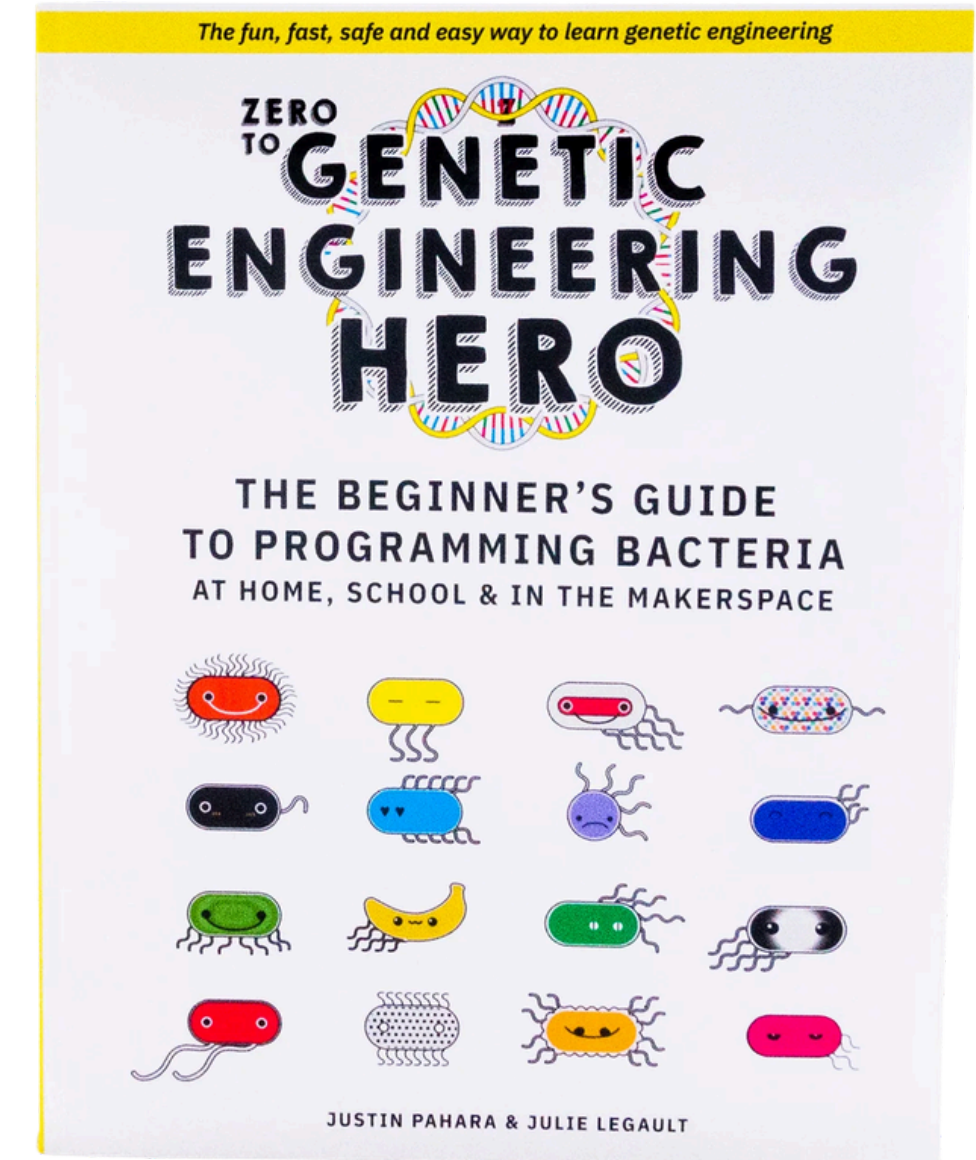


Projects and Biokits for BSL-0 Students

Ideas & Kit Proposal

Inspired by Amino Lab's Zero to Genetic Engineering Hero as well as by HTGAA's numerous labs, I've put together a collection of potential experiments and kits that could allow Committed Listeners without access to a BSL-1 lab to still be able to have a hands-on learning experience at home.

I have taken into consideration EU regulations when coming up with these proposals, however since laws may change it's important to double-check the viability of all projects/kits before moving forward with any of them.

