

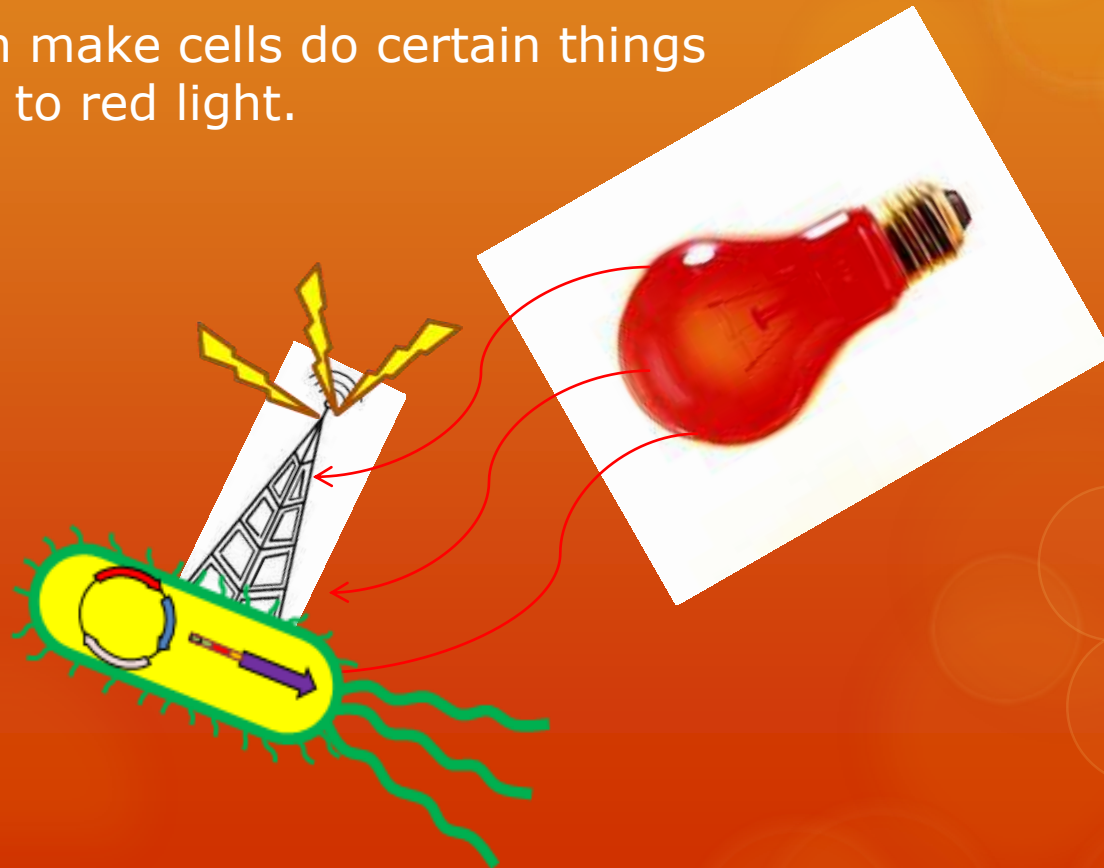
Controlling Bacteria With Light

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Special Thanks to INBRE, Mark Gomelsky, Gavin Lawlis, and Stacey Formicheva

What is Optogenetics?

- Optogenetics is the regulation of cellular activities directed by light via genes.
- Basically, I can make cells do certain things when exposed to red light.

