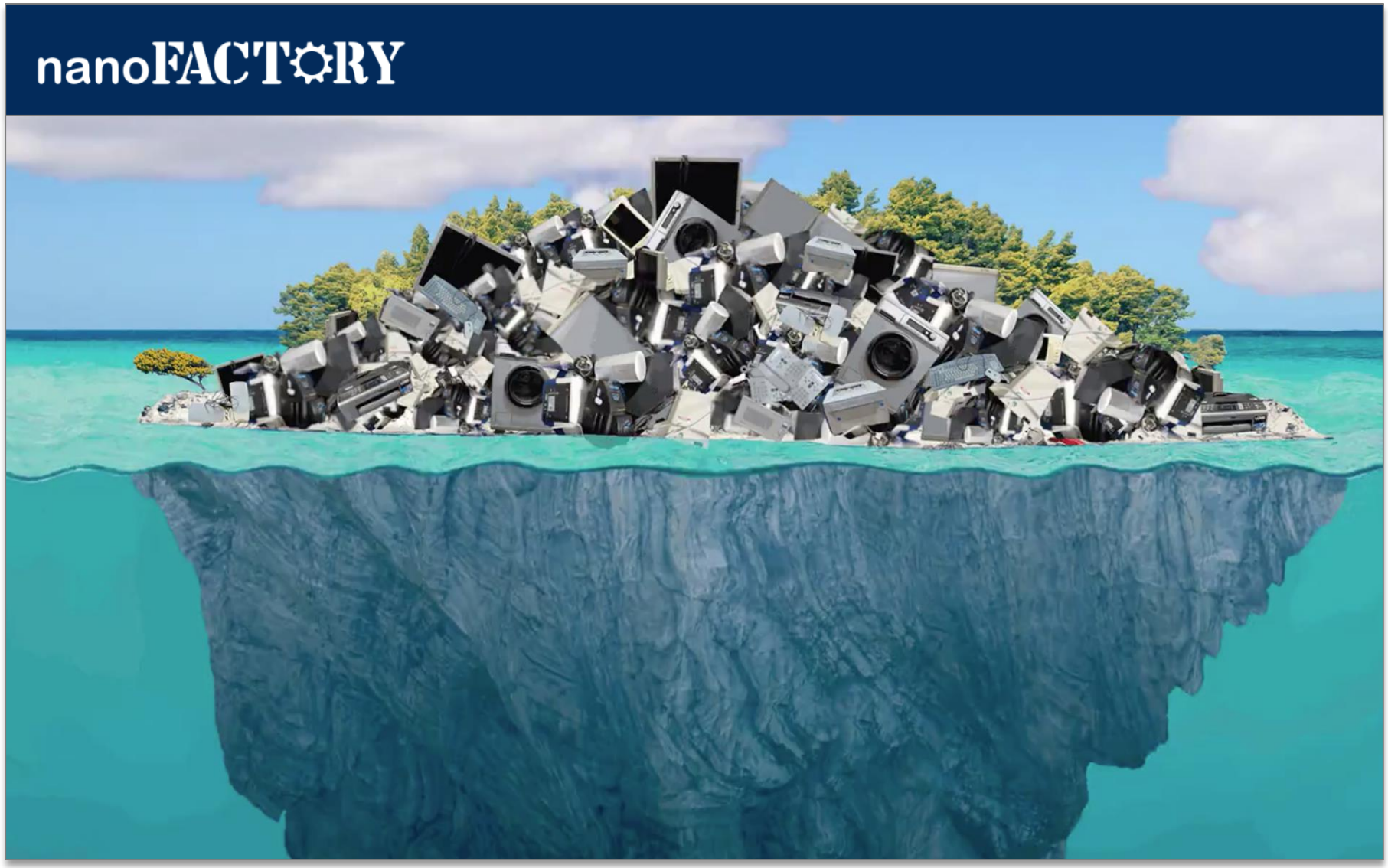
Biological information cannot be neatly segregated into the safe and open, and the hazardous and secret: much is to a greater or lesser degree "dual use"; it is also often incremental, building upon prior information that is openly available.