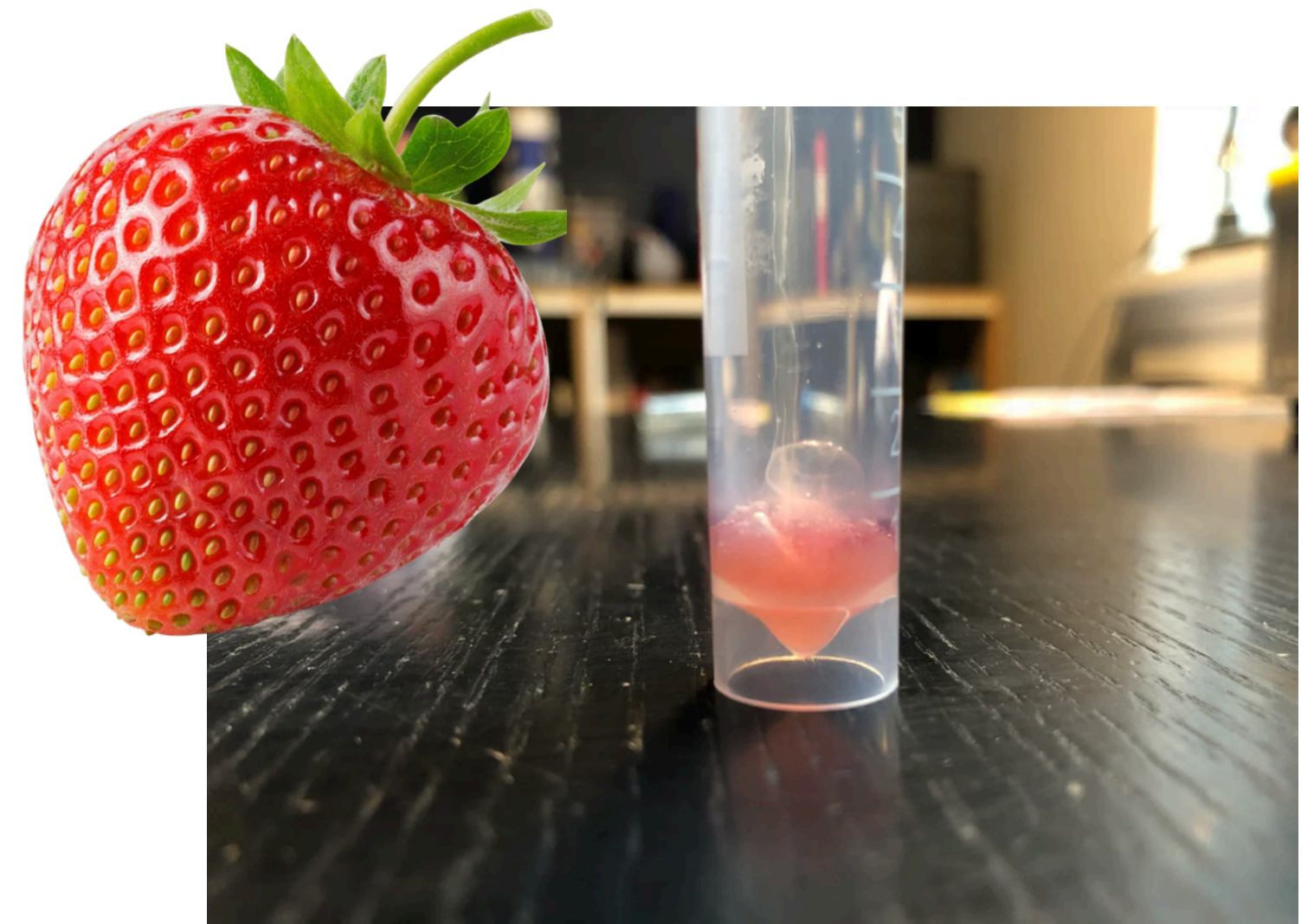


Fruit DNA Extraction

The classic lab where you can extract DNA out of a strawberry (or kiwi) using nothing but salt, soap, and alcohol. You can then physically hold and see the DNA of that organism. This would be an interesting basic introduction for this course.

Digital Component:

The student can look up the published genome of their fruit on NCBI. They can try to find a gene that interests them, like the one affects taste or color!



Supplies:

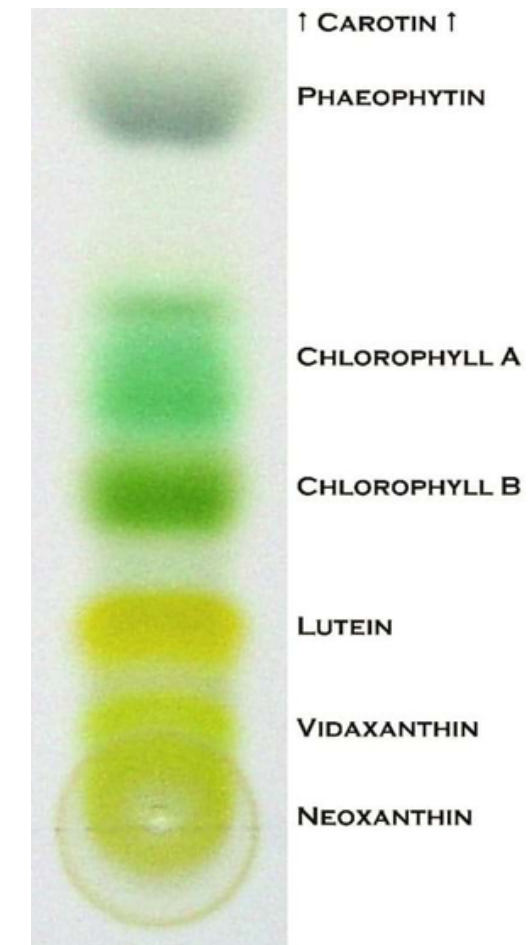
Strawberries or kiwi · table salt · dish soap · isopropyl alcohol · cheesecloth or coffee filter · beaker · transfer pipettes · petri dish · microtubes

Plant Pigment Chromatography

You can use chromatography strips for four different plants side by side (ie. spinach, red cabbage, carrot, yellow pepper) and watch each one separate into a different pigment profiles. It's a similar mechanism to gel electrophoresis except instead of separating DNA molecules from each other we are separating pigment molecules.

