BIOETHICS – RESPONSIBLE RESEARCH AND INNOVATION

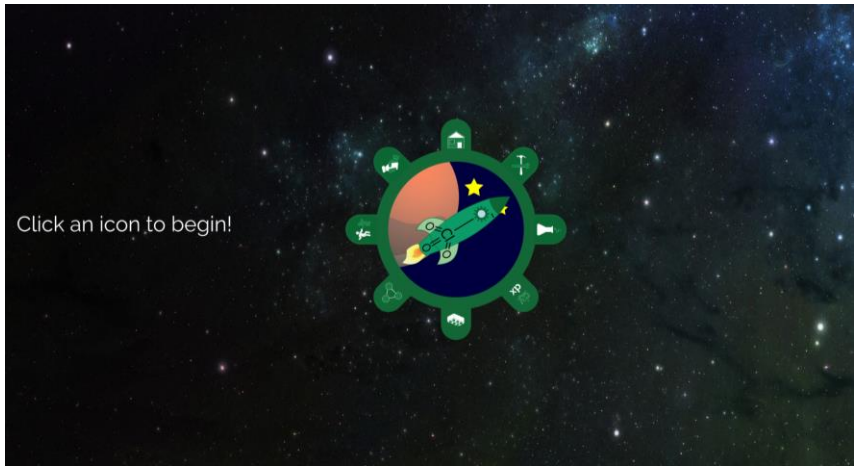
iGEM

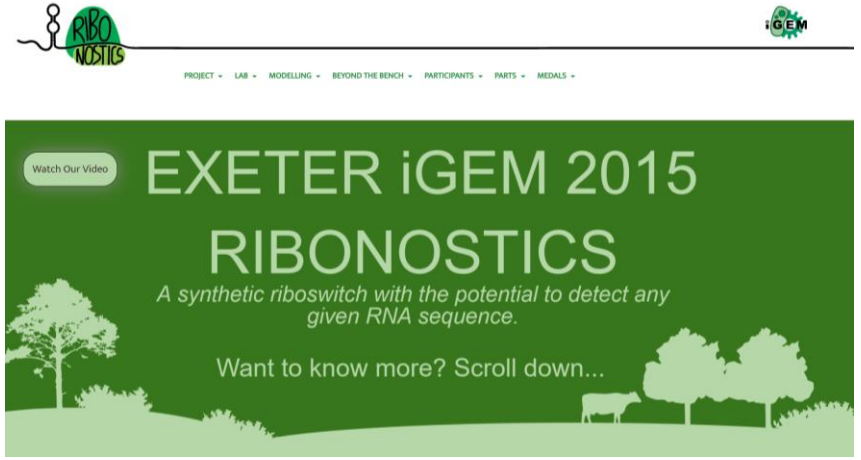
WHAT ACTUALLY IS IGEM?

An international synthetic biology competition that gives students from any discipline an opportunity to develop a biological solution to a real-life problem.

