TEAM IGEM@IITB

iGEM Project

Vision of a Better future

The Heart of Synthetic Biology

4 300+

Synthetic biology projects and proofs-of-concepts have been tested at iGEM, leading to future research, PhD thesis projects, and the launch of new companies.

200+

Startups have emerged from the iGEM Competition, with the first iGEM Startup having gone public in 2021. Today, these companies are developing biological solutions to preserve the environment and improve the lives of people all over the world.

iGEM's world-class responsibility program ensures that participants think beyond their lab work, dealing with biosafety and biosecurity risks, and embody a culture of responsibility.

20 000+

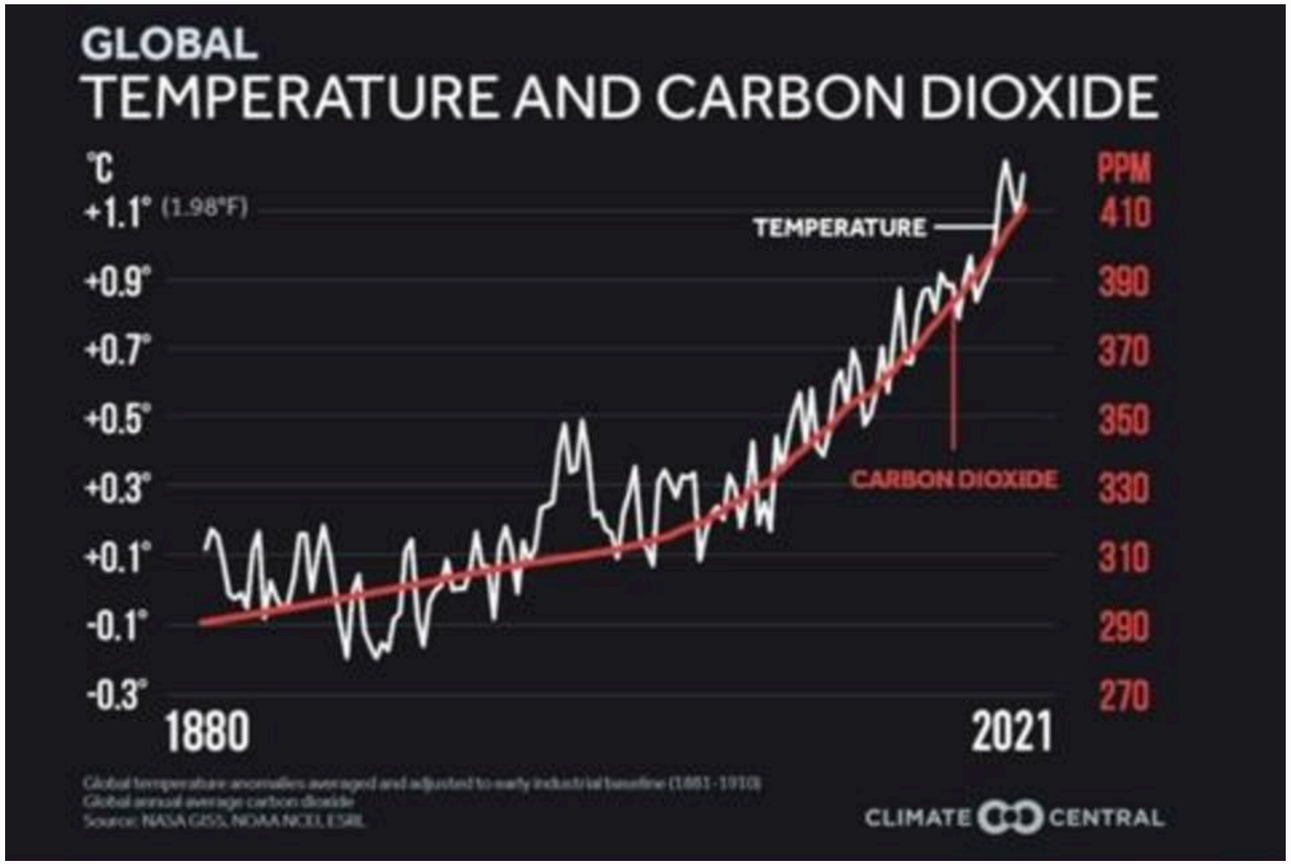
More than 20,000 DNA parts have been curated and sequenced for synthetic biology applications, available as a shared resource through iGEM's Registry.

75 000+

Participants from 65+ countries have been trained in the responsible, safe and secure use of synthetic biology. Today, they are leaders in synthetic biology who have gone on to create startup companies and pursue careers in academic research, industry, NGOs and government agencies.

