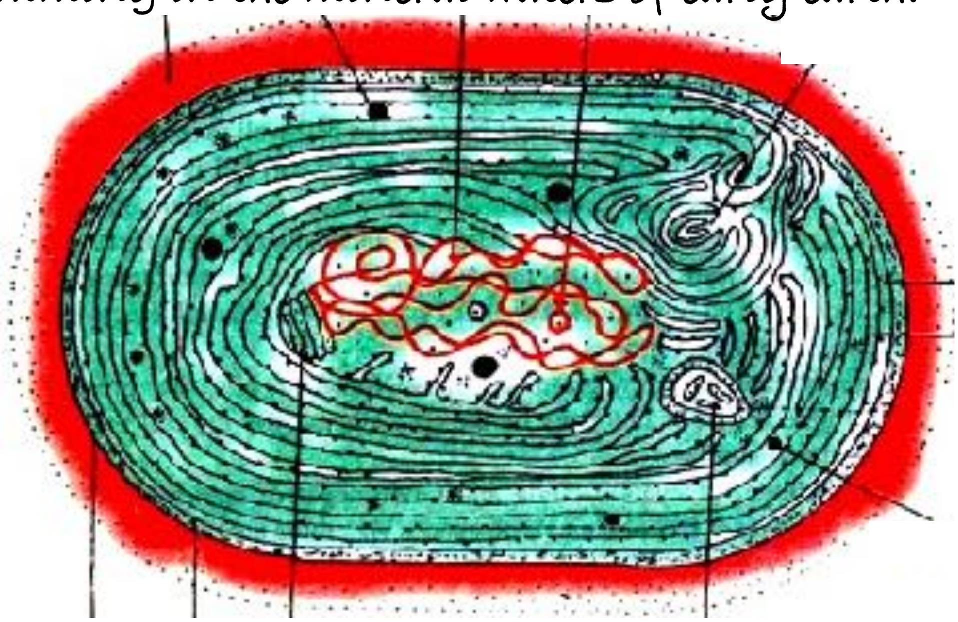
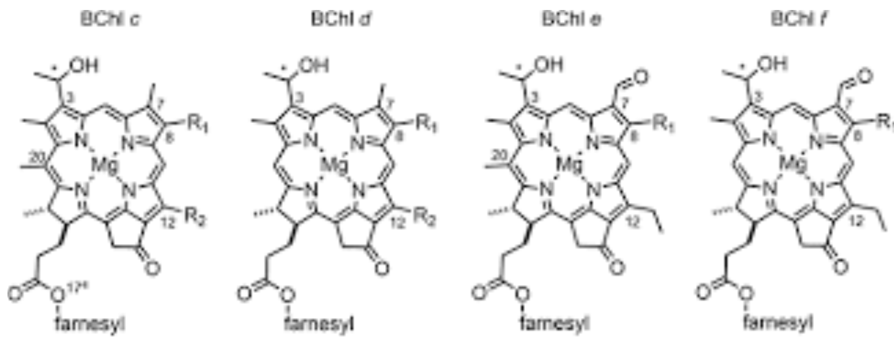
We caught the cell red handed over 2.7 billion years ago, swimming in the mineral waters of early earth.

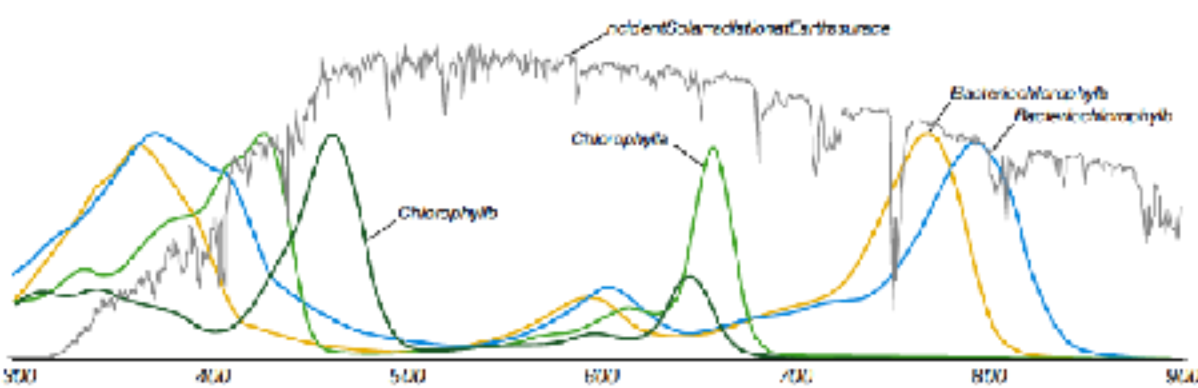


Something very strange was happening inside this microscopic unicellular creature.