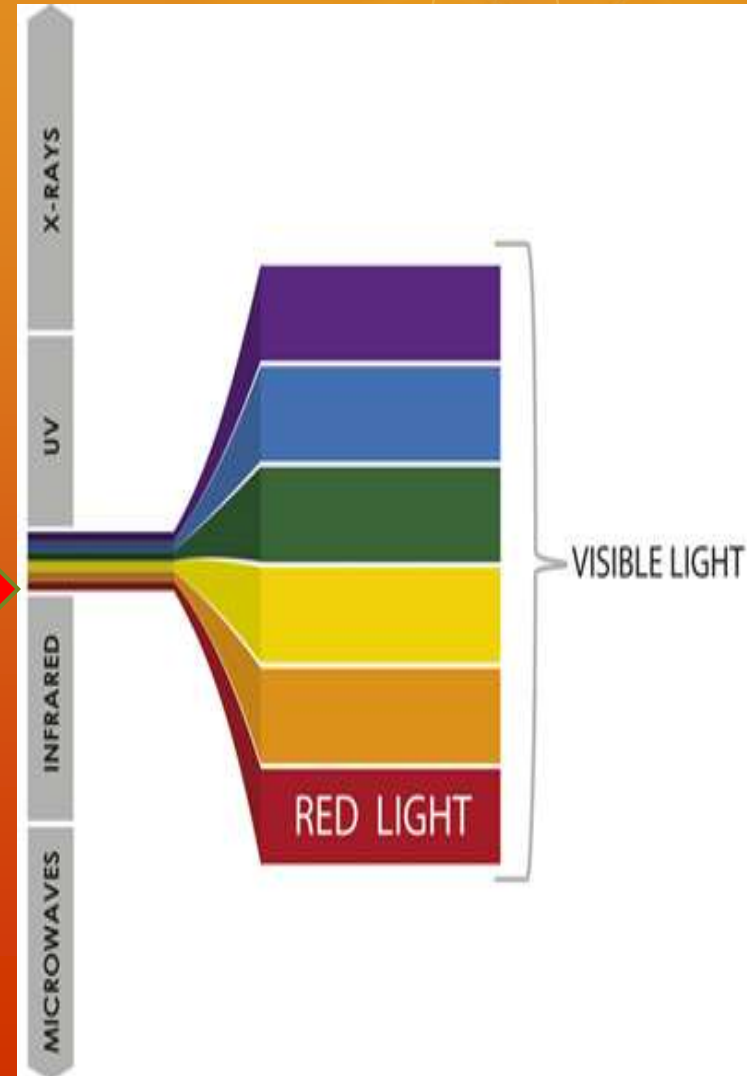


Why NIR (Near Infrared) light?

- Benign
- Deeply penetrates mammalian tissue
- High precision: activation when and where you need it.

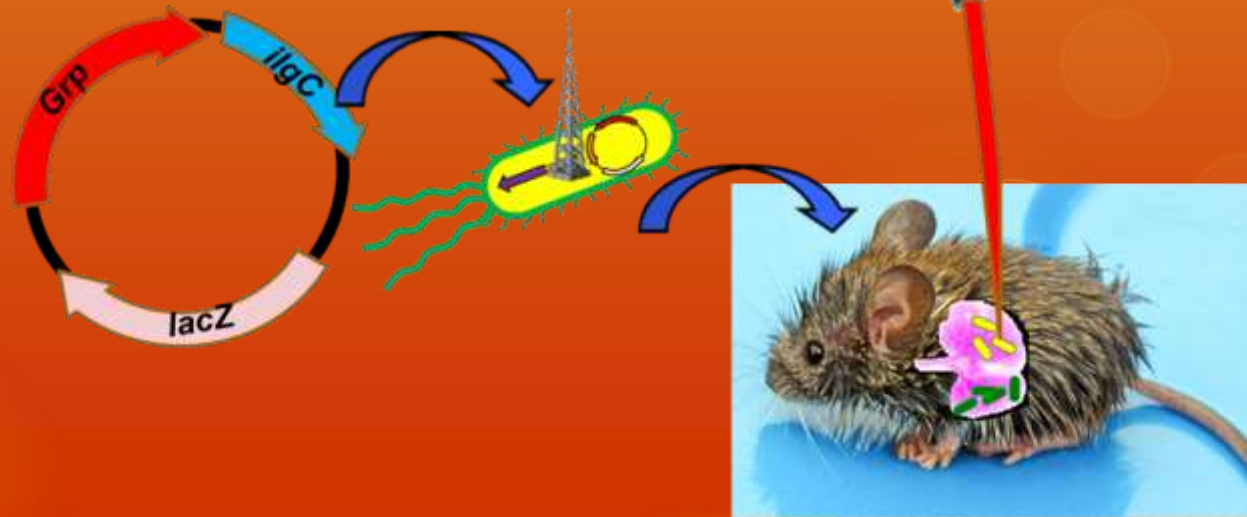
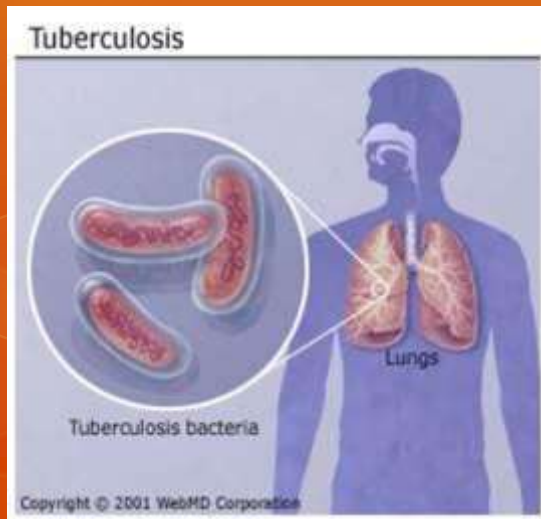