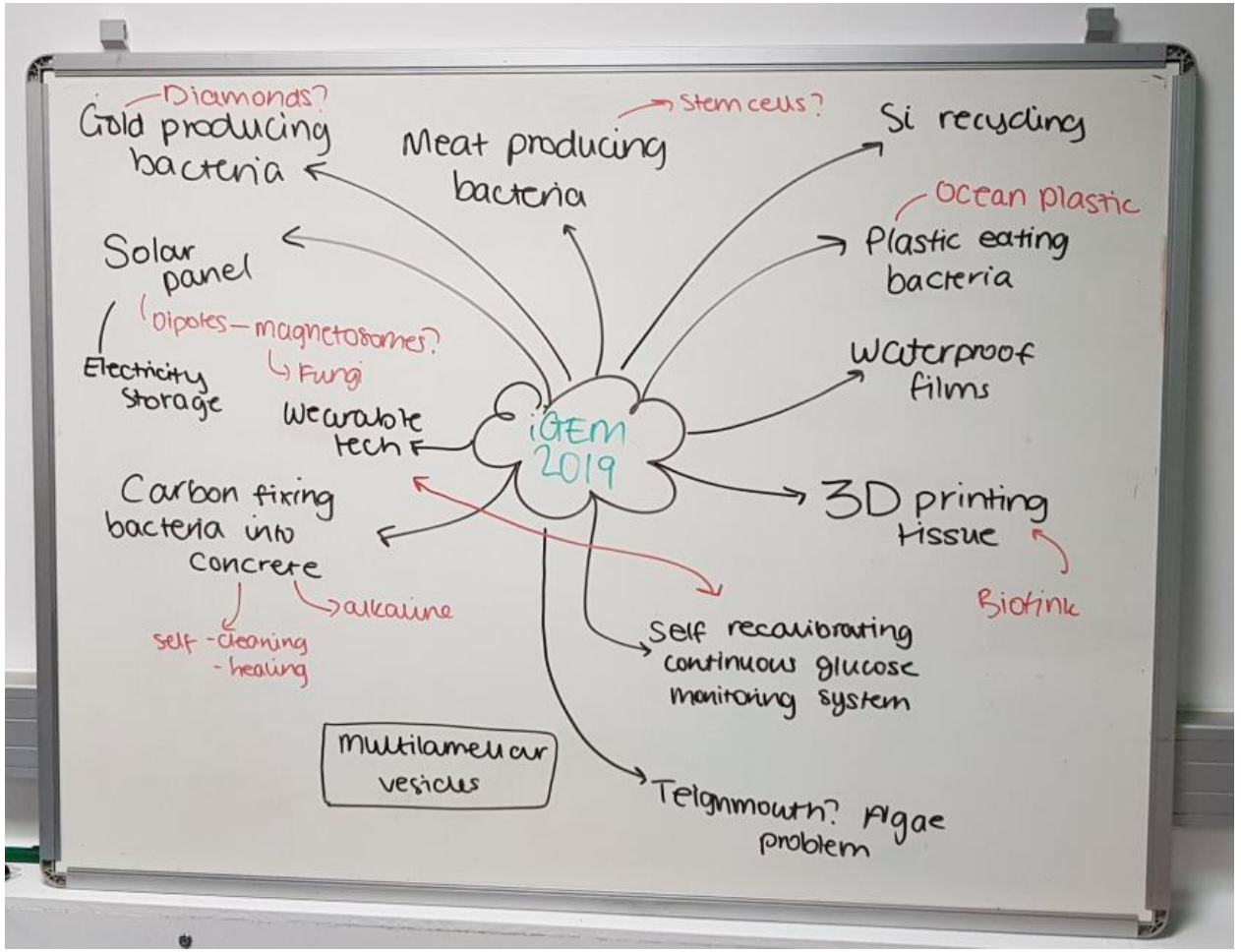
https://youtu.be/oCGp-Y6a0bU

PREVIOUS PROJECTS





INITIAL IDEAS



PETEXE:

PROTECTING THE OCEANS ONE WASH AT A TIME

WHY PETEXE?

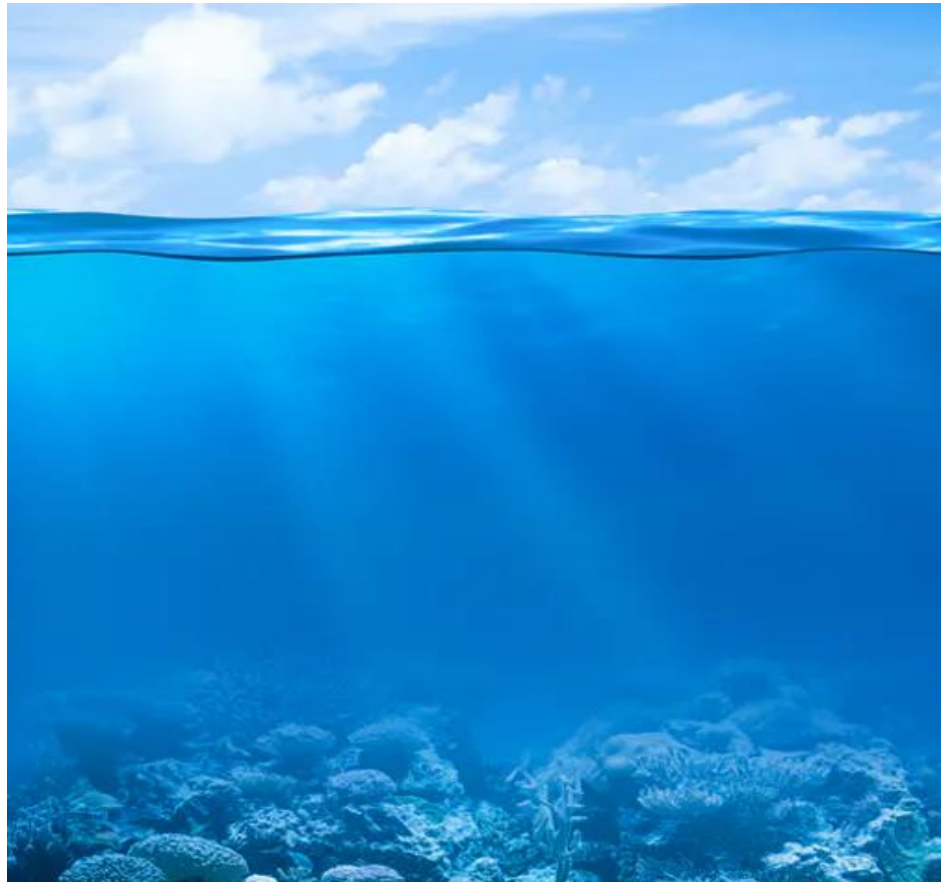
- 35% of microfiber pollution is from washing clothes
- Polyethylene terephthalate (PET) accounts for 80% of synthetic fibres

#Plasticfree: how to handle the scary plastic threat on our own backs

Decades of washing synthetic clothes has contributed to vast, irreversible pollution, with microfibers found in our drinking water, beer and table salt. So what can we do?