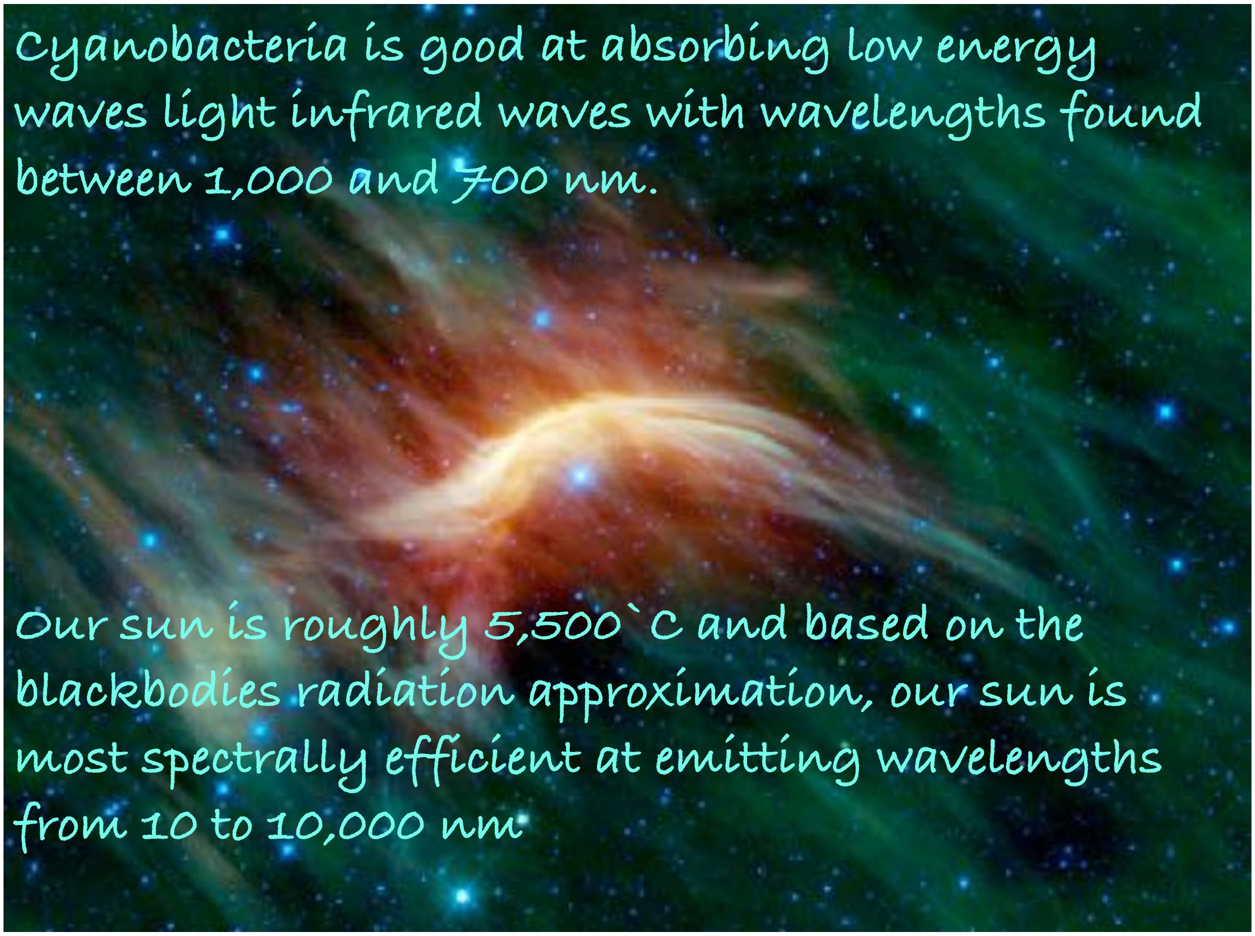


Take some time to color these hexagons
This is bacteriochlorophyll.