Climate Crisis

The world is 1.2°C warmer now!



CO2 Emissions contribute significantly to climate change

Why can’t we rely on existing solutions?

CCUS

Carbon Capture Use and Storage

Not sustainable

Major issues with upscaling

Issues with storing captured carbon

BECCS

Bioenergy with carbon capture and storage

Costly ~ 30-76 $/ton

Not efficient

Focused on energy generation,
not carbon capture

E. huxleyi

612 tonnes of Carbon
10 km radius per annum

Industrial CCS

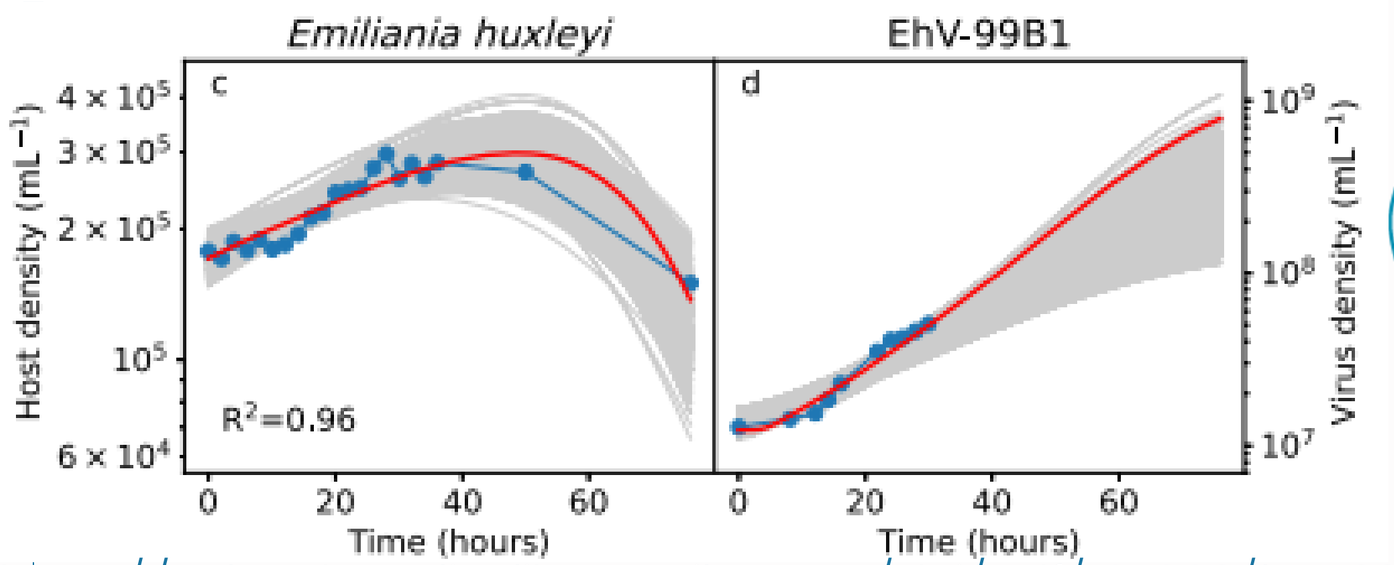
374 tonnes of Carbon per plant per annum