OUR VISION

- A way of capturing synthetic microfibers
- A way to break down the microfibers
- Cleaner water entering the oceans

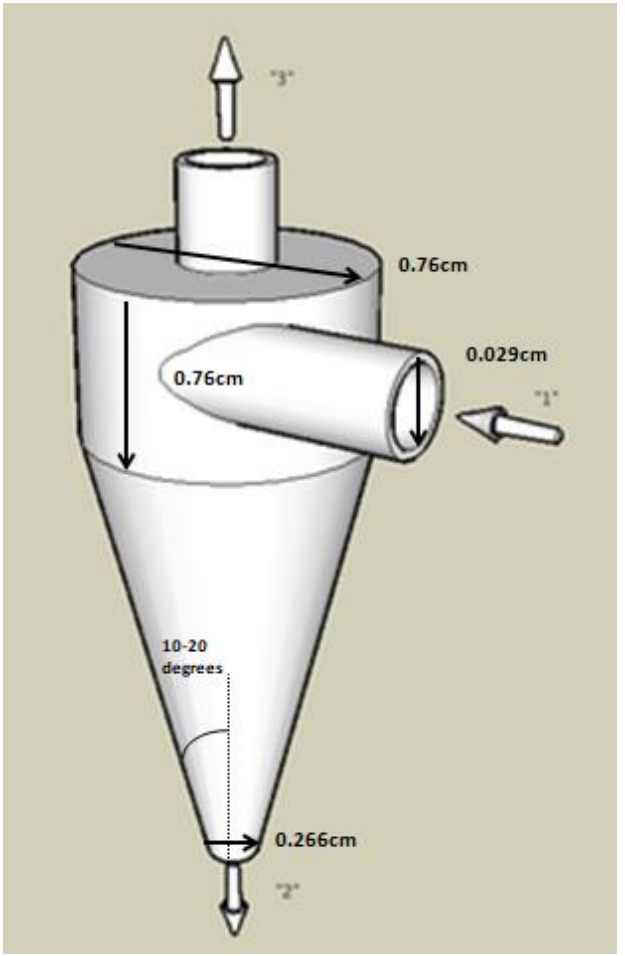


OUR SOLUTION

- A filter that captures and breaks down microfibers
- An enzyme delivery system

MODELLING OF OUR WORK

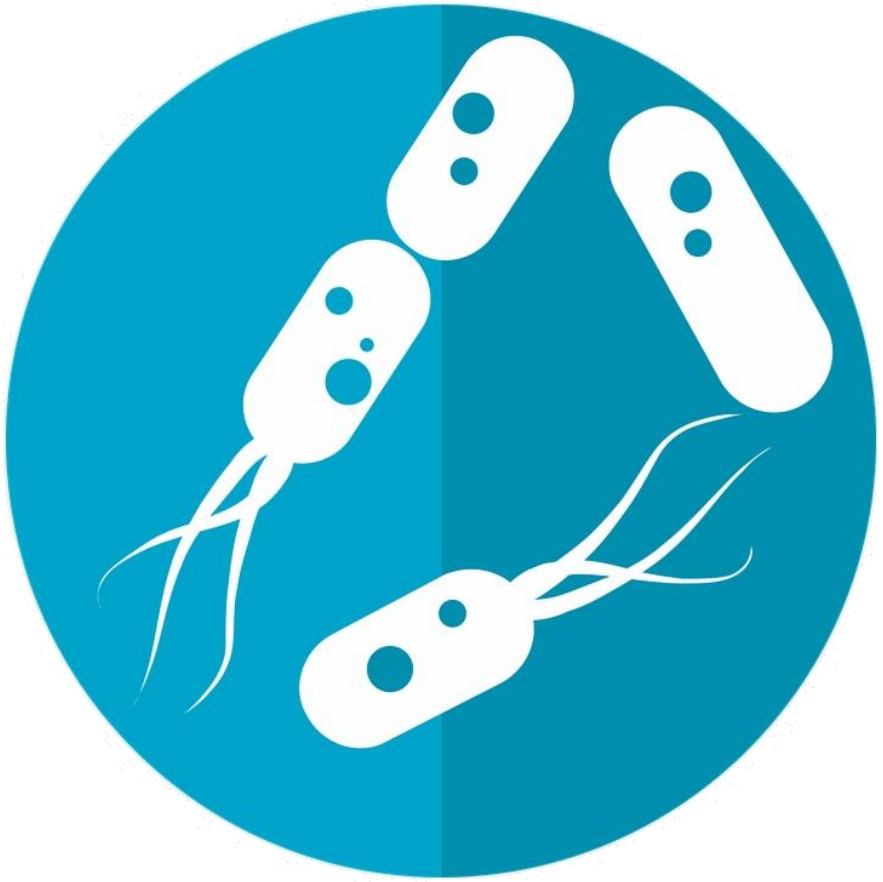
- Modelling can save time
- A hydrocyclone was suggested
- The dimensions that came out were not reasonable
- We were able to skip weeks of testing and we dropped the hydrocyclone idea



WHAT IS SYNTHETIC BIOLOGY?