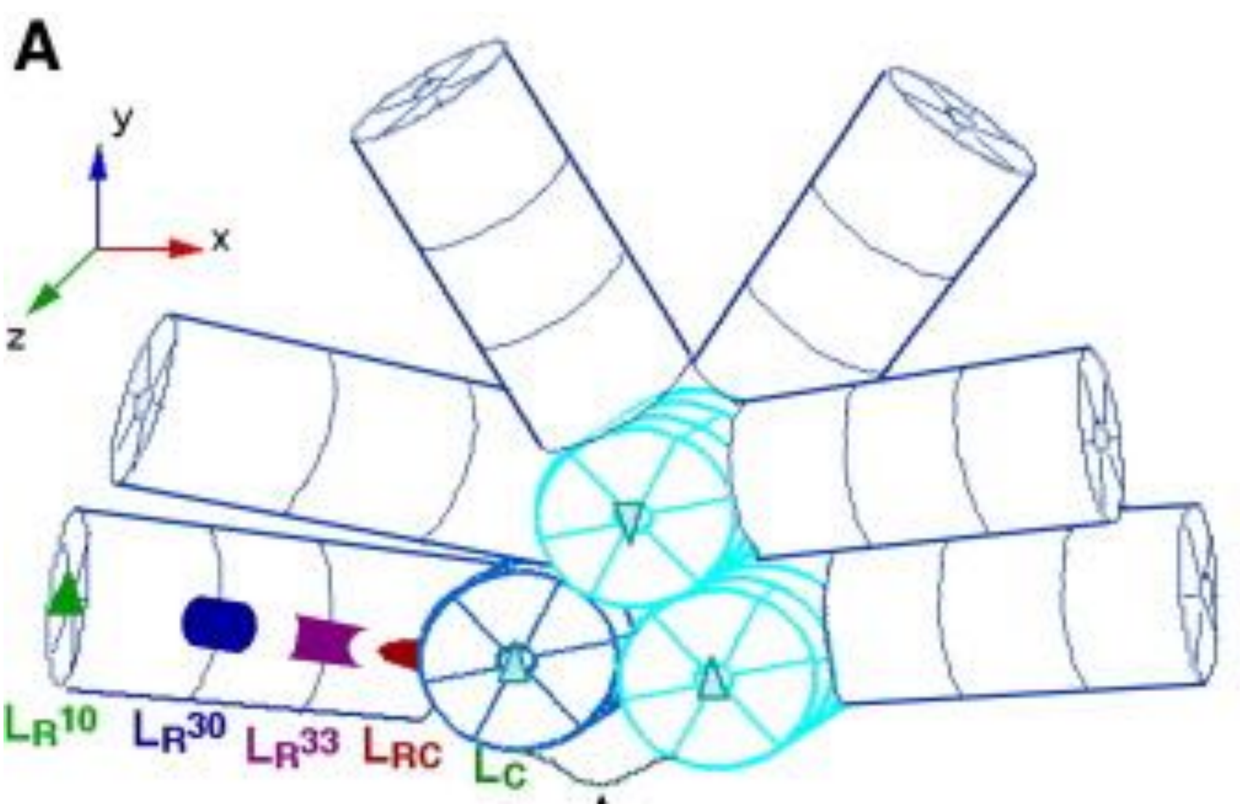
Both chlorophyll and bacteriocholorophyll use solar rays as light energy to produce chemical energy.