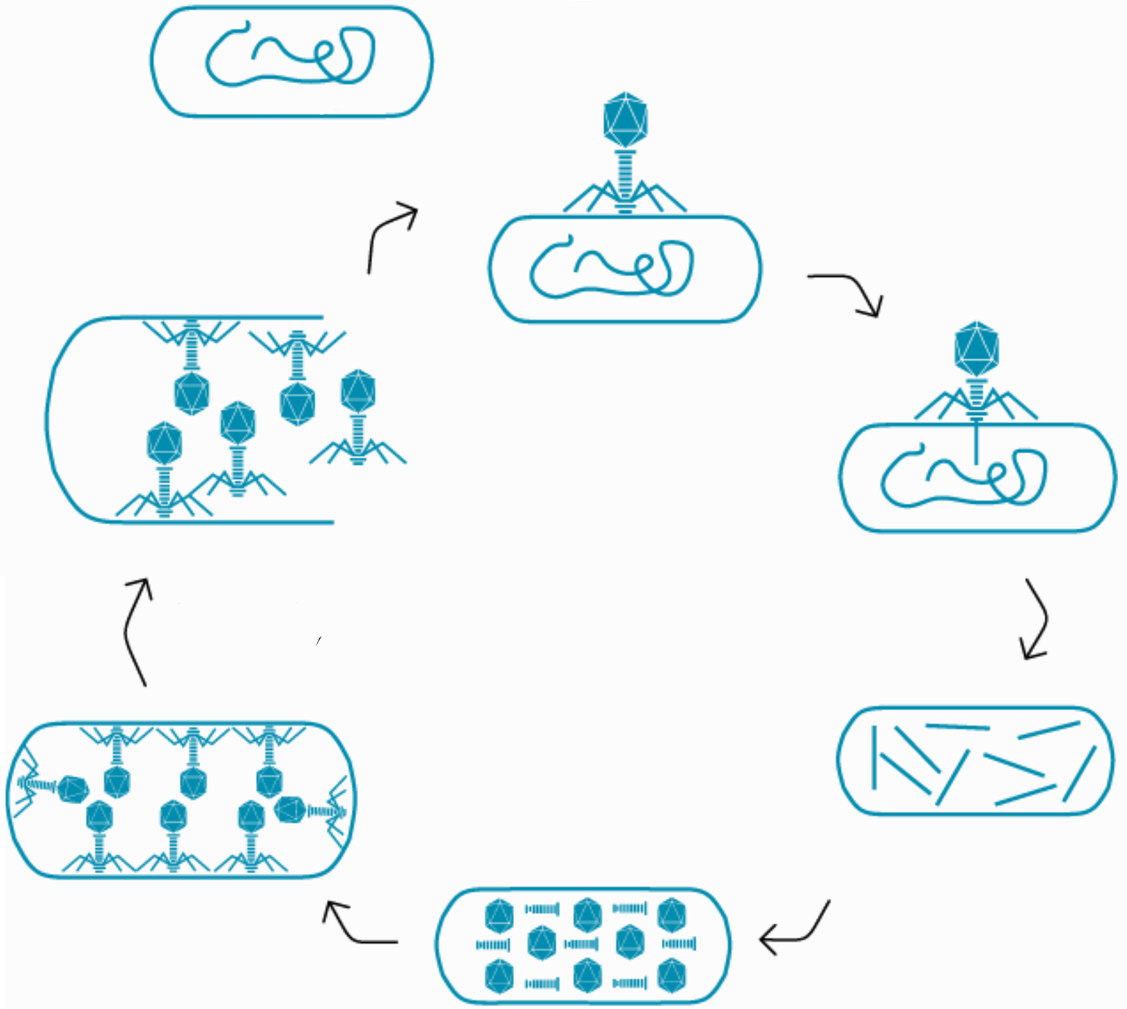
Algae – Virus Relationship

Coccolithophore E. huxleyi enhances production of CaCo3 as result of viral infection.

The algal growth followed by decline, due to infection is a cyclic process lasting for 23 days.

This is a naturally occurring self sustainable phenomenon.