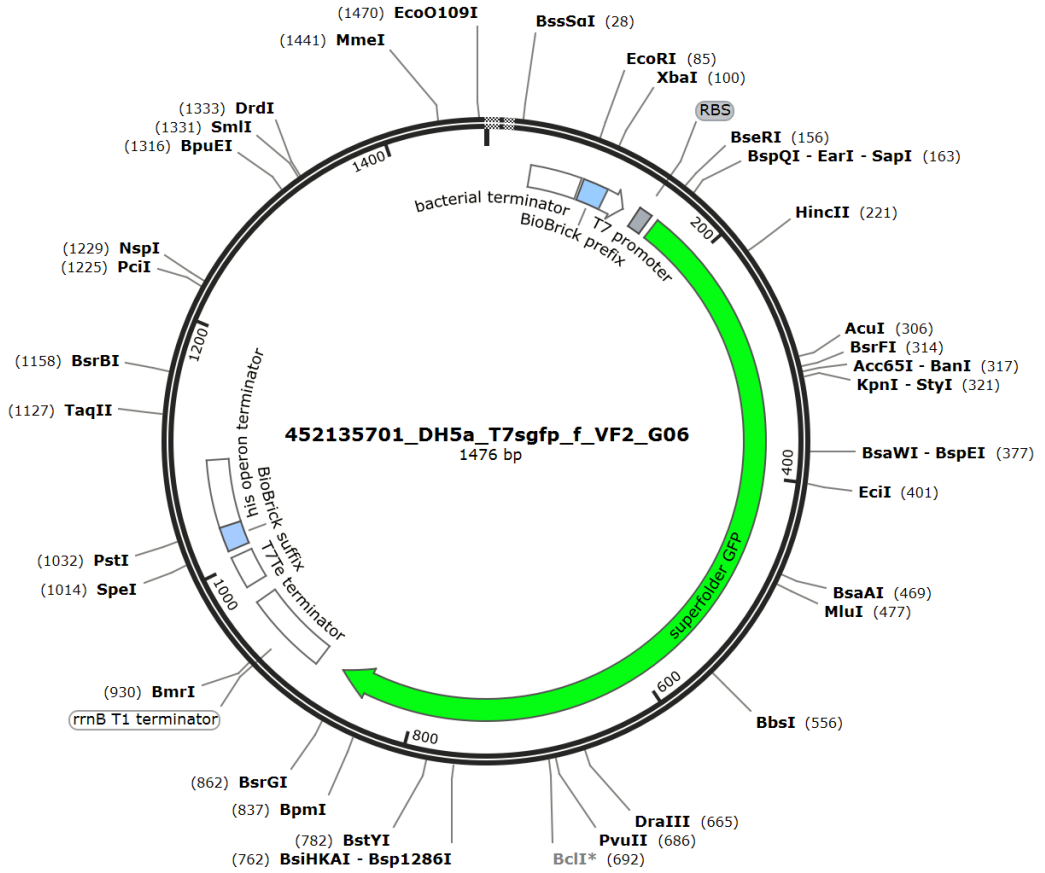
Noun

Synthetic biology is the design and construction of new **biological** entities such as enzymes, genetic circuits, and cells or the redesign of existing **biological** systems.

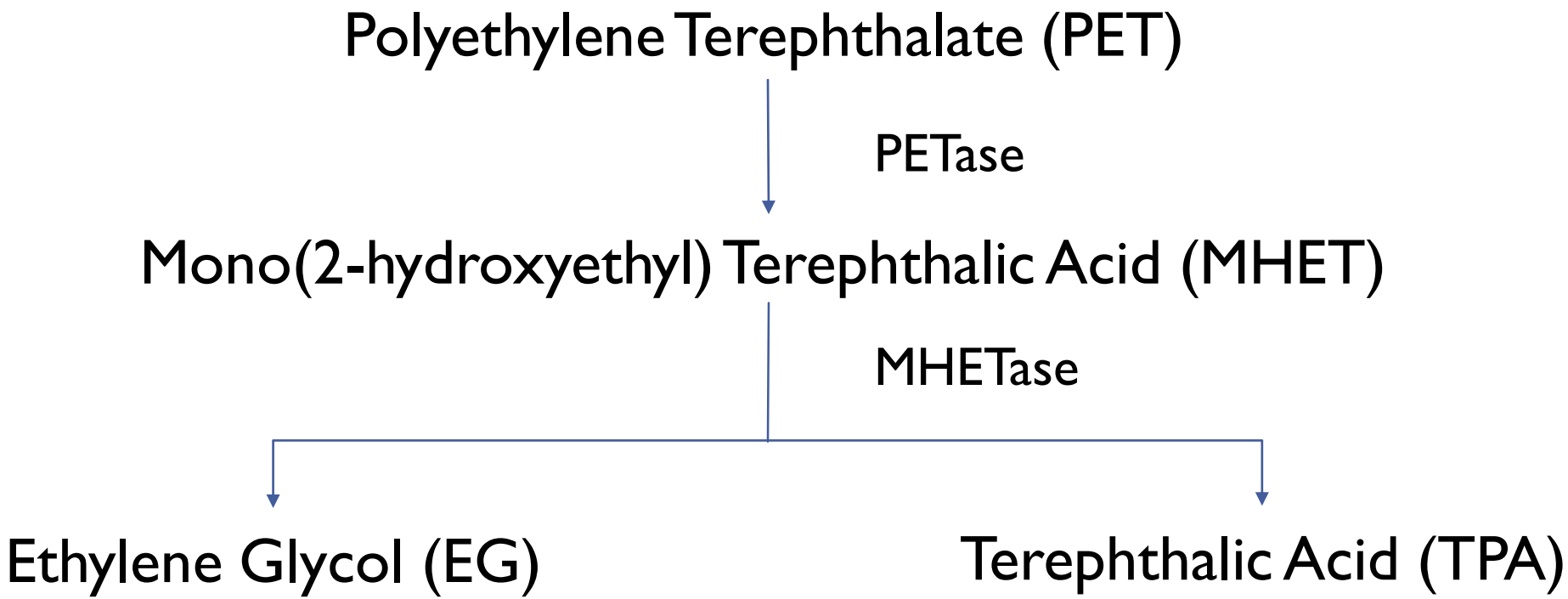


OUR SYNTHETIC BIOLOGY SOLUTION

- We transformed PETase, MHETase and BHETase genes from *Ideonella sakaiensis* into *Escherichia coli*

