

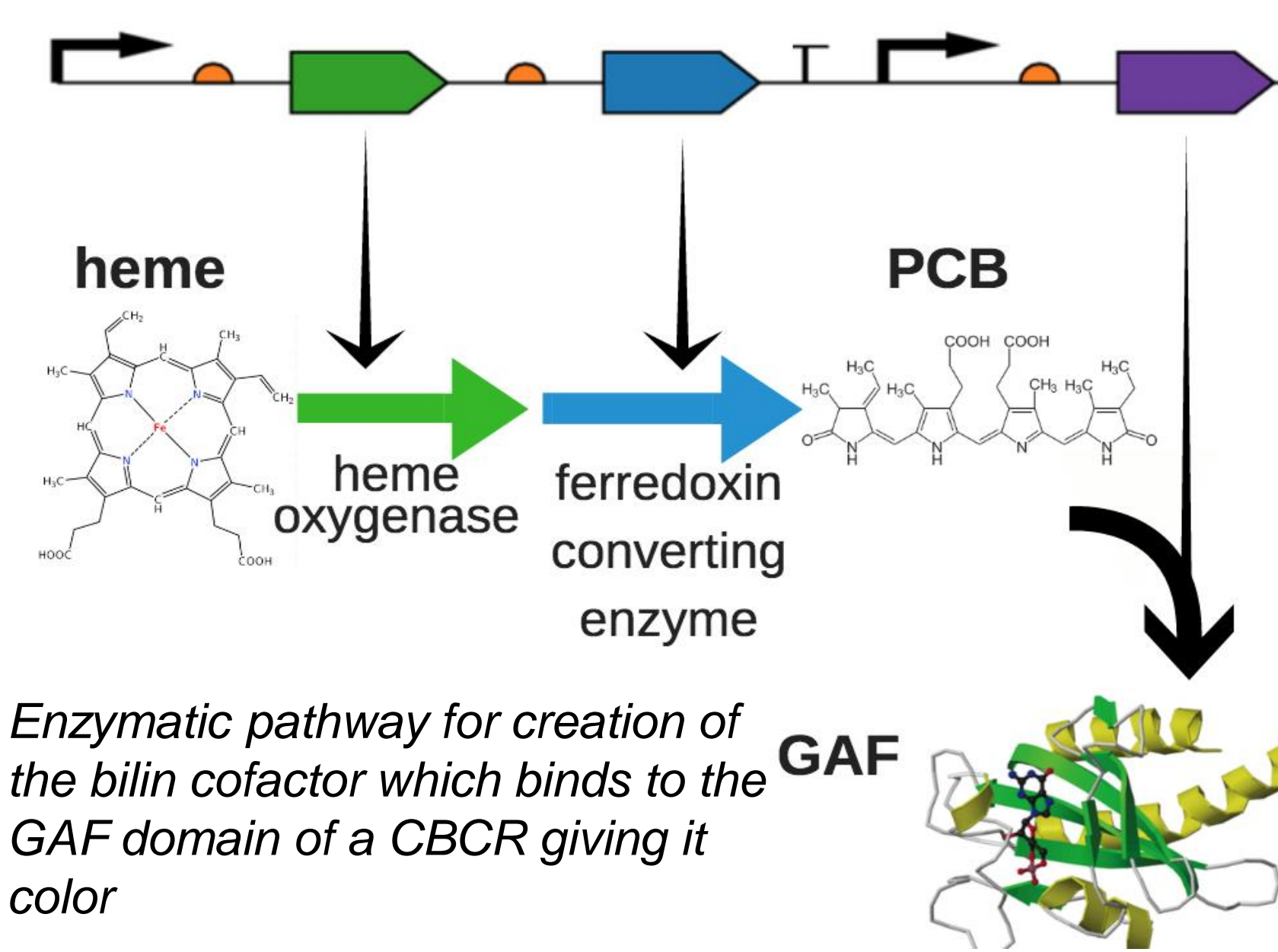
Motivation

Color is innate in food perception and consumers expect vivid colors -- beyond those already naturally present in food. However, due to backlash against artificial colorants, some large food companies have pledged to exclusively use natural food colorings.