https://onlinelibrary.wiley.com/doi/full/10.1111/risa.13235

Heuristics to judge biosecurity info hazards

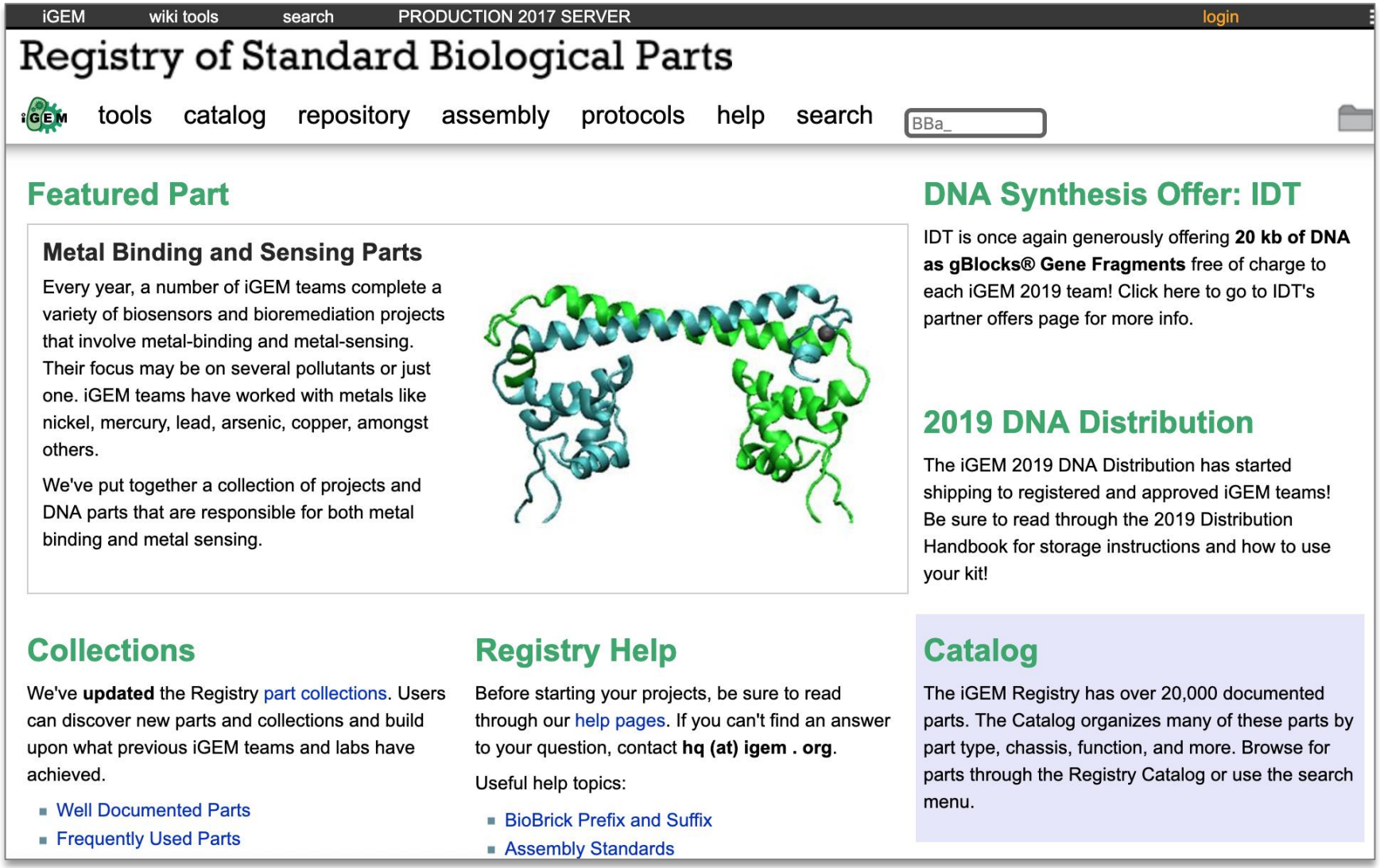
- High risk info must provide significant capacity to cause harm over what is already widely available
- Many potential risks require several pieces of information to realize. The hardest pieces to discover comprise the greatest hazard. This could be experimental results, innovations with broad applications, or tacit knowledge for performing a given technique.
- Information can also act as a substitute for other resources in dangerous projects.
- Information can become more or less hazardous over time
- Uncertainty about degree of hazard is usually a cause for caution rather than reassurance