680-880nm



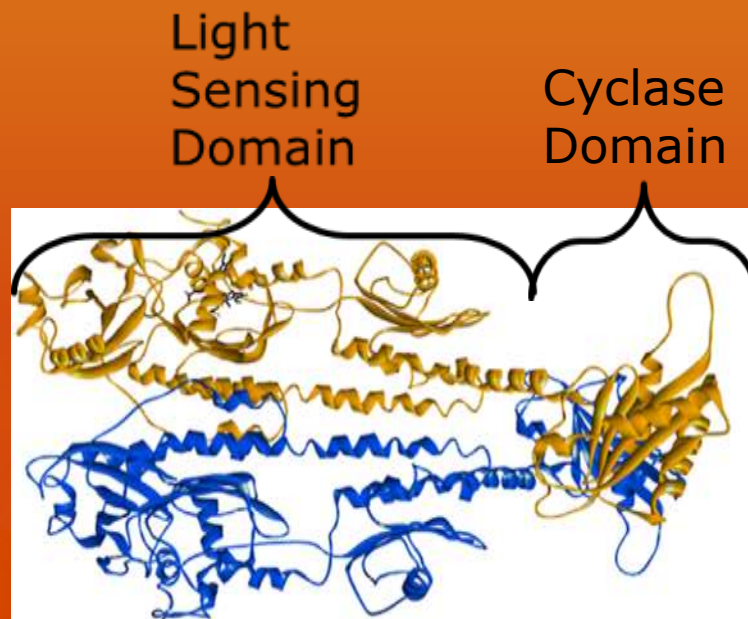
Why Should You Care?

- Host-Pathogen Studies
- Pathogens are changing all the time: MRSA or *Mycobacterium tuberculosis*
- Discovery of new targets for antibiotics or treatments