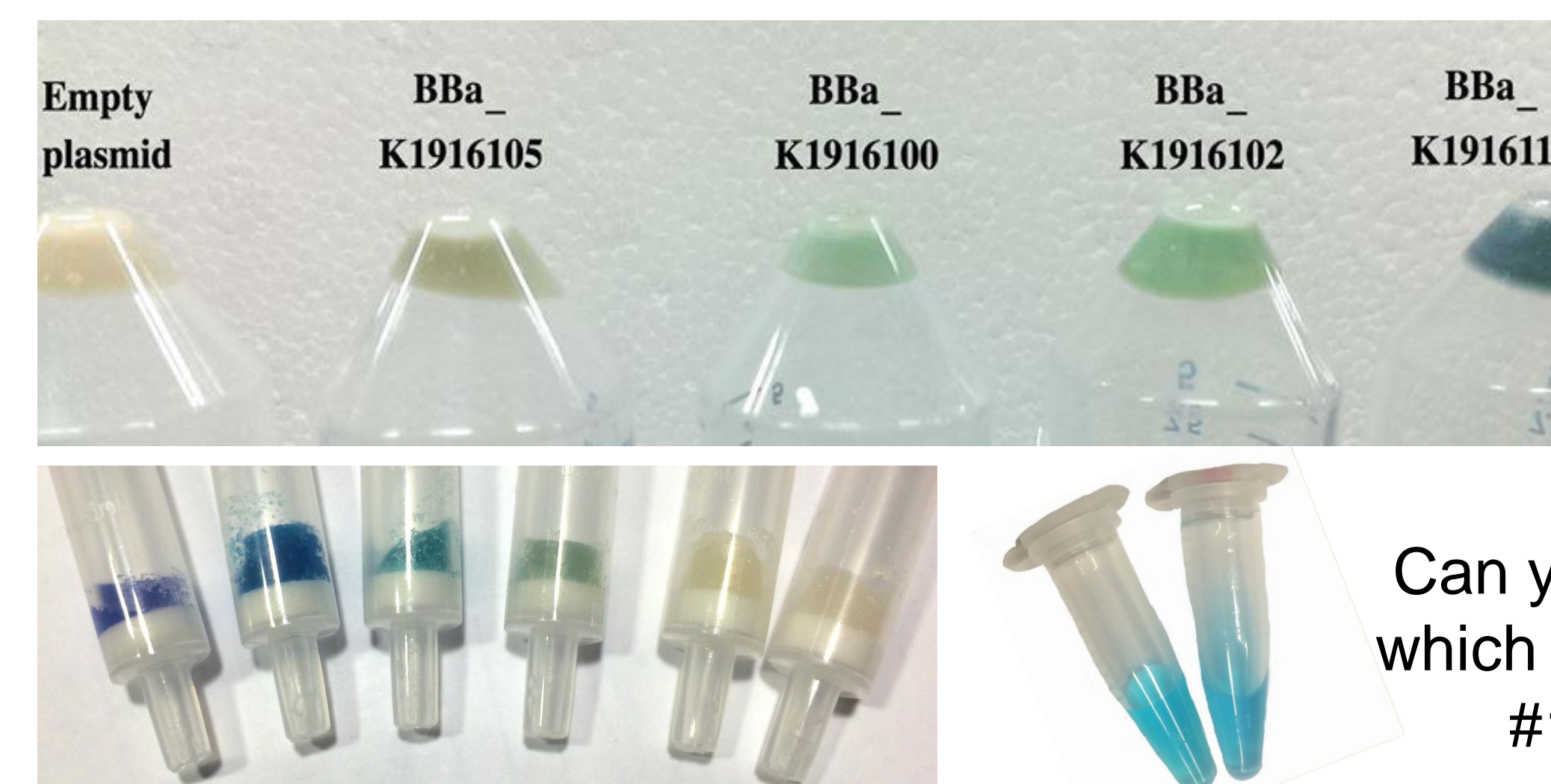


Natural substitutes for blue dye #1 are thought to be the hardest to find.

