OVERVIEW
We engineered E. coli to exploit sunlight and live better under the anaerobic conditions of Microbial Fuel Cell (MFC) and increase electrons production.

more ATP with Proteorhodopsin.
Proteorhodopsin (PR) creates a light-driven proton gradient, activating ATP synthase and increasing bacterial lifespan.

WHERE IS OUR RETINAL?
We successfully produced β-carotene (BBa_K1604020) which is cleaved by blh in two molecules of retinal (BBa_K1604022) in NEB10b cells.

Our Solar pMFC under construction (left) and at work (right). It is composed of 6 cathods in parallel that share the same anodic chamber. We obtained a maximum power of 109 μW with a current values compared to the negative control BBa_K731201, showed higher voltage and current values calculated by Ohm law. BBa_K1604010 showed higher voltage and current values compared to the negative control BBa_K731201, (blue).

WHERE IS OUR RETINAL?
The pigments were extracted by acetone and run on a HPLC reverse phase column, which evidenced the loss of β-carotene.

CONCLUSION and FUTURE PROSPECTIVE
We were able to engineer E. coli able to live in the absence of oxygen thanks to an increase of ATP in response to light activation of proteorhodopsin. We paved the road for retinal biosynthesis and built a new device able to produce more NAD. Finally we constructed our own MFC prototype and we powered up a blue LED.

This is only one step forward: while we work to improve our ability to use bacteria to produce energy we all need to put effort to reduce our energy needs!