https://aslopubs.onlinelibrary.wiley.com/doi/pdf/10.1002/lno.12256

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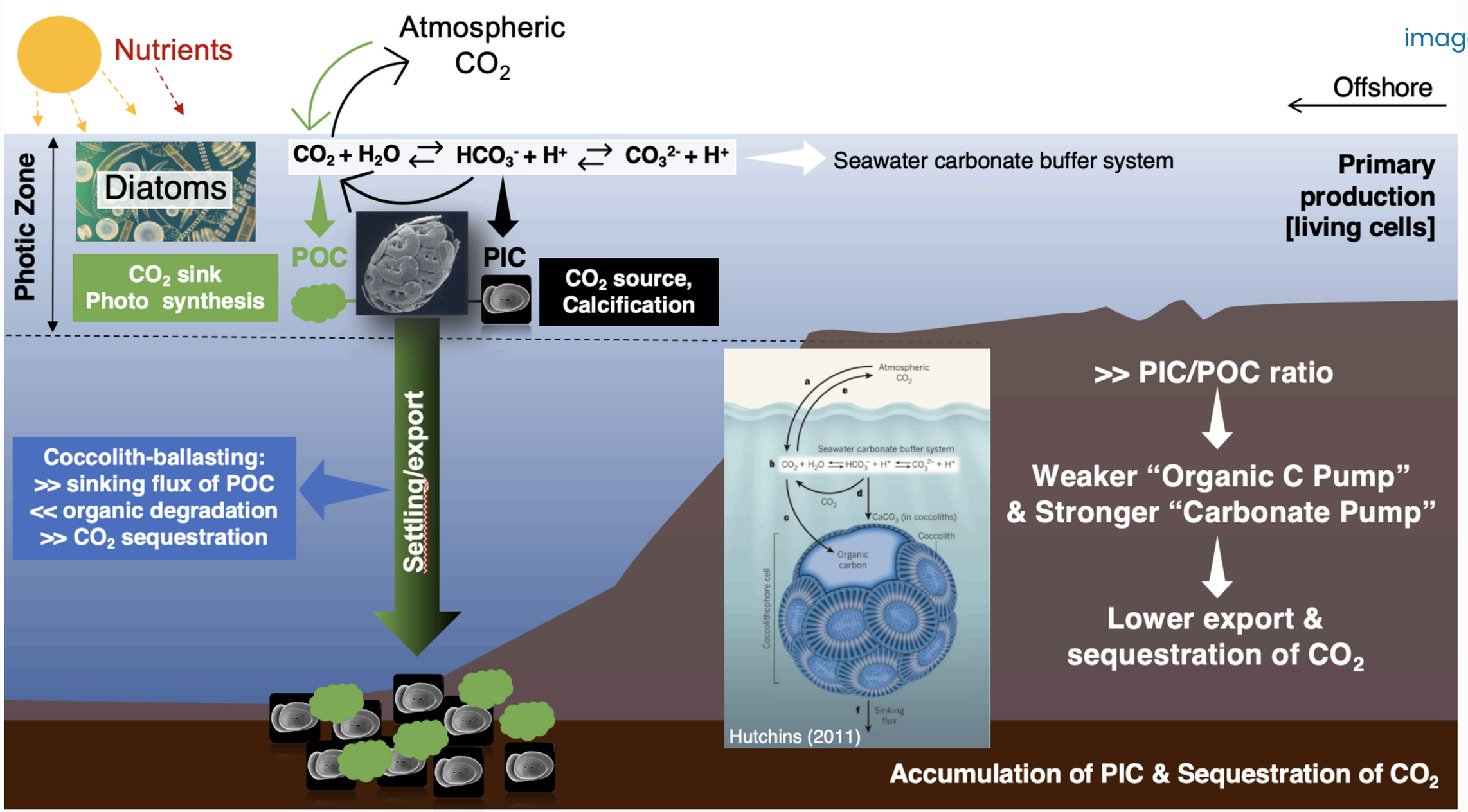


"Biological Carbon Pump": Photosynthetic fixation of atmospheric CO_2 to produce POC which is then exported from the photic