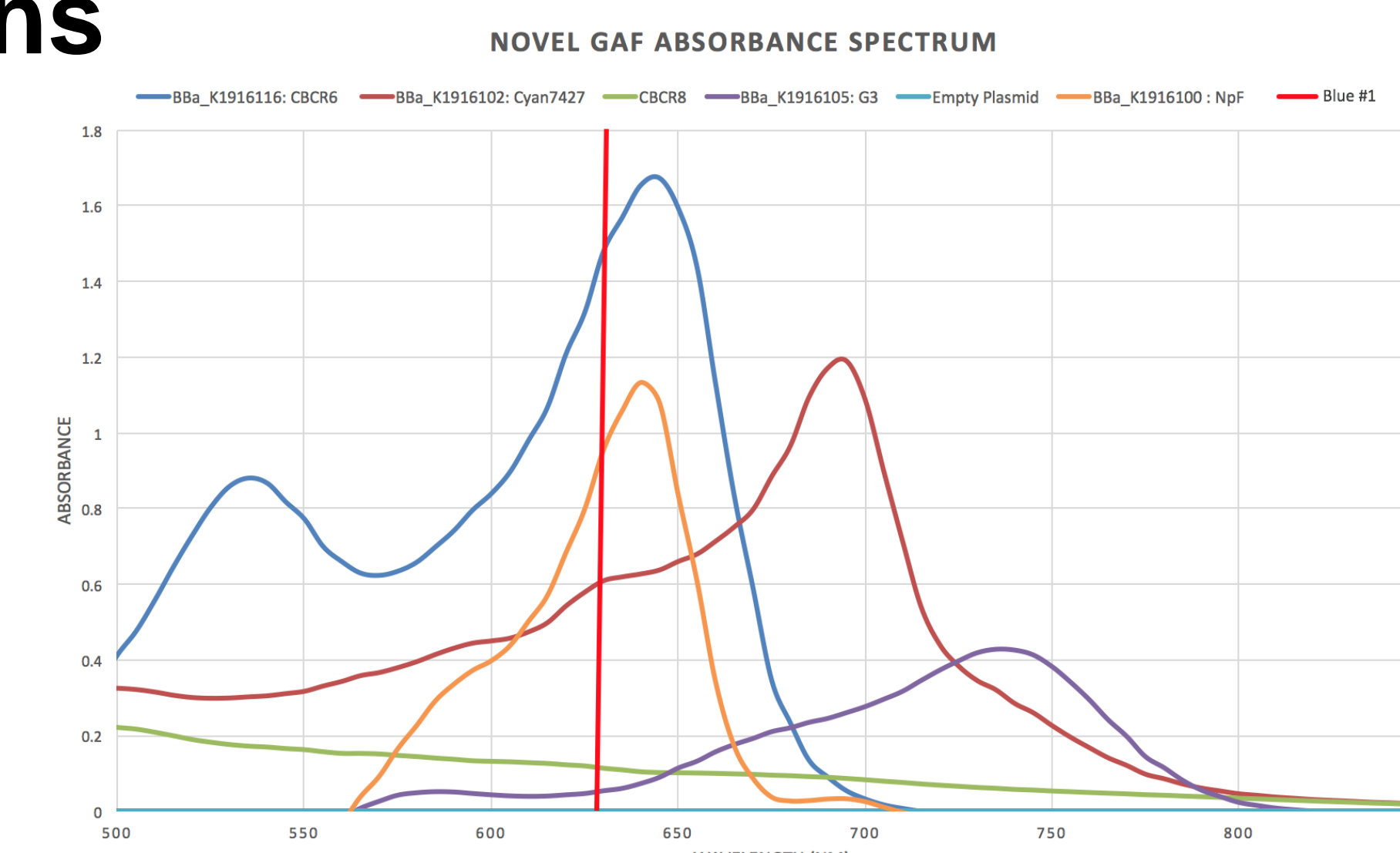
In this project we demonstrate that cyanobacteriochrome (CBCR) proteins -- like those found in spirulina - are a viable natural alternative to artificial food dyes.