https://onlinelibrary.wiley.com/doi/full/10.1111/risa.13235

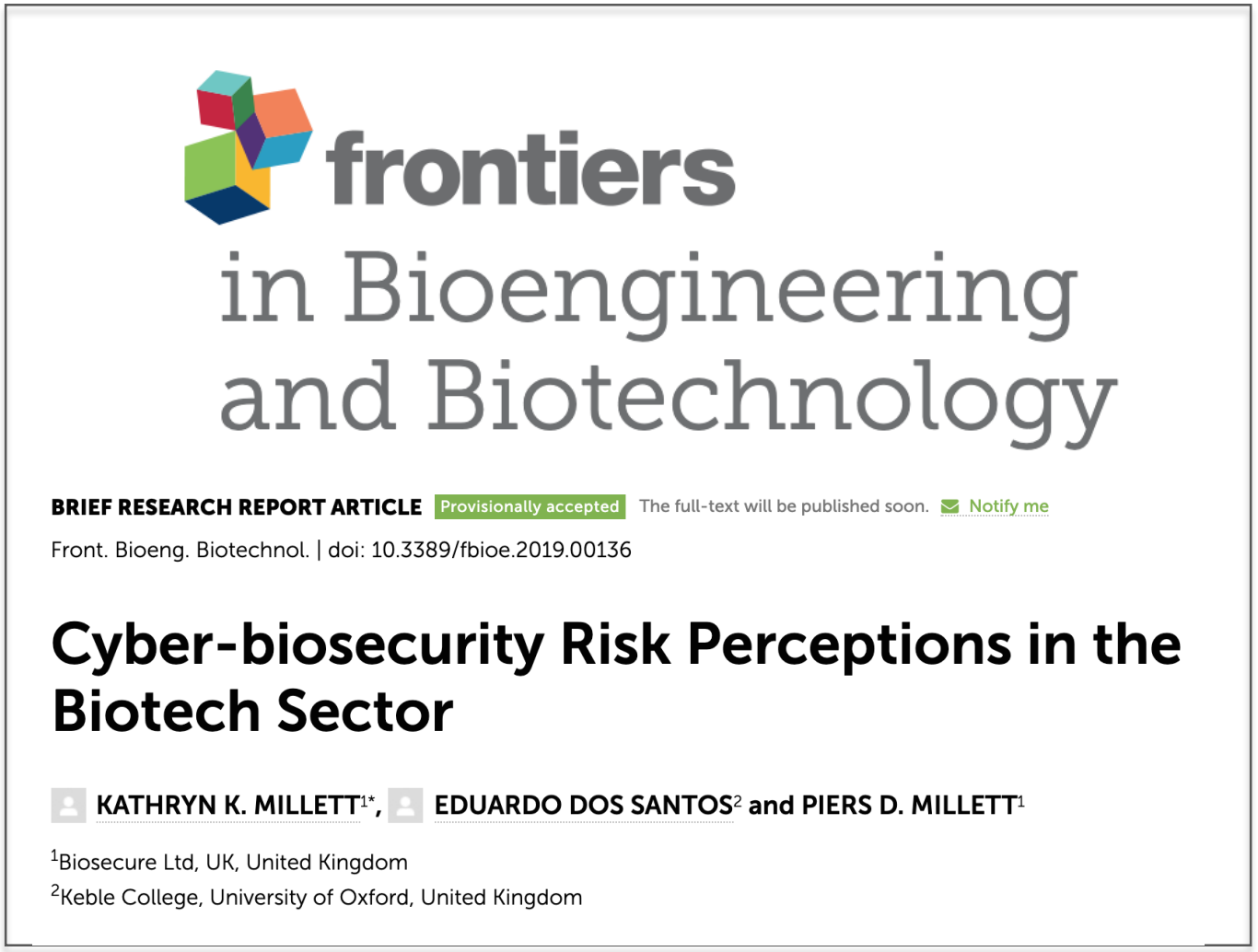


http://2018.igem.org/Team:Bielefeld-CeBiTec

Increasing digitization of biology will present new biosecurity risks



http://parts.igem.org



frontiers in Bioengineering and Biotechnology

BRIEF RESEARCH REPORT ARTICLE Provisionally accepted The full-text will be published soon. Notify me

