Using E. Coli as a Model for the Synthetic Alteration of Native Zooplankton to Control the Cyanotoxins Produced by Algal Blooms in the State of Maine.

M Howard, Abigail Erwin, and Logan Williams from HCTC in Ellsworth,ME

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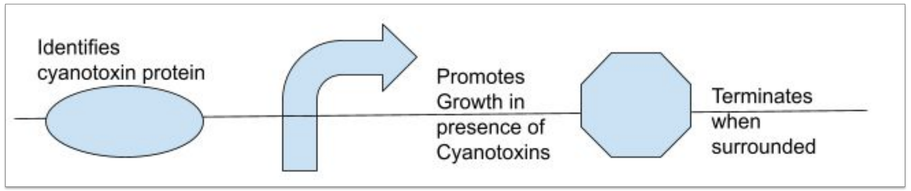
Introduction & Project Details

In recent years, the influx of cyanobacteria can be attributed to a few potential factors: climate change and the eutrophication of Maine's freshwater bodies. Cyanobacteria reproduce at a high rate, especially in fresh, brackish, and marine water. In warm, nutrient- rich environments cyanobacteria can multiply quickly causes algal blooms. The algae itself is not toxic, but releases toxins during decomposition. As it decomposes, the cyanobacteria exude a cyanotoxin or neurotoxin that is harmful to other species in the ecosystem, threatening the larger aquatic predators and terrestrial species. If there is nothing to deter the growth of the algae it will overproduce and decay too quickly, releasing prodigious amounts of toxins into the water. When a body of freshwater has been compromised by cyanotoxins, access to clean water for the purposes of drinking, manufacturing, fishing, and recreation is lost.

Our project's purpose is to use synthetic biology to design an E. coli model with increased metabolism and reproduction. Our long-term goal is to use this process to genetically engineer zooplankton with increased reproduction and/or metabolism in the presence of cyanotoxins. Promoting the growth of zooplankton, a natural consumer of cyanobacteria, will decrease the population of cyanobacteria present in bodies of freshwater. Theoretically, reproduction of the zooplankton population will be promoted in the presence of cyanobacteria and/or cyanotoxins and will turn off in their absence preventing overpopulation of the synthetic organism. Promoting the reproduction of zooplankton will increase the predators of cyanobacteria, the source of the cyanotoxins that

Experiments We Did &/or Planned

- Experiment details / plans - we have not conducted any experiments directly related to our project.
- Results if you have them - our design is using a e coil as a model for the genetic modifications intended for zooplankton (daphnia). Three modifications will be interested the the hosts genome: cyanobacteria identifier, reproduction promotor, and a kill switch triggered when (group behavior word) occurs. Indicator is needed to allow the change to the organism to happen when cyanotoxin levels are too high. This is done to insure the growth is only promoted when necessary. The promotor simply promotes organism growth. While the terminator prevent overpopulation of our host organism, preventing the food chain from becoming unbalanced.
  Our chosen indicator is
  The promotor for the genetic modification
  Our terminator is BBa-K51506-composite-lactate required kill switch



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Challenge for Next Year's Team

- Identify key needs for advancing the project or lessons learned from this experience:

- Plan a simple experiment first and then complicate it
- Know the time and resource constraints
- Research until confident in your own understanding of the subject

- If your team doesn't continue the project next year, but it was picked up by another school's team, what experiment would you want them to do? (Be specific so they can actually try it!)

Our plan for the future of this project is to have parts of our team continue the project next year. As well as taking it to the Maine State Science Fair next year. As we establish the baseline of our research we plan to envelop more complex conclusions with our data with our experiments.

If others undertake our project we recommend that:
We recommend that establish your baseline first before complicating the experiment. Keep all of your resources in one space to locate at a later time. Make sure that while you are researching to continue until you are confident in your understanding of the subject.

About This Year's Team

Our team is new to this part of biobuilders. Two of our members participated in the bio builders program last year. We are a team of three high school students in the 2nd year of biomedical sciences program at Hancock County Technical Center.

Our highlight experiences include our mentor, Chris, networking a meeting with from labs for advance. We also had the chance to

References & Acknowledgements

- Our mentor: Chris Kuffner, a 3rd year Ph.D student at Boston University majoring in Hardware and metabolic engineering
- Dr. José Á. Fernández- Robledo, Ph.D a senior research scientist studying molecular biology and his associates at Bigelow Laboratory
- Sarah Petroulis

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