Characterization of Novel GAF Proteins

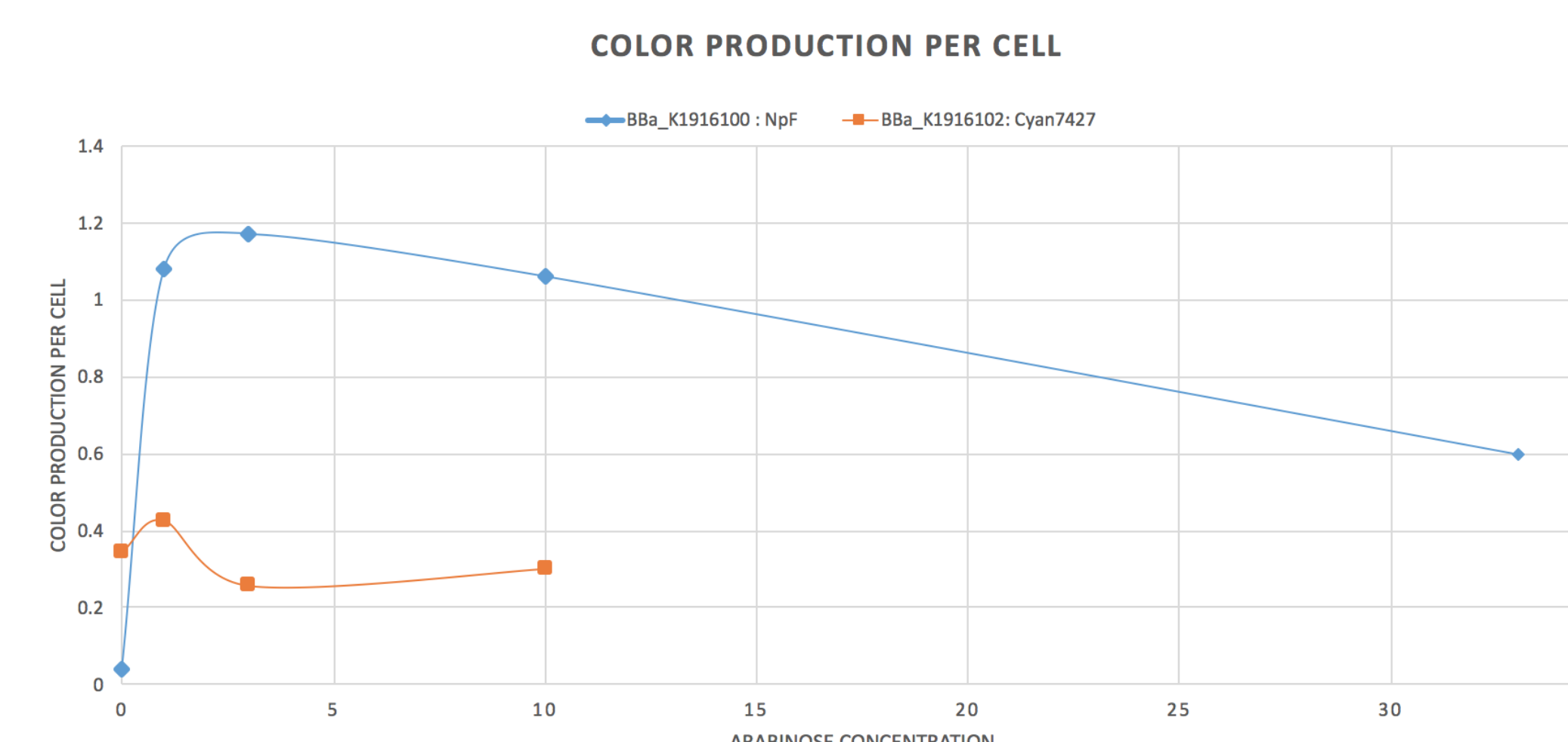
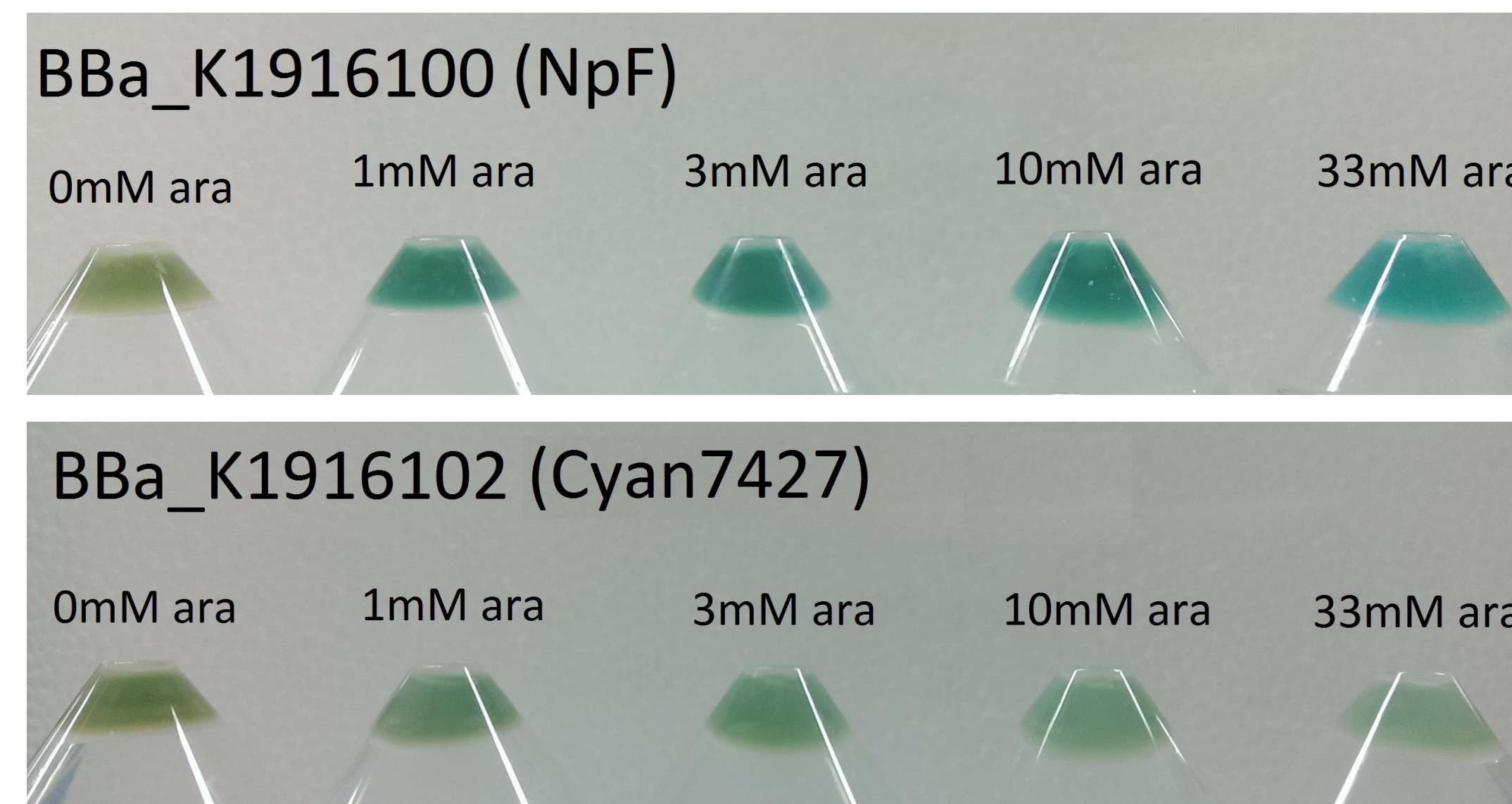


Can you tell which is Blue #1?