zone to the ocean floor, resulting in the sequestration of CO_2.

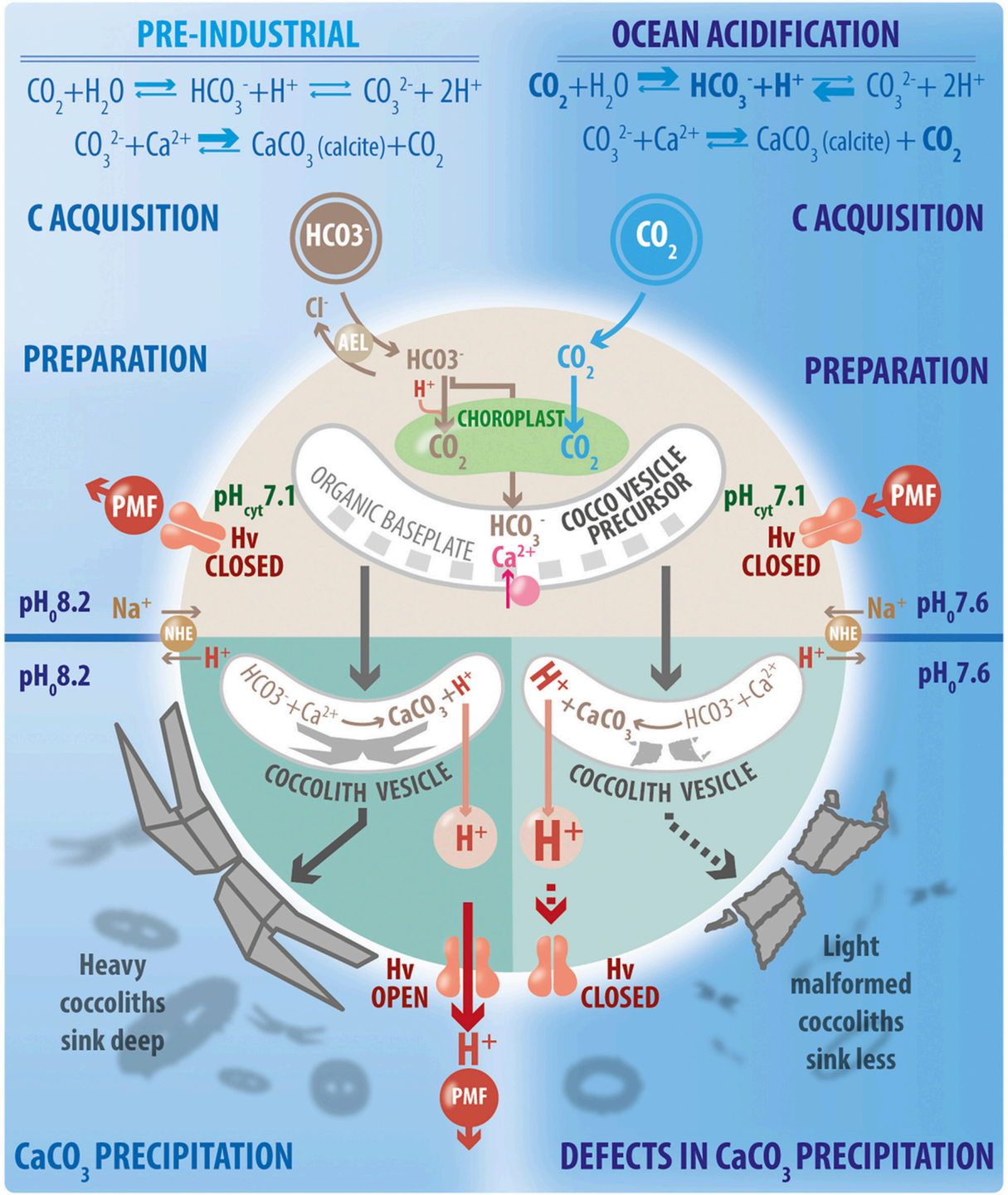
"Carbonate Counter-pump": release of CO_2 via the production of PIC, or $CaCO_3$, in the course of the calcification of planktonic organisms (e.g., coccolithophores, foraminifera).

