Almost half of all fruit and vegetables produced are damaged, lost, or wasted!

What can synthetic biology do about it?

Ethylene is a major hormone involved in the ripening of fruits. High demand for seasonal fruits represents a challenge in terms of long storage and transportation times. Small amounts of ethylene can cause unwanted ripening and spoilage, leading to wastage. We need a way of determining ethylene levels, but current methods are expensive, labour intensive, and frequently not portable. Our solution was to create an ethylene biosensor by engineering bacteria to SENSE ethylene, EXPRESS a visible output, and KEEP our produce FRESH.

For our biosensor to sense ethylene, we turned to the ethylene-oxidising Mycobacterium NBB4. We investigated two genes from its ethylene metabolism operon (below), which we suspected were responsible for its regulation.

We hijacked the ethylene regulatory system so that E. coli could express a chromoprotein (amiC) upon detection of ethylene.

AmiC is a blue chromoprotein and an iGEM part that we improved through error prone PCR. We generated 3 colour mutants with shifted absorbance peaks.

Suspected EtnR1 and EtnR2 interactions and the assays to characterise them.

As an intermediate product whilst cell-free technology is being developed, a latex nanoporous bio-coating will be used to immobilise GM E. coli on a paper base.

After consulting with potential consumers (Zespri, Avocados Australia, and Fresh Produce Group) we selected three designs for our final biosensor chassis: a fruit sticker, an industrial sticker for use on shipping containers, and a plate and strip system for warehouses.

Attributions

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Our fruit sticker
Current fruit labelling
Gas chromatography