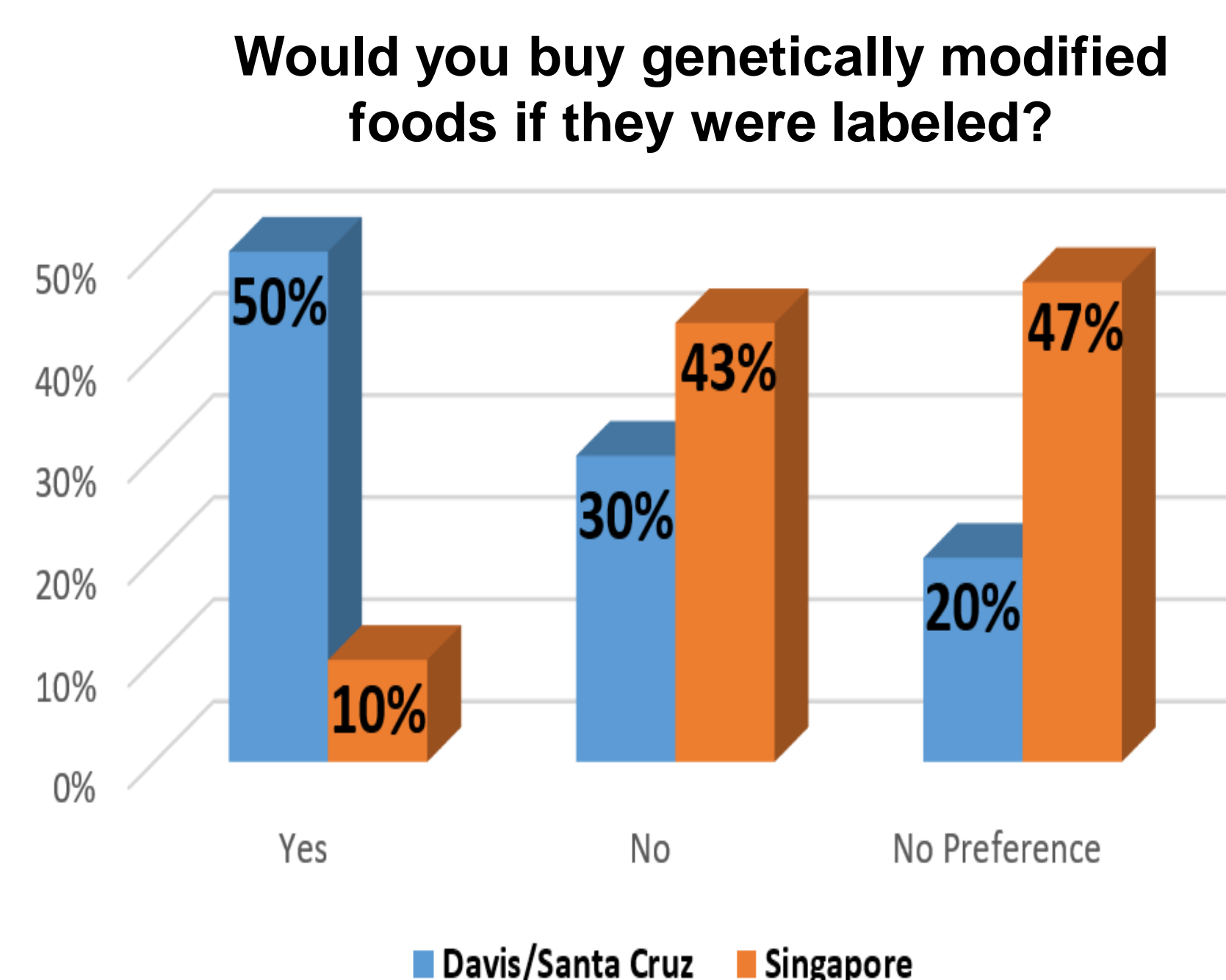
Metagenomic mining was used to discover 13 protein sequences three were transformed into *E. coli* and subsequent spectrophotometric analysis were performed to find that our model correctly predicted all three GAF sequences would reflect above 600 nm. The spectra shown here as compared to Blue #1.