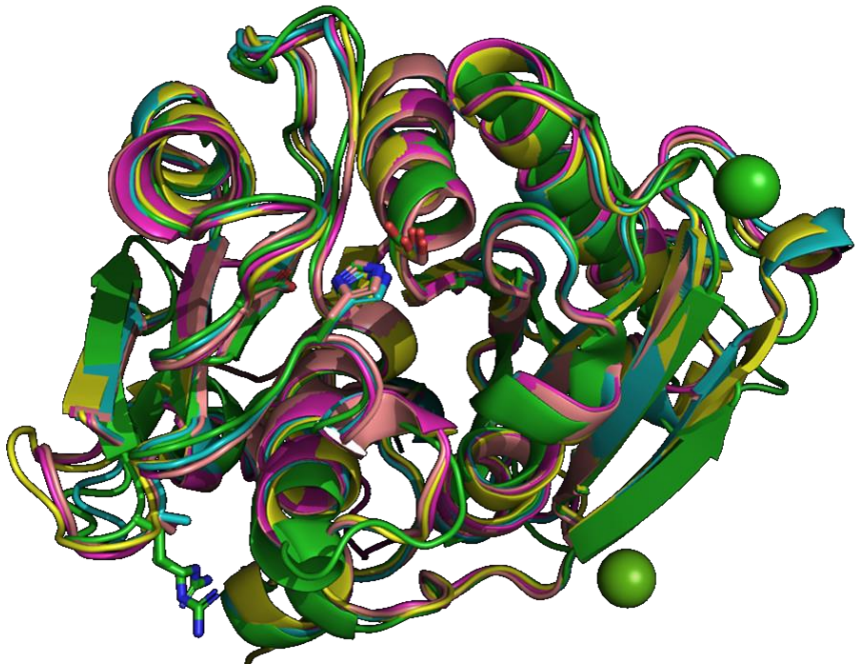


WHY PETASE AND MHETASE?



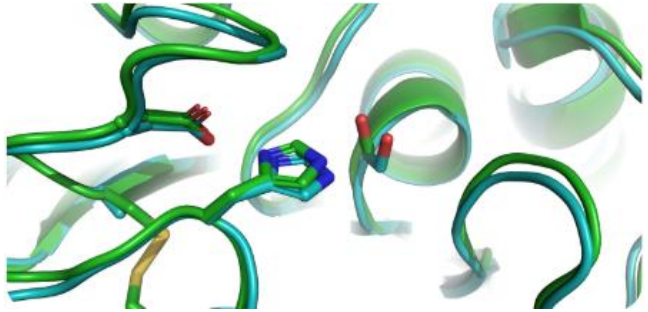
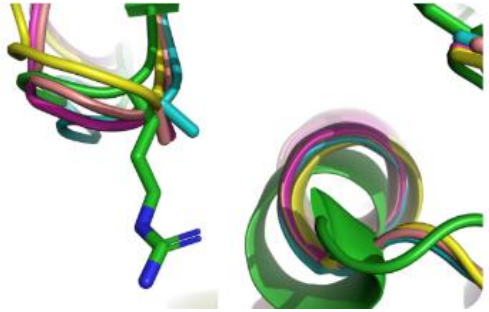
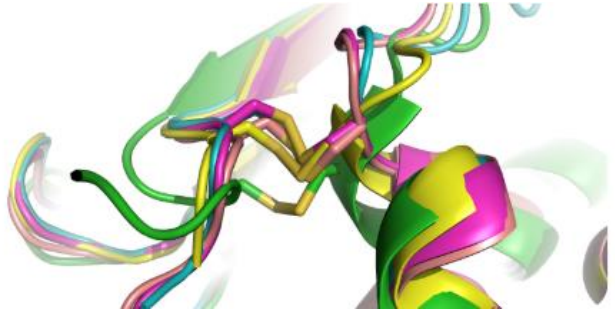
MODELLING OUR ENZYMES

- Ancestral reconstruction
  - Used to recover ancestral traits that are useful but have been lost during the process of evolution
- The process starts by looking at phylogenetic trees
- $N_{w.bal} = \frac{a}{b}(a + b)$



MODELLING OUR ENZYMES

- The results of the equation are run using the YASARA software
- Professor Harmer aligned the results against the wildtype PETase sequence
- Significant changes in the sequence were highlighted
- We selected ancestors where the catalytic triad were conserved