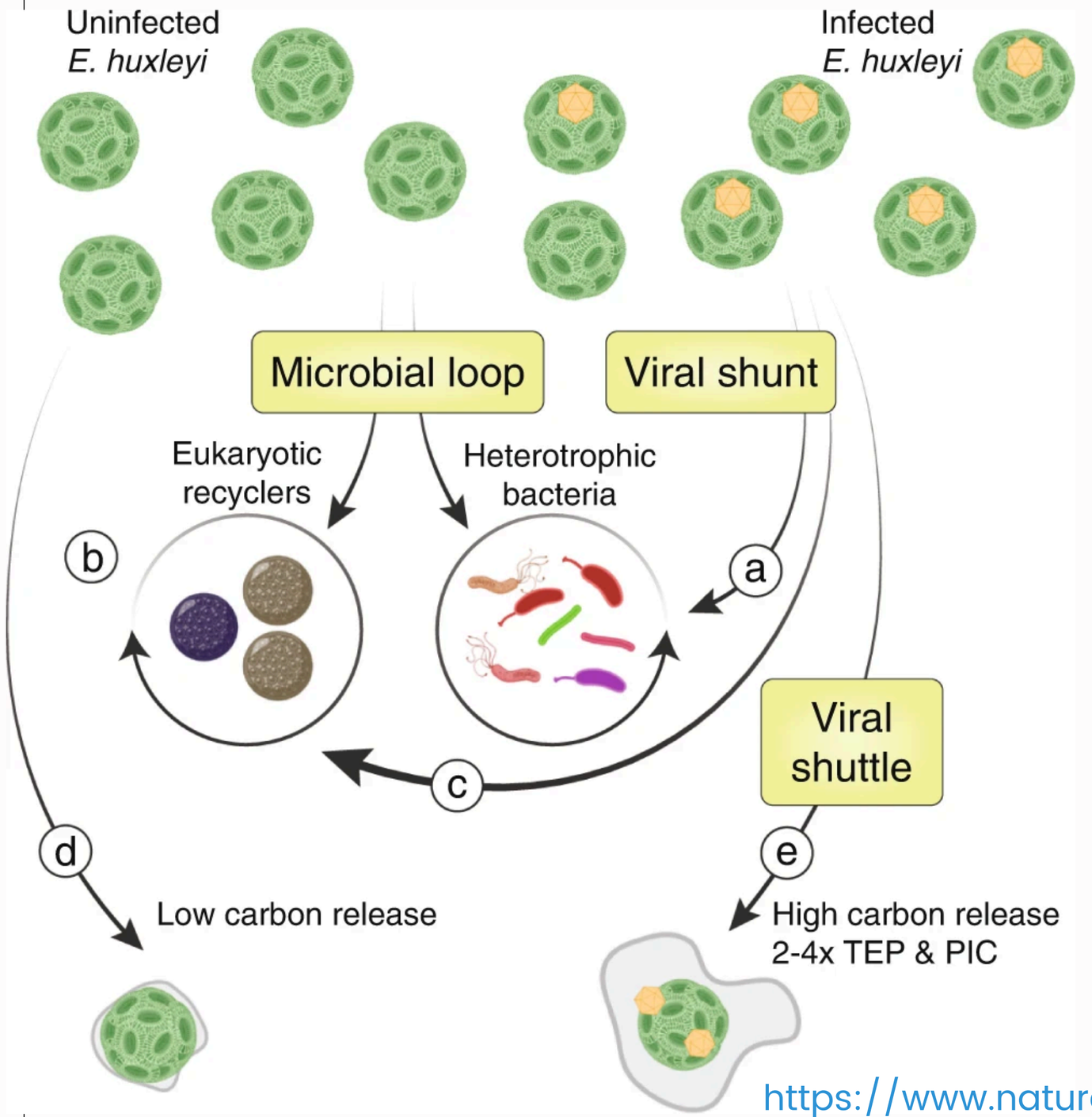
Our Solution

Genetically modify E. Huxleyi to increase its carbon capture effeciency

Targeting Calcification:

Calcite sinks to the ocean floor permanently sequestering atmospheric CO2.





Harnessing the Virus:

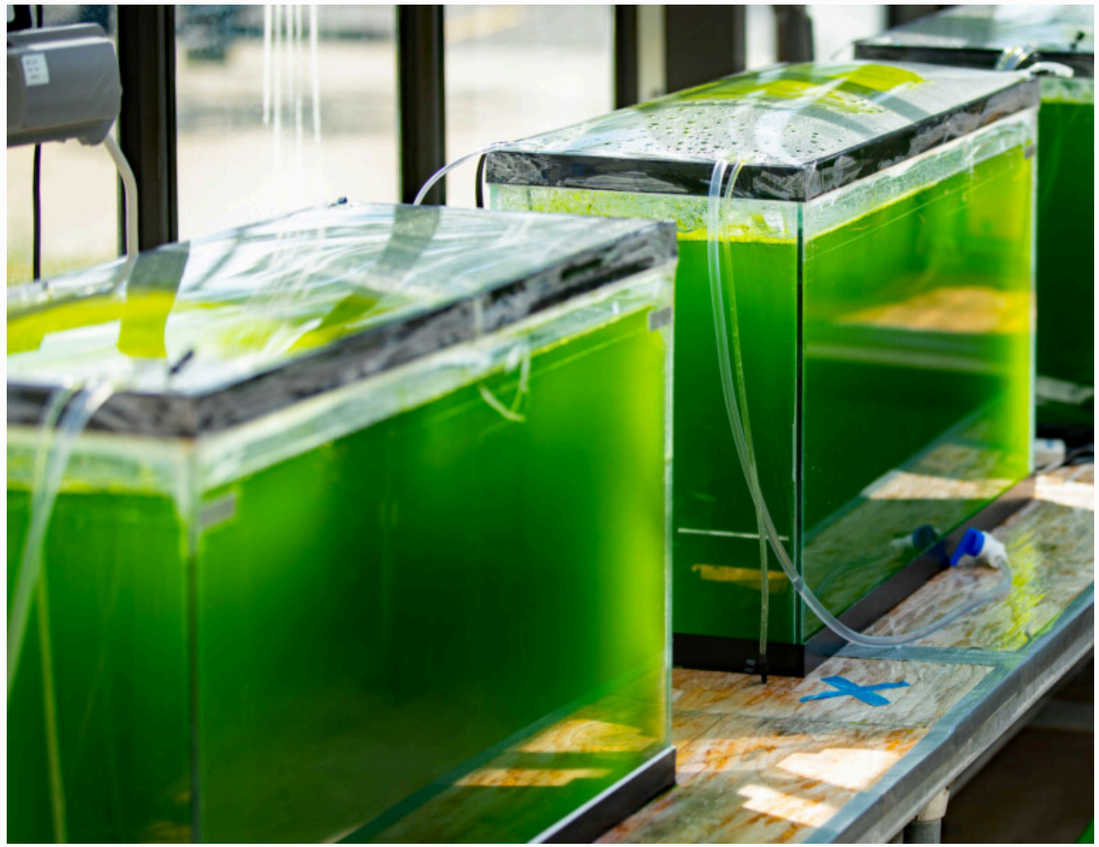
Engineering algae to mimic virus-induced calcification