Protein Production Optimization

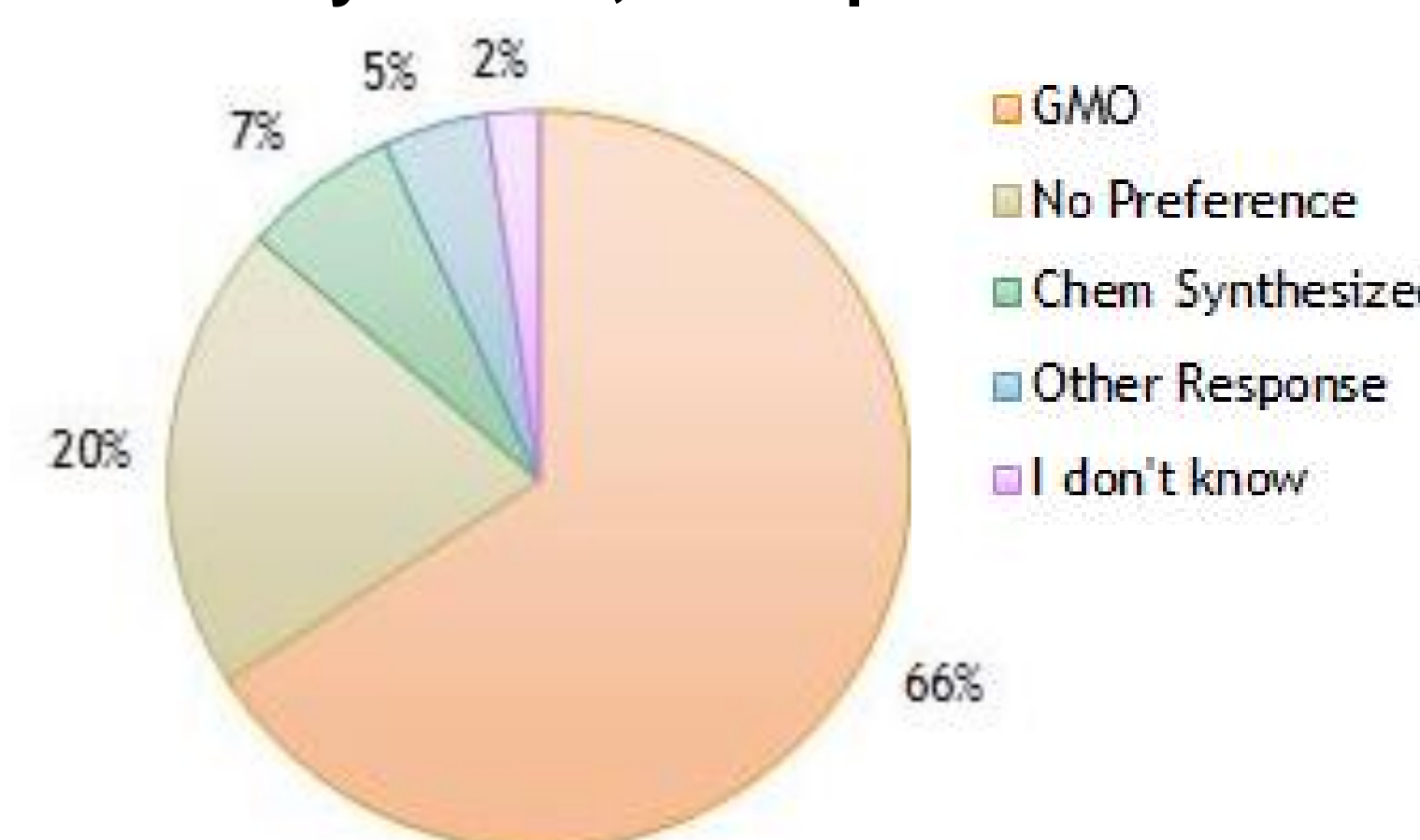


We induced cultures with different concentrations of arabinose, and after harvesting we assessed pellet volume and color vibrancy to see if there was an optimal inducer concentration.

Consumer Acceptance of Product



Which would you prefer? Dye from an altered organism, chemical synthesis, or no preference?