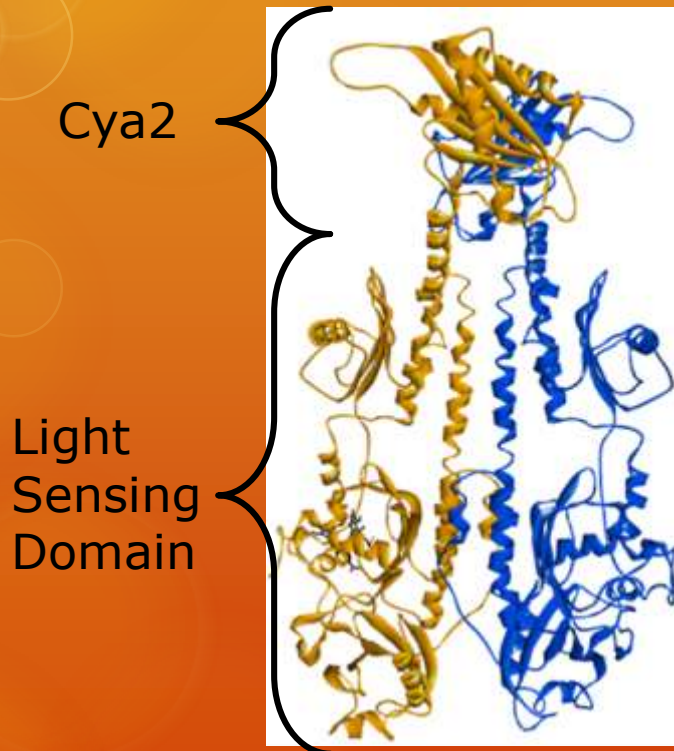
Why Guanylate Cyclase?

- Guanylate cyclase produce cGMP
- cGMP is almost undetectable by pathogen
- NOT present in most pathogens

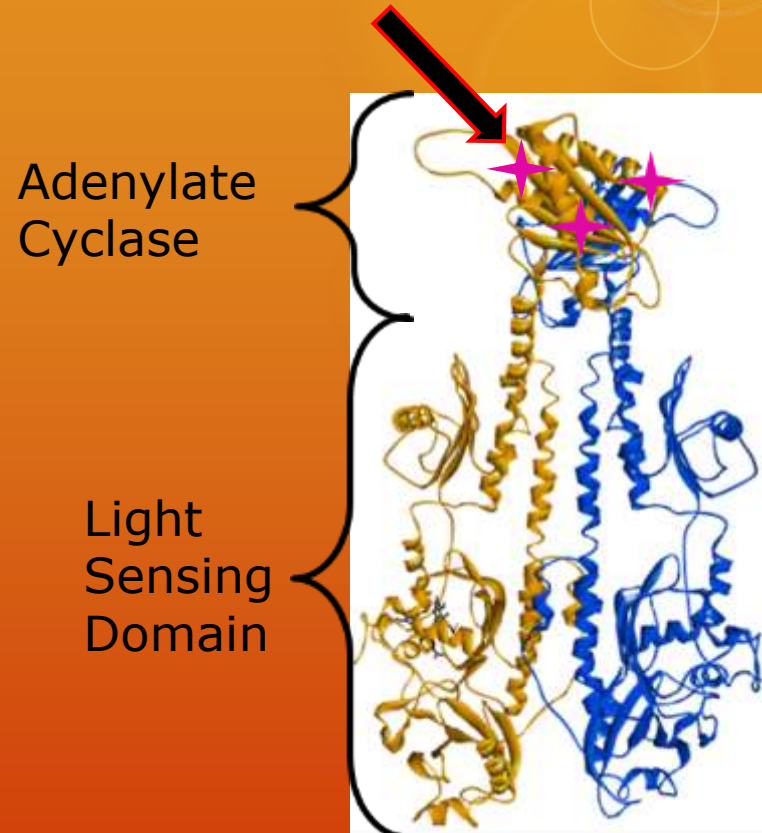


How is this enzyme made?

Cya2 (guanylate cyclase from *Synechosystis*) Domain Fusion Via Yeast Recombineering