BIOETHICS

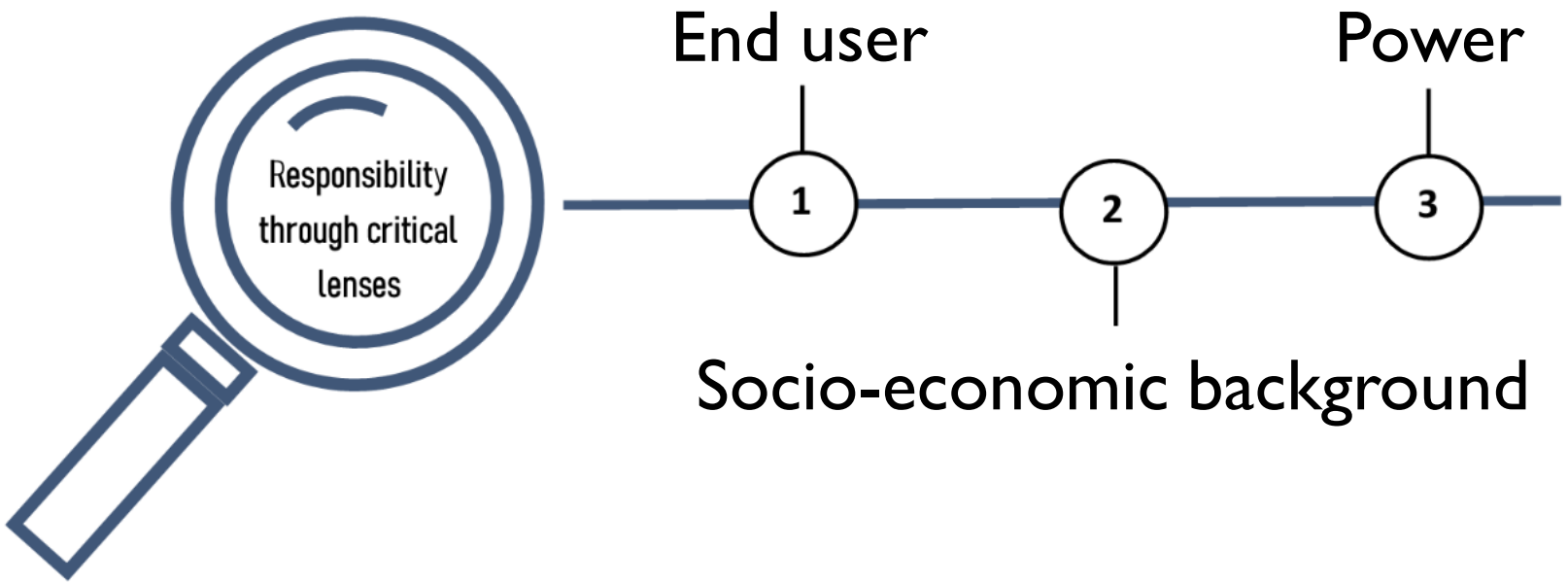
WHAT ARE HUMAN PRACTICES?

Noun

The study of how your work affects the world, and how the world affects your work