Advantages:

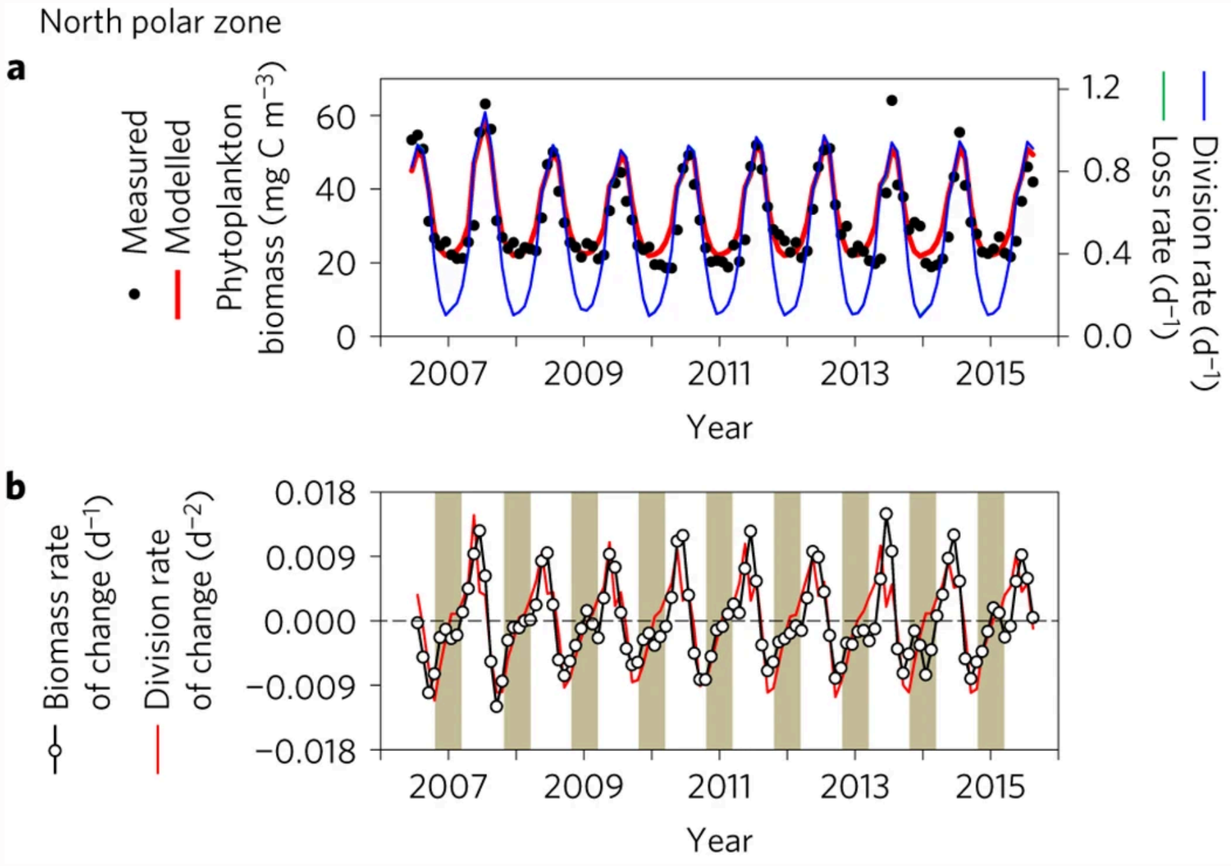
Elevated calcification even in the absence of viral infection

https://www.nature.com/articles/s41467-023-36049-3/figures/5

Prototype and Dry Lab



Natural Carbon Capture Center



https://www.nature.com/articles/ngeo2861/figures/2

Future Implementation

- Utilization of vast ocean spaces for carbon capture.
- Scaling our project to ocean wide level by making enclosures like these.
- This will have huge impact on global carbon levels as a self sustainable large scale carbon sink.

Novelty

- Scalability

Open sea, no bioreactors, aim to solve the problem on a much greater scale!