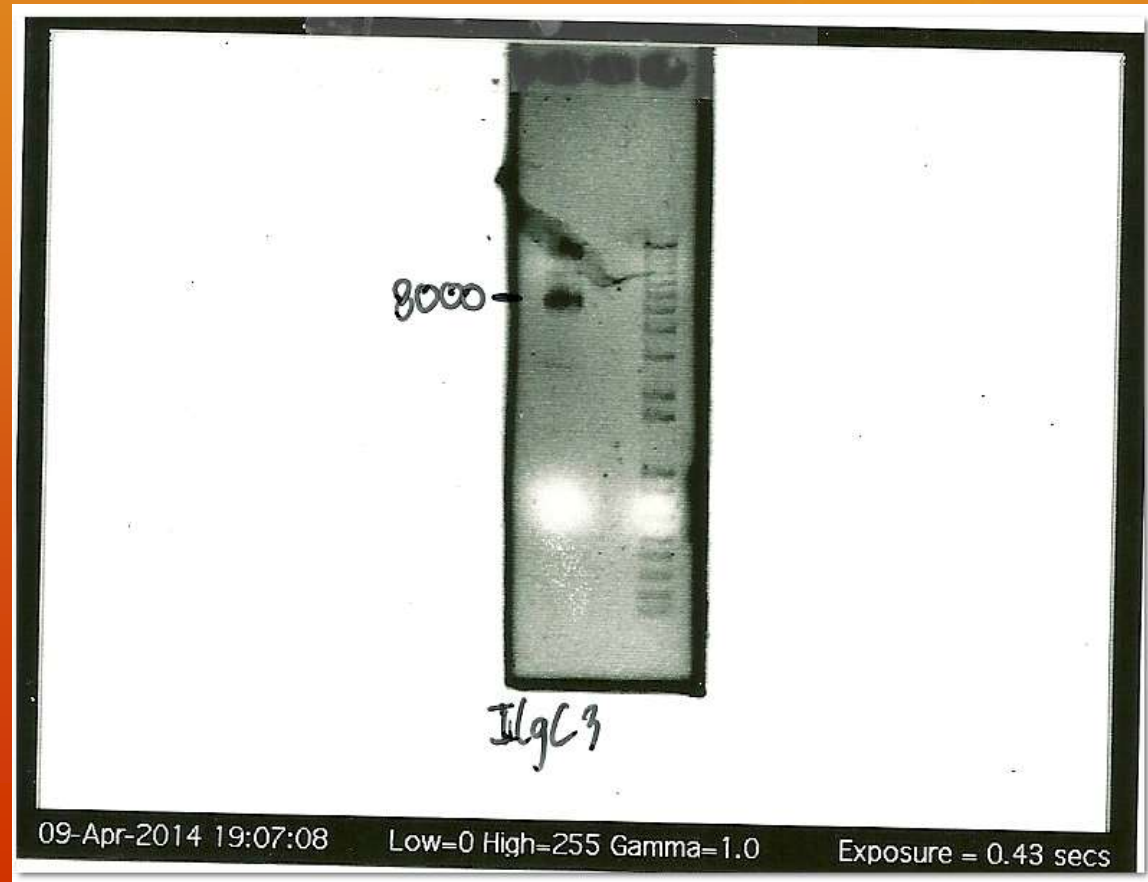
Point Mutations in IlaC