Peter Carr – Director of Judging

RESPONSIBILITY

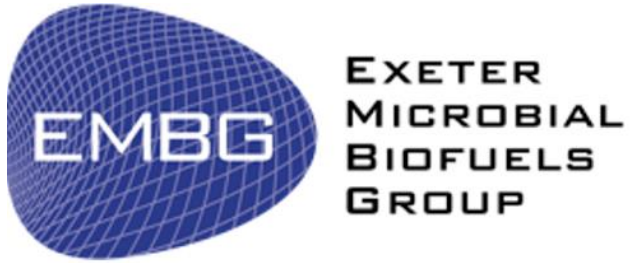


FRAMEWORKS


ANTICIPATE
REFLECT
ENGAGE
ACT


ASK
IMAGINE
PLAN
CREATE
EXPERIMENT
IMPROVE

STAKEHOLDERS



CONSENT

Exeter iGEM 2019 Information Sheet

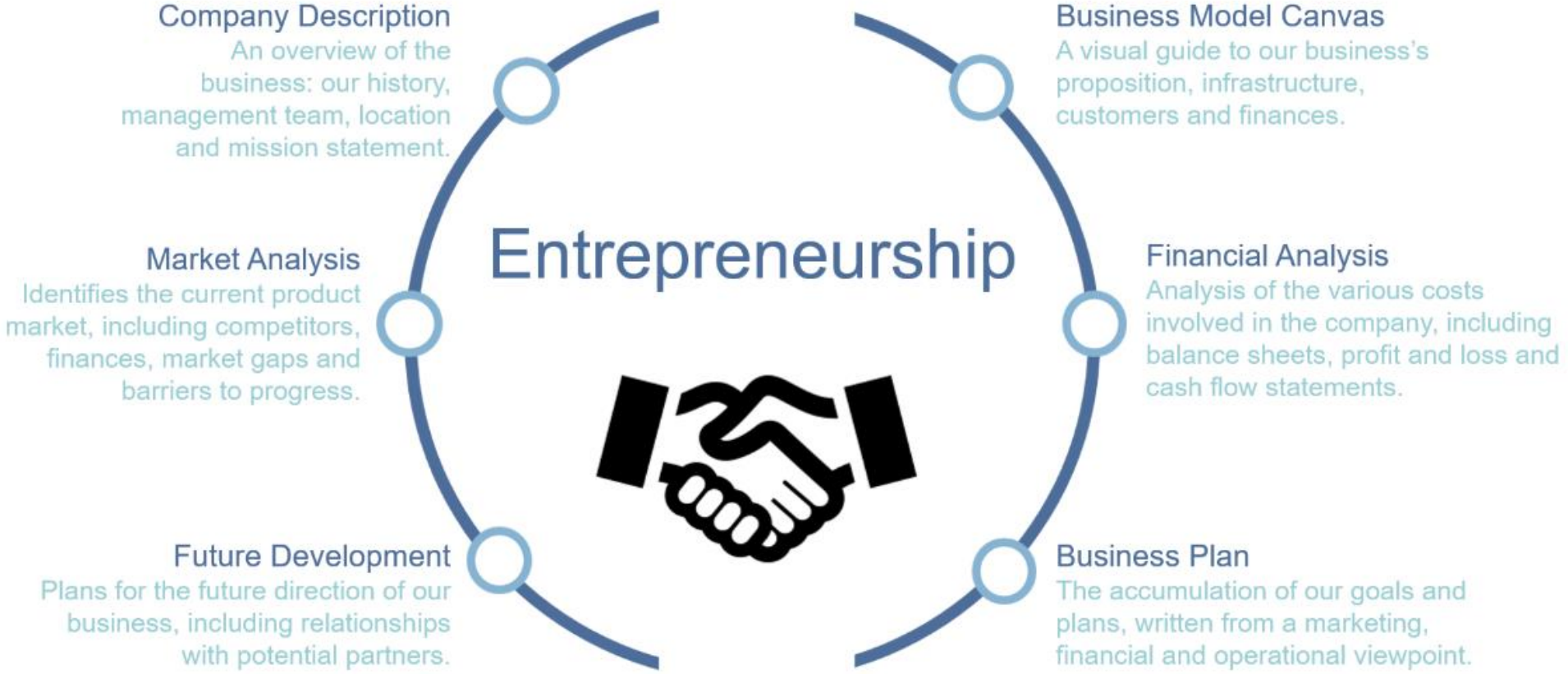
Thank you for your interest in participating in this research project.

The research is being conducted by a team students at the University of Exeter as part of the International Genetically Engineered Machine (iGEM) competition. iGEM is a competition designed to provide undergraduate students an opportunity to work on a synthetic biology project with the chance to partake in interdisciplinary research. Exeter's iGEM 2019 team is supervised by the Exeter Microbial Biofuels Group run by Professor John Love and we are guided in our social science research by Dr. Sarah Hartley from the University of Exeter Business School. The team has the summer to build and test a biological system that addresses a pressing social or environmental problem.

The project chosen for Exeter's 2019 iGEM team is to create a filtration system to trap micro-plastic

IGEM PROJECTS CAN BECOME BUSINESSES

OUR BUSINESS PLAN



https://www.facebook.com/watch/?v=499449183967210

AWARDS

AND MORE ABOUT THE IGEM COMPETITION ITSELF

AWARDS

Every iGEM team is eligible for a Bronze, Silver or Gold award as long as they fulfil the medal criteria.

Bronze	All Criteria must be met		
1	**Registration and Giant Jamboree Attendance**	Register for iGEM, have a great iGEM season, and attend the Giant Jamboree.	
2	**Competition Deliverables**	Convince the judges that you have completed the following **Competition Deliverables**: #1 **Wiki** #2 **Poster** #3 **Presentation** #4 **Judging Form**	
3	**Attributions**	Convince the judges that you have completed **Competition Deliverable** #5 **Attributions**. Please note: This requirement is not about citing literature references. Attributions is about describing what work your team did and what other people did for your project.	
4	**NEW FOR 2019: Project Inspiration and Description**	Convince the judges that you have completed **Competition Deliverable** #8 **Project Inspiration and Description**. On your Project Description page, document how and why you chose your iGEM project, and in a few sentences describe how you will achieve your goal(s). Refer to work outside or inside of iGEM that inspired your project, how you selected your project goal(s), and why you thought your project was a useful application of synthetic biology.	
5	**Characterization / Contribution**	**Updated For 2019: Characterization - Standard Tracks** Convince the judges that you have added quantitative experimental characterization data to an existing Part from the Registry of Standard Biological Parts. • Clearly document the experimental characterization on the **Part's Main Page on the Registry** (see the **Registry Document Parts page** for instructions). • This existing part may be a Basic or Composite part and must be **BioBrick RFC10** or **Type IIS** compatible. • The part that you are characterizing must NOT be from a 2019 part number range. • It is acceptable to add new data to an already highly characterized part. • Sample submission is not required. See the **Measurement Hub** for more information, resources, and examples of previous teams' exemplary work.	**Contribution - Special Tracks** Document on your team wiki at least one new substantial contribution to the iGEM community that showcases a project related to BioBricks. This contribution should be central to your project and equivalent in difficulty to characterizing a BioBrick Part.