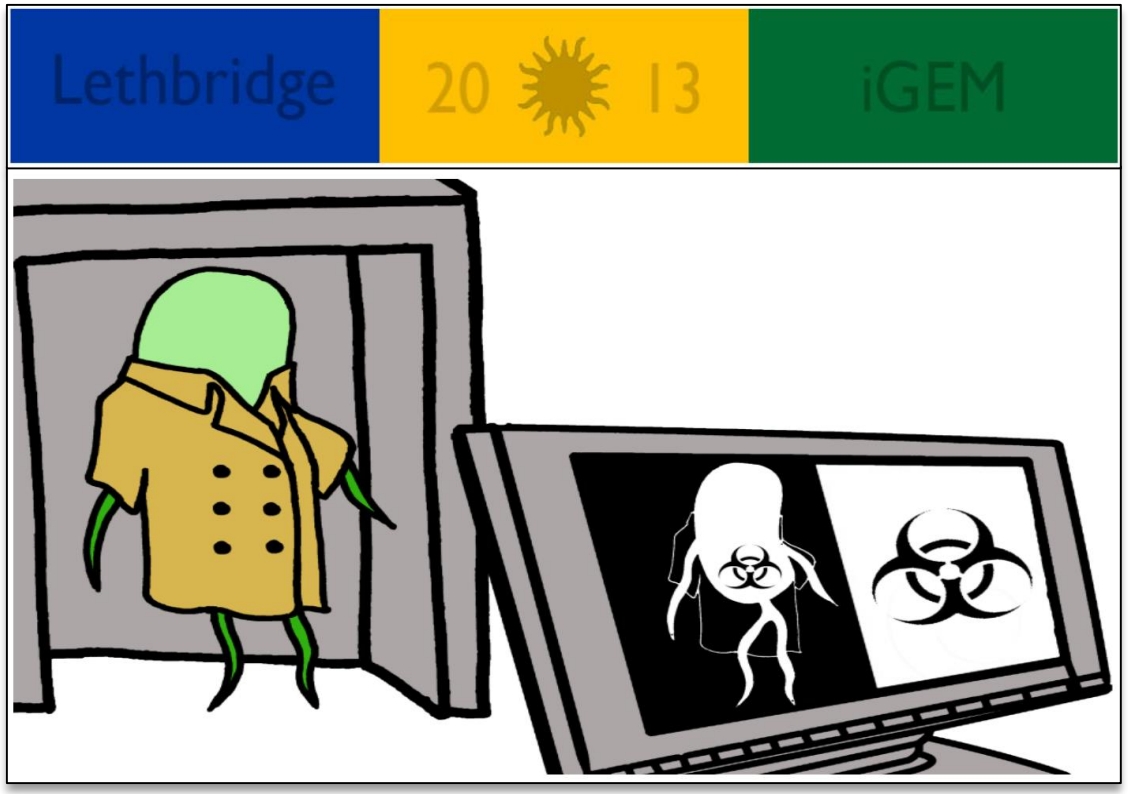
Front. Bioeng. Biotechnol. | doi: 10.3389/fbioe.2019.00136

Cyber-biosecurity Risk Perceptions in the Biotech Sector

KATHRYN K. MILLETT[1*], EDUARDO DOS SANTOS[2] and PIERS D. MILLETT[1]