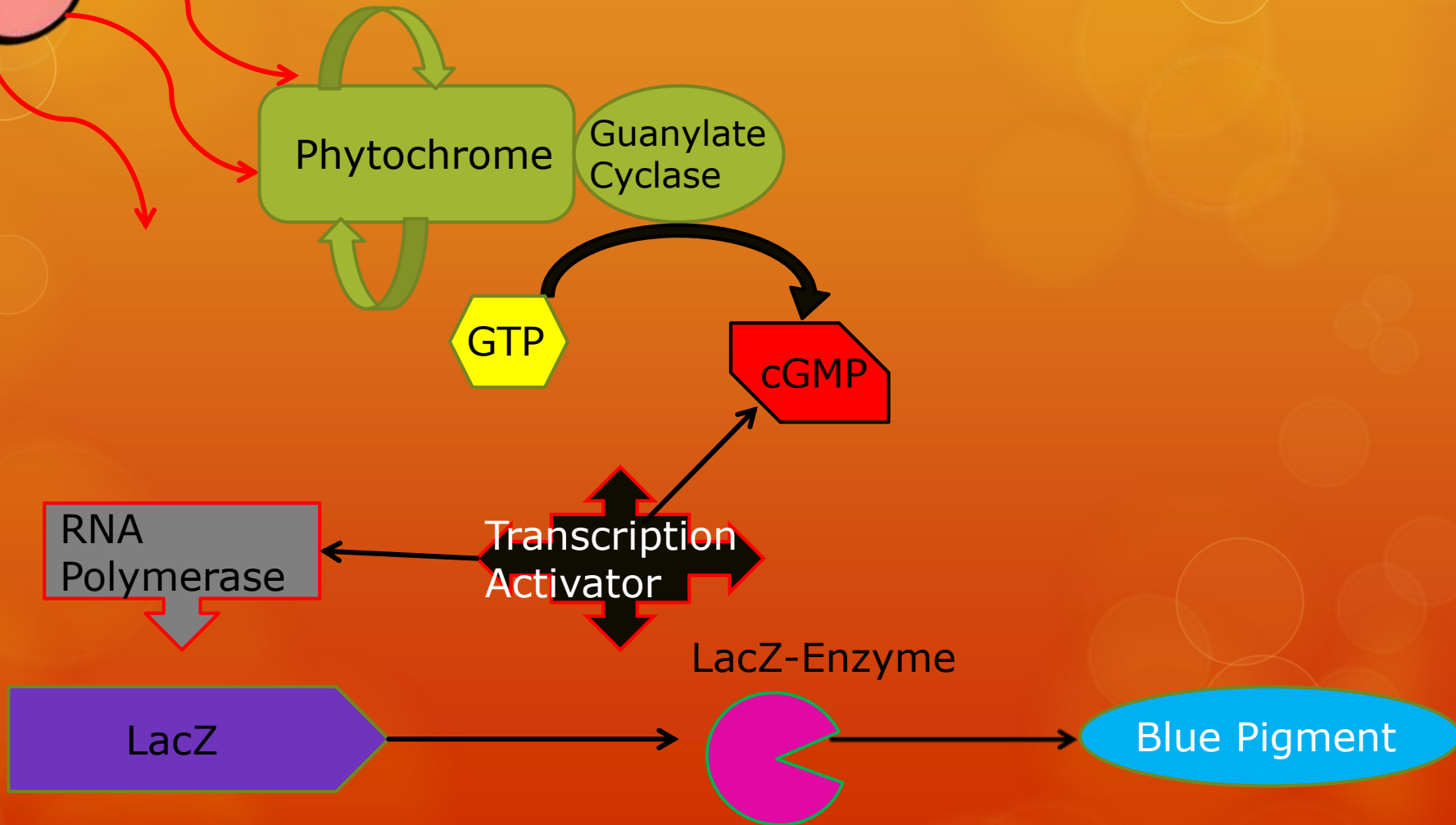
Same function, different approaches

How can we tell it exists?