Silver	All Bronze criteria must be met, plus all Silver criteria below must be met		
1	**Validated Part / Validated Contribution**	**Validated Part - Standard Tracks** Convince the judges that at least one new BioBrick Part of your own design that is related to your project works as expected. • Clearly document the experimental characterization on that **Part's Main Page on the Registry** (see the **Registry Document Parts page** for instructions). • This new part may be a Basic or Composite part. • This new part must be **BioBrick RFC10** or **Type IIS** compatible. • If your team is creating a new part for Gold #2, this part must be different from the new part documented for Gold #2. • Sample submission is not required. See the **Measurement Hub** for more information, resources, and examples of previous teams' exemplary work.	**Validated Contribution - Special Tracks** Convince the judges that something you created (art & design, hardware, software, etc.) performs its intended function. Provide thorough documentation of this validation on your team wiki.
2	**Collaboration**	Convince the judges you have significantly worked with one (or more) currently registered 2019 iGEM team(s) in a meaningful way. For example, mentor a team (or be mentored by a team), characterize a part, troubleshoot a project, host a meetup, model/simulate a system, or validate a software/hardware solution to a synthetic biology problem. Document your collaboration in detail on your wiki. Judges will look at your collaborator's wiki to see what they say about your interaction. Simply filling out a survey for a team is not enough to demonstrate a significant interaction.	
3	**Human Practices**	Convince the judges you have thought carefully and creatively about whether your work is responsible and good for the world. Document how you have investigated these issues, how you engaged with communities relevant to your goals, why you chose this approach, what you have learned, and the potential impact of your project's success. See the **Human Practices Hub** for more information and examples of previous teams' exemplary work. Please note that surveys will not fulfill this criteria unless you follow scientifically valid methods.	

Gold	All Bronze and Silver criteria must be met, plus at least two (2) Gold criteria below must be met		
1	**Integrated Human Practices**	Expand on your silver medal activity by demonstrating how you have integrated the investigated issues into the purpose, design, and/or execution of your project. Document your process and describe how your human practices work informed and shaped your project at different stages. See the **Human Practices Hub** for more information and examples of previous teams' exemplary work.	
2	**Improve a Previous Part / Project**	**Improve a Previous Part - Standard Tracks** Convince the judges that you have created a new BioBrick Part that has a functional improvement of an existing BioBrick Part. You must perform experiments with both parts to demonstrate this improvement. • Clearly document the quantitative experimental characterization data on the **Part's Main Page on the Registry** for both the existing and new parts (see the **Registry Document Parts page** for instructions). • The new part must be **BioBrick RFC10** or **Type IIS** compatible. • The sequences of the new and existing parts must be different. Making an existing part compatible to RFC10 or Type IIS is not sufficient to fulfill this criterion. • The existing part must NOT be from your 2019 part number range. • The existing part must be different from the part you used in Bronze #5. • The new part you create must be different from the new part documented in Silver #1. • Sample submission is not required. See the **Measurement Hub** for more information, resources, and examples of previous teams' exemplary work.	**Improve a Previous Project - Special Tracks** Improve the function of an existing iGEM project (that your current team did not originally create) and document your achievement on your team wiki.
3	**Model Your Project**	Convince the judges that your project's design and/or implementation is based on insight you have gained from modeling. This could be either a new model you develop or the implementation of a model from a previous team. You must thoroughly document your model's contribution to your project on your team's wiki, including assumptions, relevant data, model results, and a clear explanation of your model that anyone can understand. The model should impact your project design in a meaningful way. Modeling may include, but is not limited to, deterministic, exploratory, molecular dynamic, and stochastic models. Teams may also explore the physical modeling of a single component within a system or utilize mathematical modeling for predicting function of a more complex device.	
4	**Demonstration of Your Work**	Convince the judges that your engineered system works. Your engineered system has to work under realistic conditions. Your system must comply with all **rules** and **policies** approved by the iGEM Safety Committee. Your system can derive from or make functional a previous iGEM project by your team or by another team. For multi-component projects, the judges may consider the function of individual components.	

TRACKS AND SPECIAL AWARDS

Diagnostics

Energy

Environment

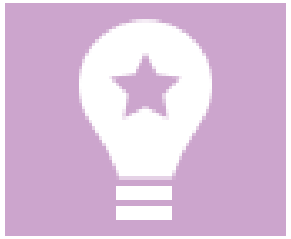
Food and Nutrition

Foundational Advance

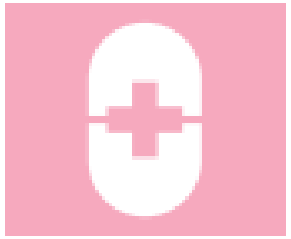
High School

Information Processing

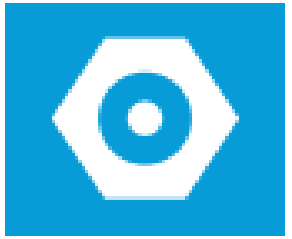
Manufacturing



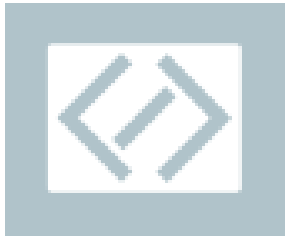
New Application



Therapeutics



Open



Software

Special Tracks

THANK YOU – ANY QUESTIONS?