[1]Biosecure Ltd, UK, United Kingdom
[2]Keble College, University of Oxford, United Kingdom

https://www.frontiersin.org/articles/10.3389/fbioe.2019.00136



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

next vivo

LETHBRIDGE iGEM 2017

Cell-free Synthetic Biology for the Masses

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

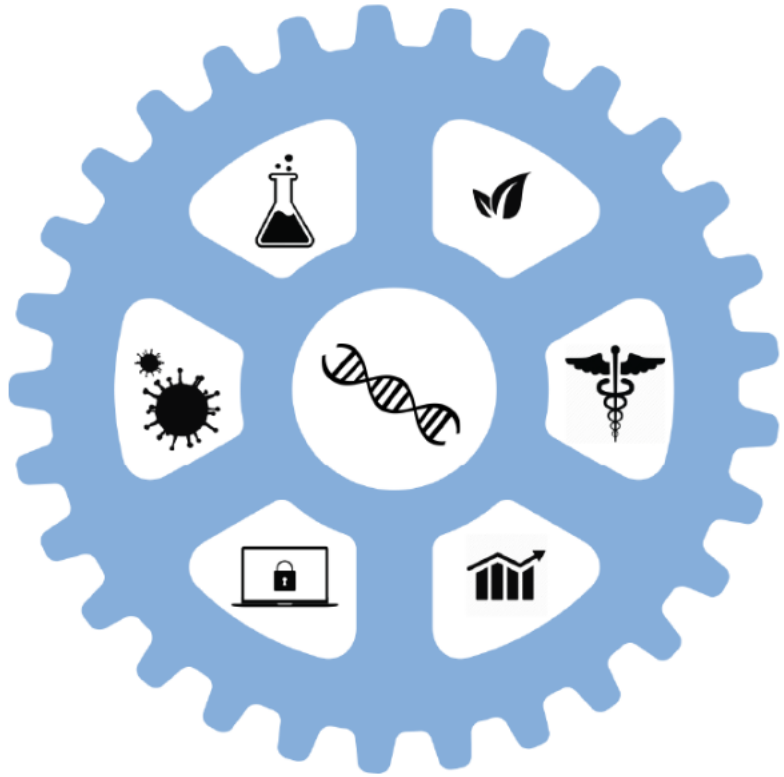
As we make more things with biology, the security implications will diversify

https://2019.igem.org/Competition/Tracks

The National Academies of SCIENCES ENGINEERING MEDICINE

SAFEGUARDING THE BIOECONOMY:
FINDING STRATEGIES FOR UNDERSTANDING, EVALUATING, AND PROTECTING THE BIOECONOMY WHILE SUSTAINING INNOVATION AND GROWTH

Research and innovation in the life sciences is driving rapid growth in agriculture, biomedical science, information science and computing, energy, and other sectors of the U.S. economy. This emerging "bioeconomy" presents many opportunities to create jobs, improve the quality of life, and continue to drive economic growth. While the US has been a leader in advancements in the biological sciences, other countries are also actively investing in and expanding their capabilities in this area. More than 40 countries have created and implemented national bioeconomy strategies and priorities.