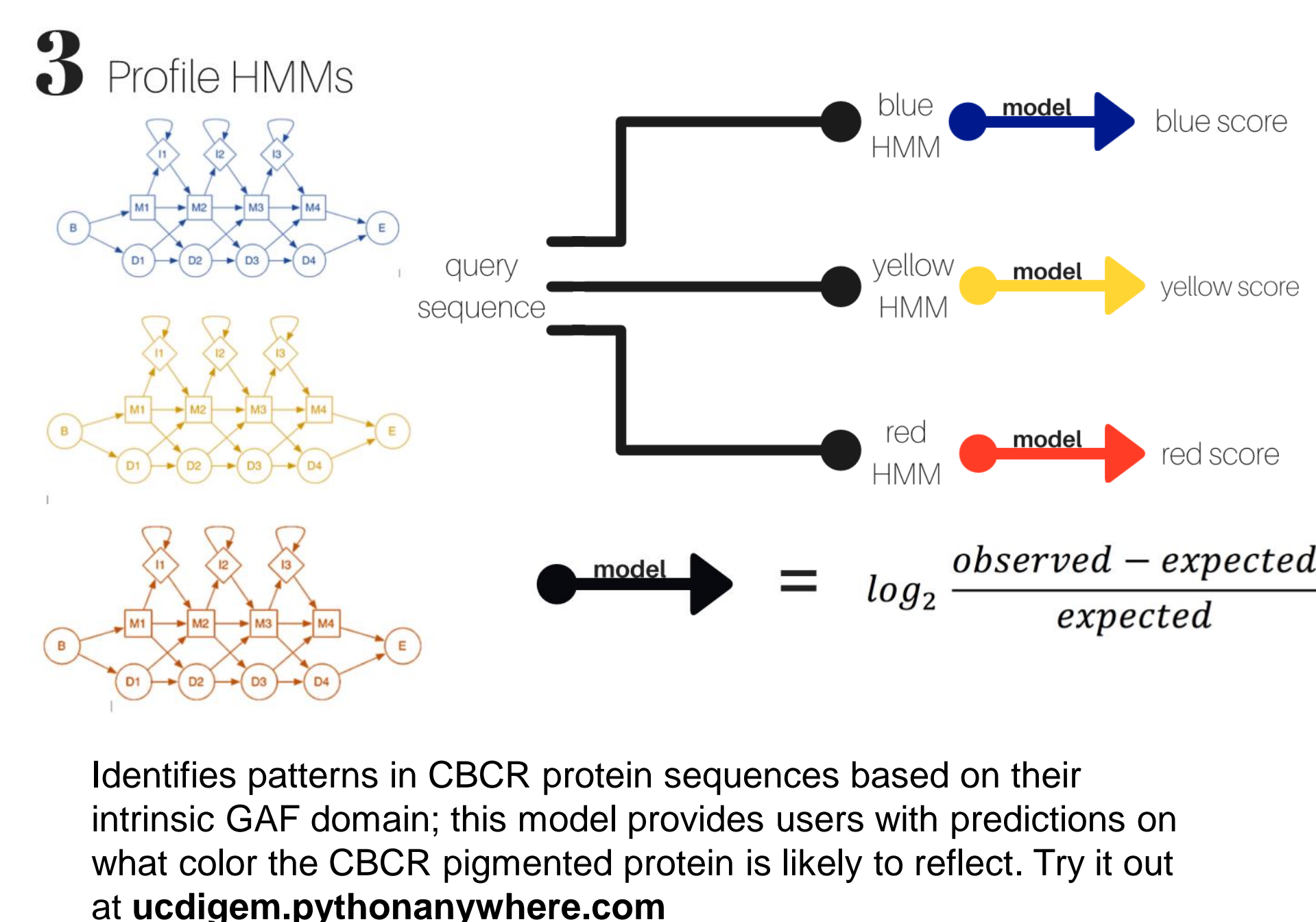
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We created a guide to be used as a tool for future iGEM teams conducting surveys to ensure that the data produced does not violate human experimentation rights and can be used in future research

We propose incremental and exponential movements toward a wealth of labels that allow accurate information to consumers and open a realistic dialogue about the current human food system.