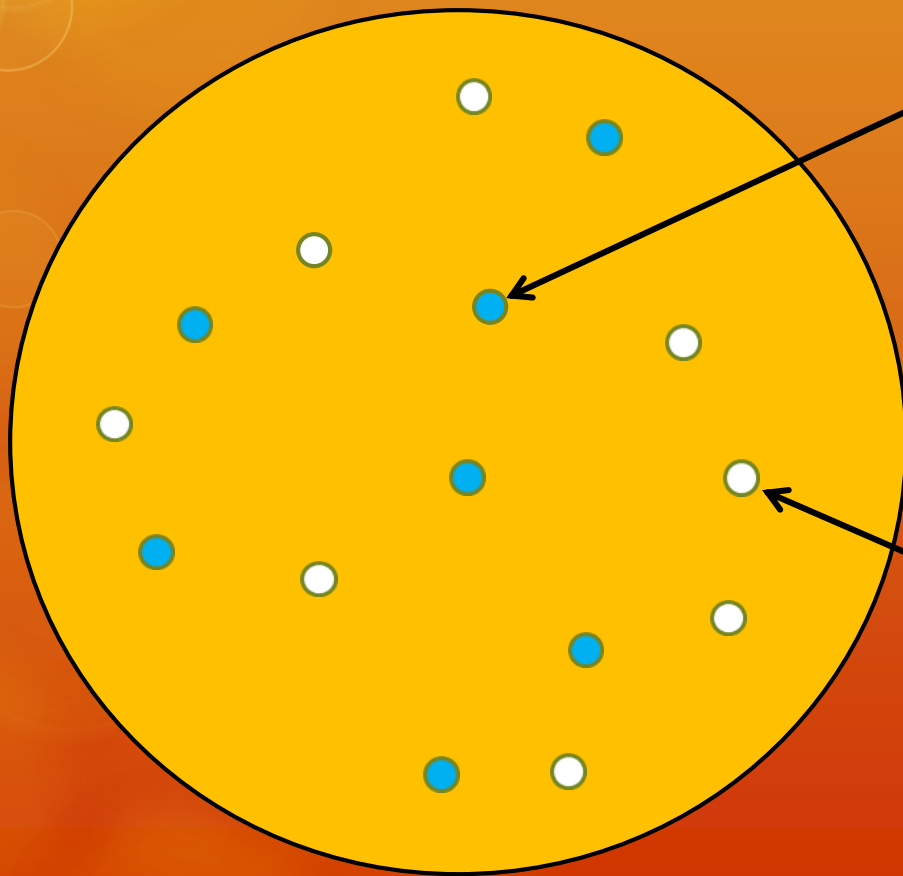
- Sequencing
- DNA gels



How do we know they work?



In a perfect world.....