http://nas-sites.org/dels/studies/bioeconomy/

Expanding how we think of biosecurity

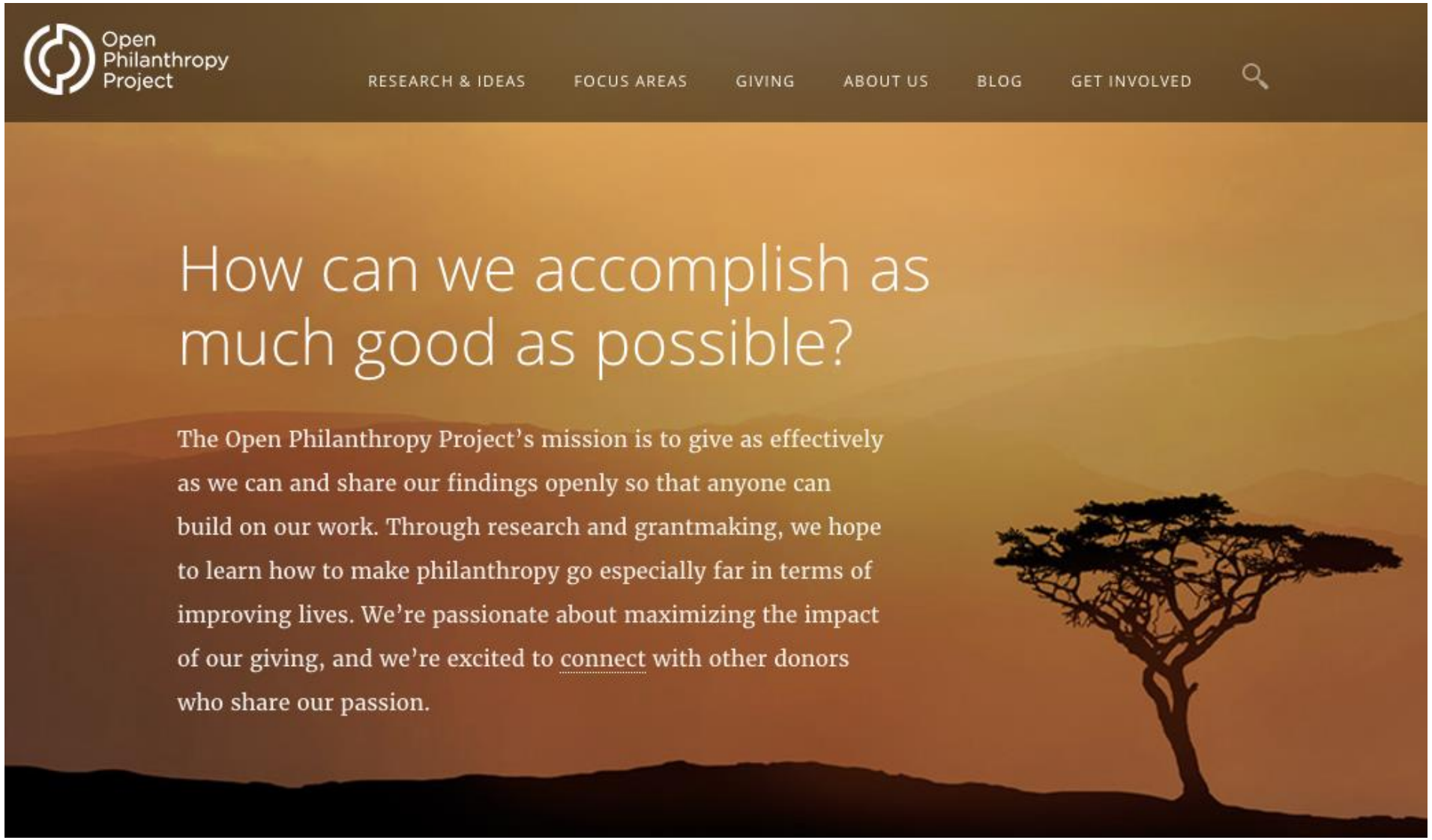
- **Access to resources** (e.g. oil, water, or agricultural capacity) has destabilized countries and resulted in wars
- **Access to energy**, is a key driver of development and its absence compounds existing disparities and undermines international stability
- **Manufacturing and industrial capacity** plays an important role in maintaining and improving international and national peace and security
- **Cyberbiosecurity** protects data and infrastructure necessary to drive the bioeconomy
- **Transnational crime**, such as the international narcotics trade, destabilizes and challenges governments
- **Maintaining the environment and preserving biodiversity** could be a key to future stability

http://sites.nationalacademies.org/cs/groups/pgasite/documents/webpage/pga_153447.pdf

Conclusions

1. Increasing digitization of biology enables sharing and collaboration: offering greater benefits but also potential loss of control
2. Current biosecurity regimes struggle to deal with biological data and information (e.g. need for function-based risk assessment)
3. Increasing digitization of biology will compound some biosecurity risks (e.g. info hazards)
4. Increasing digitization of biology will present new biosecurity risks (e.g. contamination of data)
5. As we make more things with biology, the security implications will also diversify

Our sincere thanks to our funder:



http://www.openphilanthropy.org/