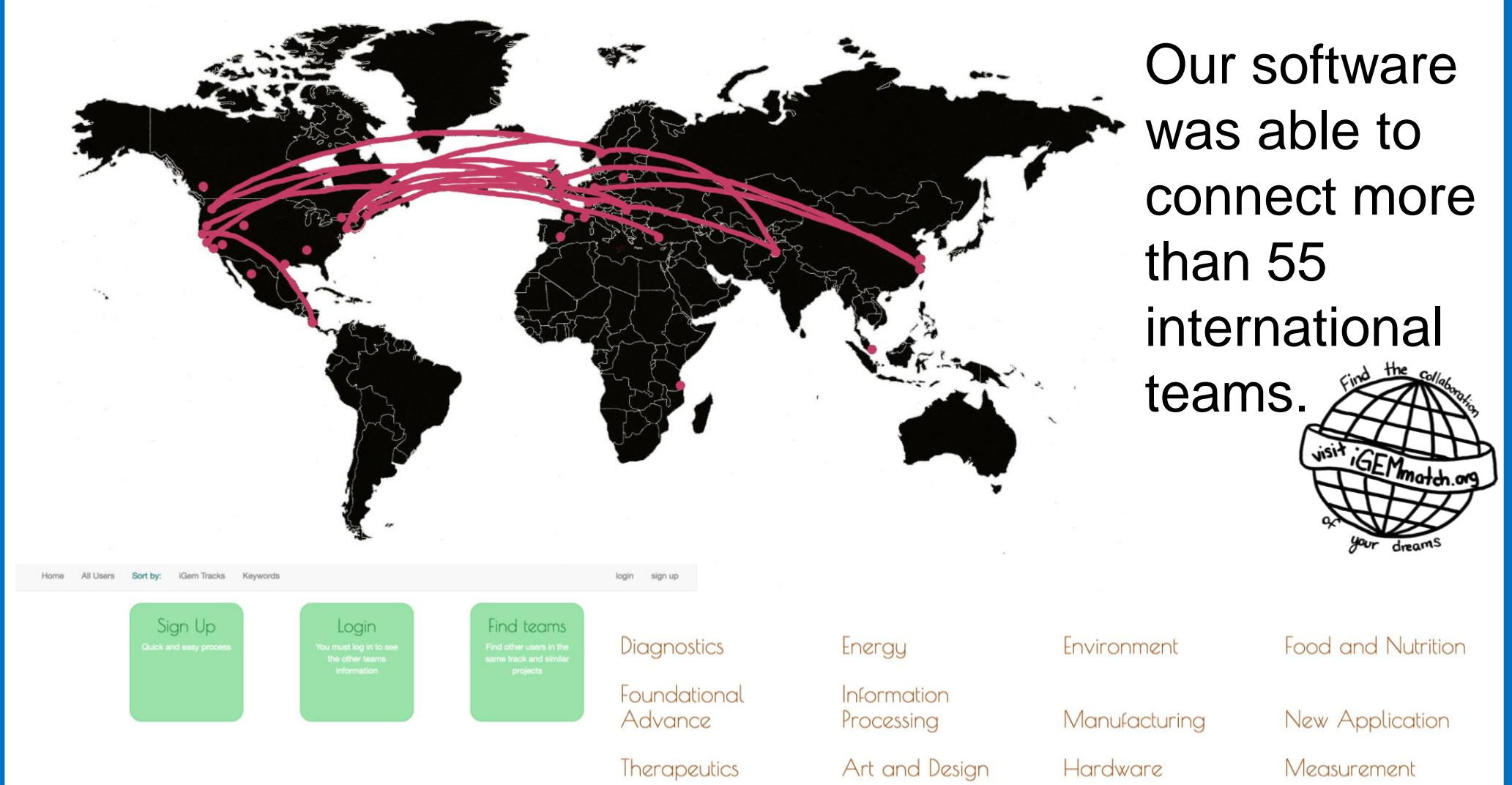
Finding New Colors

To expand the color spectrum of natural food dyes, we used mined metagenomic data to find novel CBCR proteins with varying absorption spectra. We developed a program that can predict whether the CBCRs will be primarily blue, red, or yellow based on their sequence.



Collaboration Forum: iGEMmatch

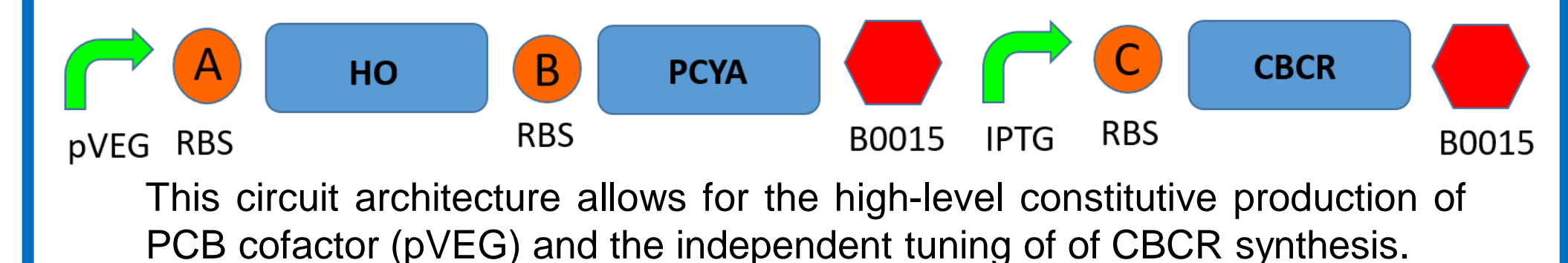
iGEMmatch.org promotes collaborations between iGEM teams. iGEM Match enables users to identify other teams with compatible projects and provides a communication modality to facilitate team-team collaboration.



Work in progress

In order to use our CBCRs for food applications and industrial production, our next step is to adapt our research in *E. coli* for expression in *Bacillus subtilis*, which has been designated by the FDA as a generally regarded as safe (GRAS) organism.

Genetic Circuit for CBCR Expression in B. Subtilis



Expression Chassis to Explore

B. Subtilis K07 (BGSC Accession # 1A1134): Seven protease deletions, no major secreted proteases, free of antibiotic resistance genes and integrated plasmids
B. Subtilis PY79 (BGSC Accession # 1A747): Wildtype strain, containing normal secreted and wall-associated proteases
B. Subtilis spo0A3 (BGSC Accession # 1S1): Does not produce alkaline or neutral proteases, non-sporulating

Acknowledgements

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