Blue colonies produce a sufficient amount of cGMP

White colonies DO NOT produce sufficient cGMP

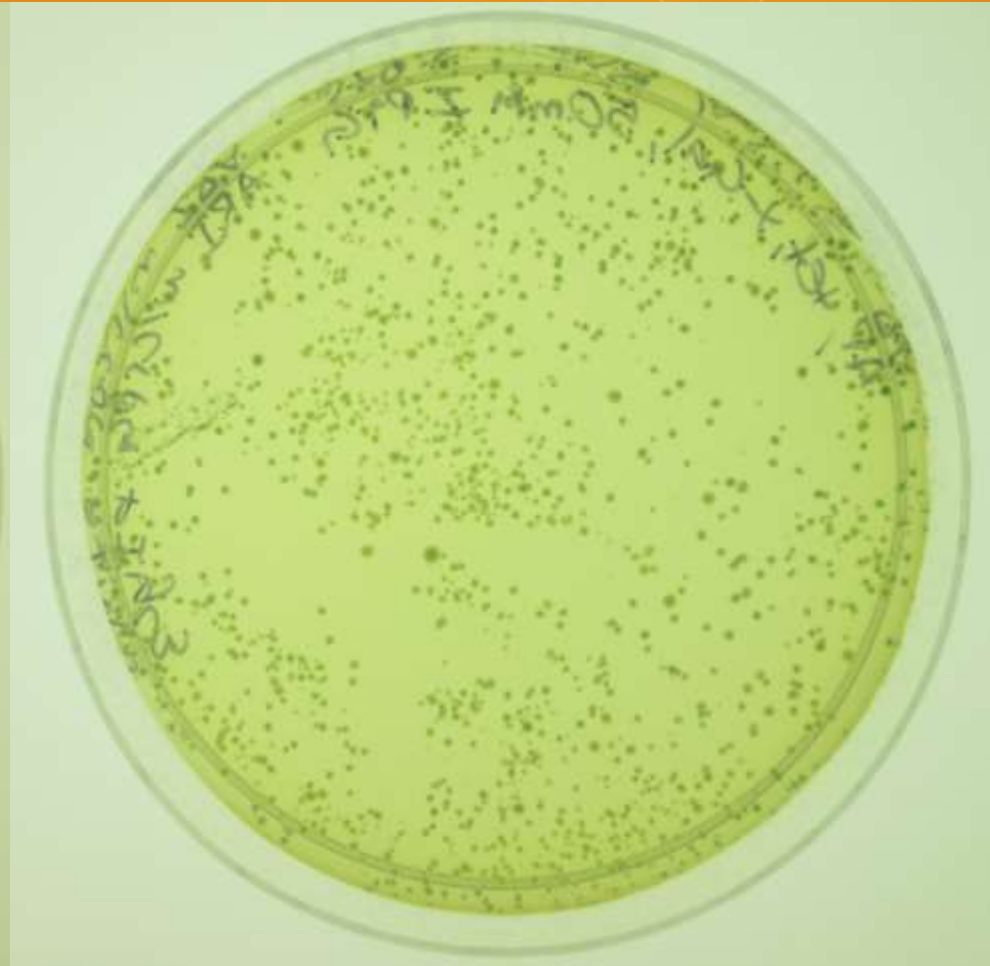
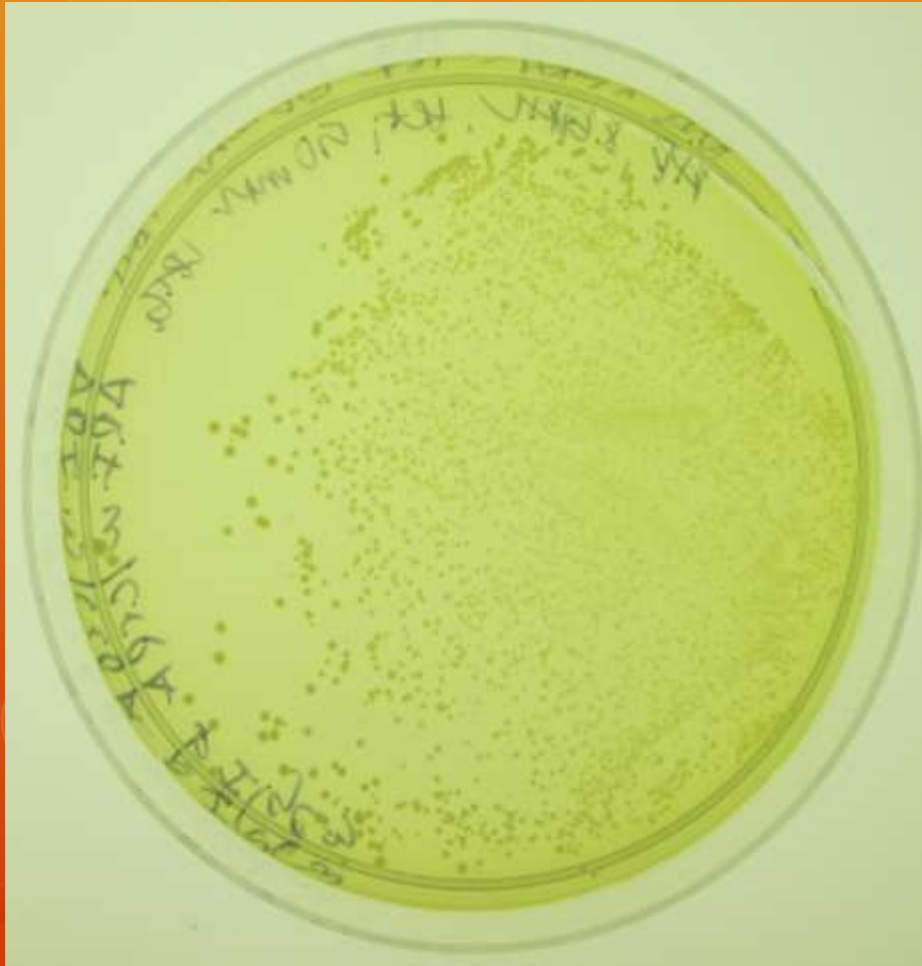
What does that ACTUALLY look like?



Do my cyclases work?

crpA & *IlgC3*

crpG & *IlgC3*



Project Future

- Random mutagenesis of point mutation construct
- Continued optimization
- Move to mice for *in vivo* analysis

Finally, Questions?