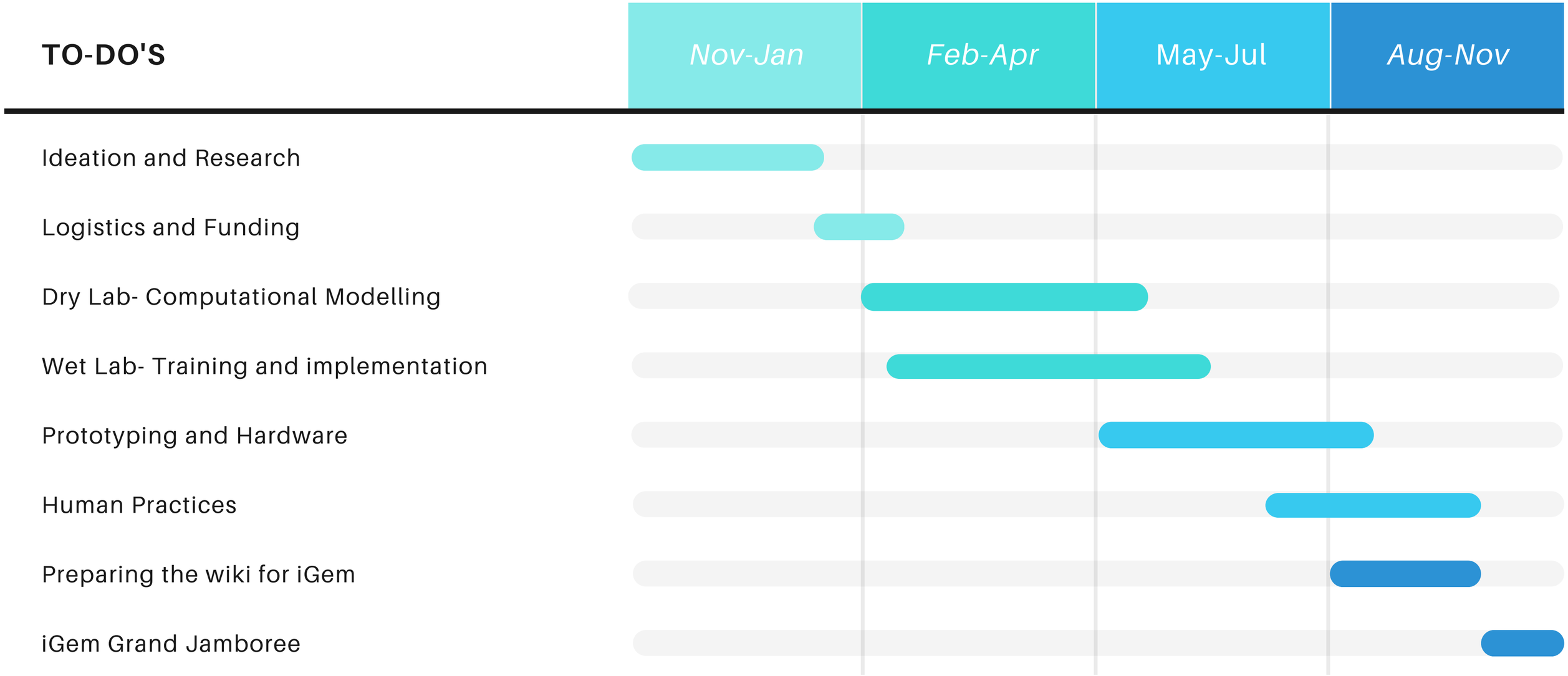
- Self Sustainable

No Human Interference necessary once modified algae is released

Incorporated into Ecosystem

- No Cleaning
- No feeding

Project Milestones



Why we need your help?

1. To prepare for all potential problems during implementation
2. For your domain expertise and research experience
3. To get trained and learn the required technical skills
4. For funding and logistics, in order to take part in iGem

Our Team

Husayn Bootwala

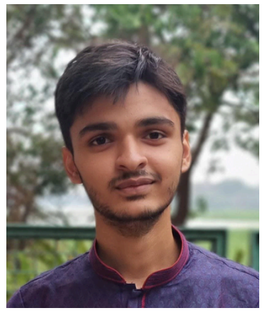
Ashish Zantye

Yash Jonjale

Abdul Qaim Ansar

Kadambari Bhide

Maitreyee Tengshe



Saransh Vottery

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Estimation

75 000–300 000 **coccoliths per ml**

Average down to 187500 per ml

0.4 pg CaCO3-C per cell

187,500*0.4*10^-12

Resulting 0.075 carbon mg/ litre

Assuming area of 10 Km radius

mixed layer depth of 20m

Volume=10*10*3.14*10^6*20=6280*10^6 m3

Volume*Concentration= Mass

10*10*2*3.14*10^6*20*0.075*10^3*0.075/10^6

942/2=417

417 tonns of carbon captured