Digital Component:

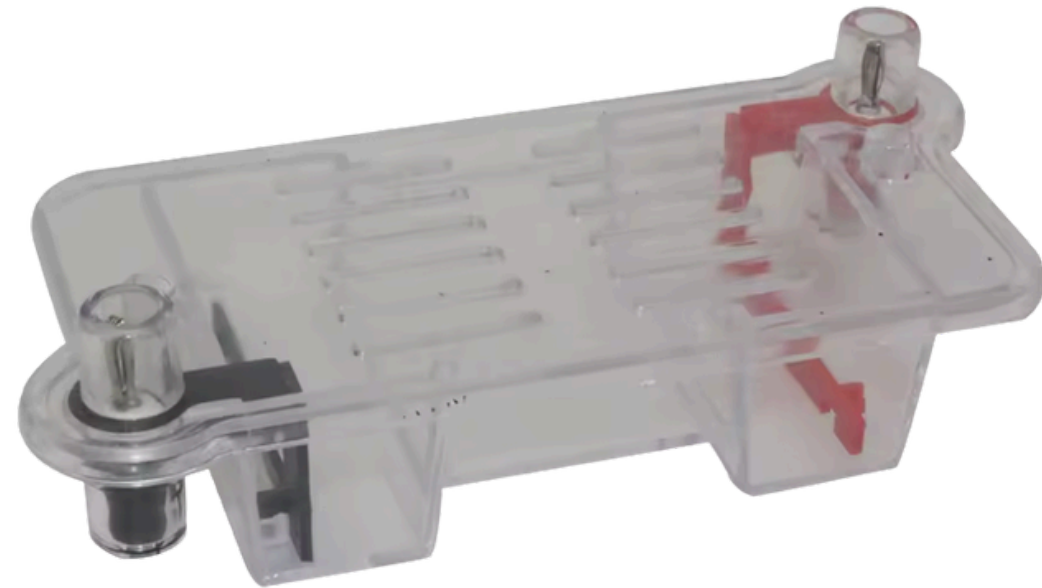
Students can look up the molecule that maps to each color fragment (ie. chlorophyll a, chlorophyll b, beta-carotene, etc.) and figure out why different organisms evolved different solutions to the same problems.



Supplies:

Chromatography paper · rubbing alcohol
· beaker · plants/veggies · scissors ·
pencil · petri dish as solvent reservoir

Gel Electrophoresis



Note: There is a way to make take-home Gel Electrophoresis kit for BSL-0 students. You can find cheap mini gel-electrophoresis boxes from 20 to 30 euros. From my understanding it is also legal to purchase 1kb DNA ladder as a regular individual. However it might be annoying to find a place that would want to ship directly to a customer. This requires further research. Methylene Blue or GelRed stain are also 2 reagents that are easily purchasable in the EU. This would be a costlier kit though that might be around 100 euros.

Supplies:

Mini gel electrophoresis box · power supply · agarose powder · methylene blue or GelRed stain · commercial DNA ladder · extracted fruit DNA from Kit 1 · pipettes and tips · microtubes

Biomaterials

There's several easy and affordable biomaterials that could be grown or made. Of course, the mycelium material lab that was done in HTGAA this year could easily be done at home.

- Bacterial Cellulose
- Casein plastic (using milk)
- Mycelium composites
- Using algae to create sodium alginate

I think a more interesting angle would be to have each student use or incorporate living organisms that are local to their environment. This could be using lichen or moss from their local forests, algae from nearby oceans/lakes, or clay from dirt in their backyard. Ideally it would be nice for students to look into the genome of the local organisms they are using and propose ways to genetically engineer them that would impact their material properties.



Biomaterials developed during a Quebec research project using foraged elements.

Cas9 Albino Plant Editing

Near-future kit: pending EU New Genomic Techniques regulation finalization

This lab involves purchasing a pre-designed Cas9-guide RNA complex which would cut out the PDS gene - which is responsible for producing green pigment. You then take young leaves from tomato plants and use protoplast isolation to remove the cell walls. You then use PEG to make the cell membranes permeable and that way you can mix in the RNA. In a week or so the cells create clusters and you will be able to see the white parts where the new RNA was introduced.

Note: The same issues about ordering DNA would apply here. It is tricky for an individual to buy it as opposed to a company. However it is not illegal to sell to an individual so I'm confident we would be able to find some work around.



Supplies:

Pre-designed Cas9-RNP targeting PDS in tomato · tomato seedlings · cellulase R-10 and macerozyme R-10 · PEG 4000 (sold as Macrogol at pharmacy) · Murashige and Skoog salt mix · petri dishes · pipettes · microtubes · still-air box