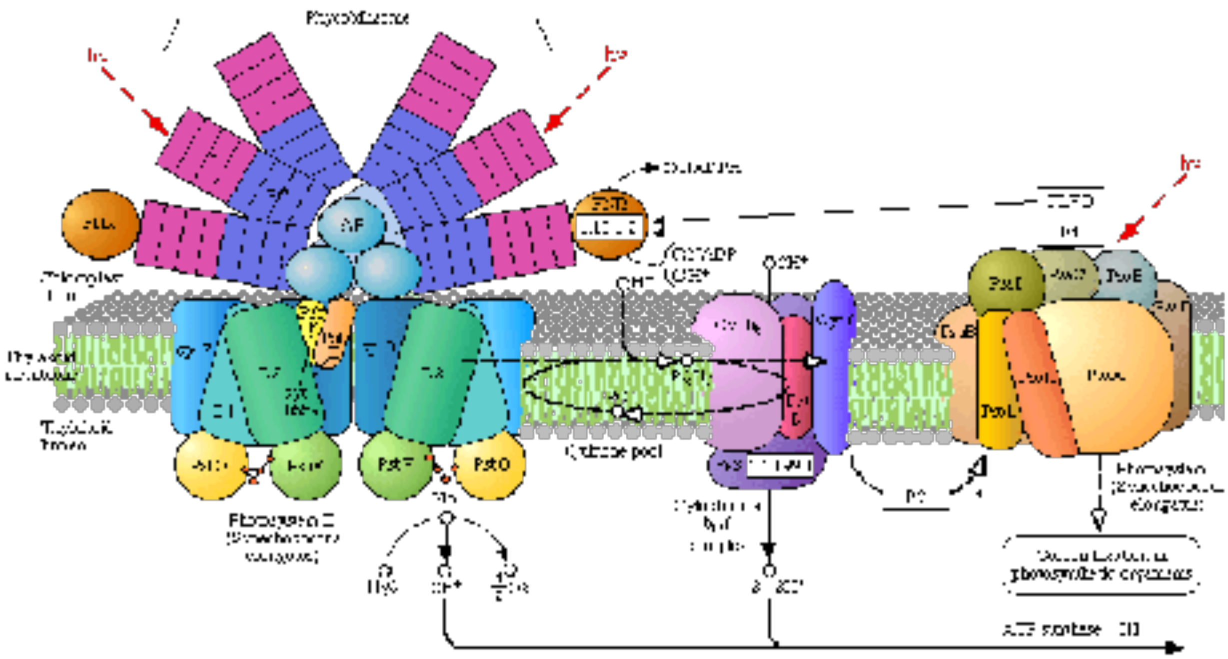


Cyanobacteria were some of the earliest photosynthetic organisms on Earth, producing oxygen!

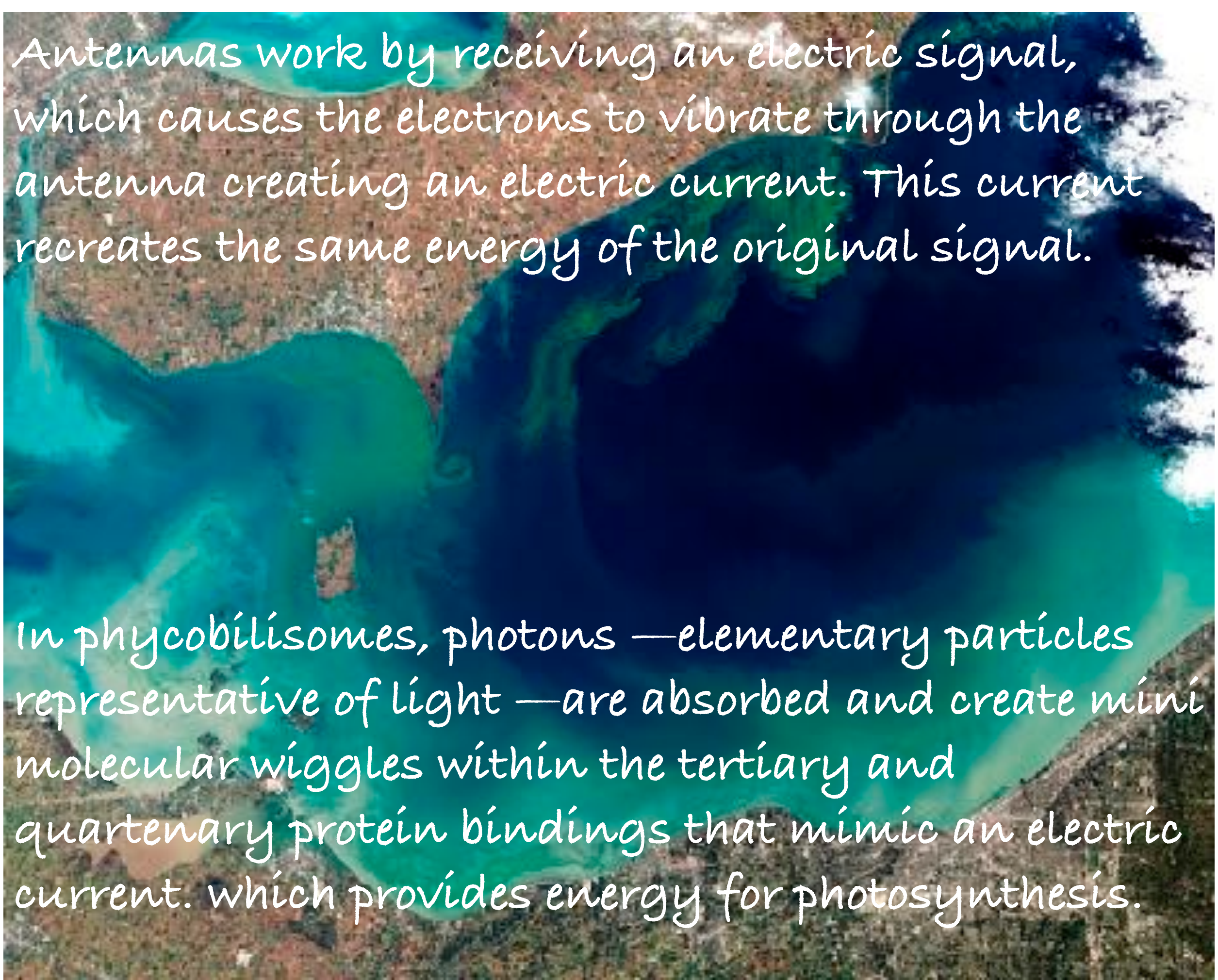


Another monster part!
Give this one a color based on the protein notation.



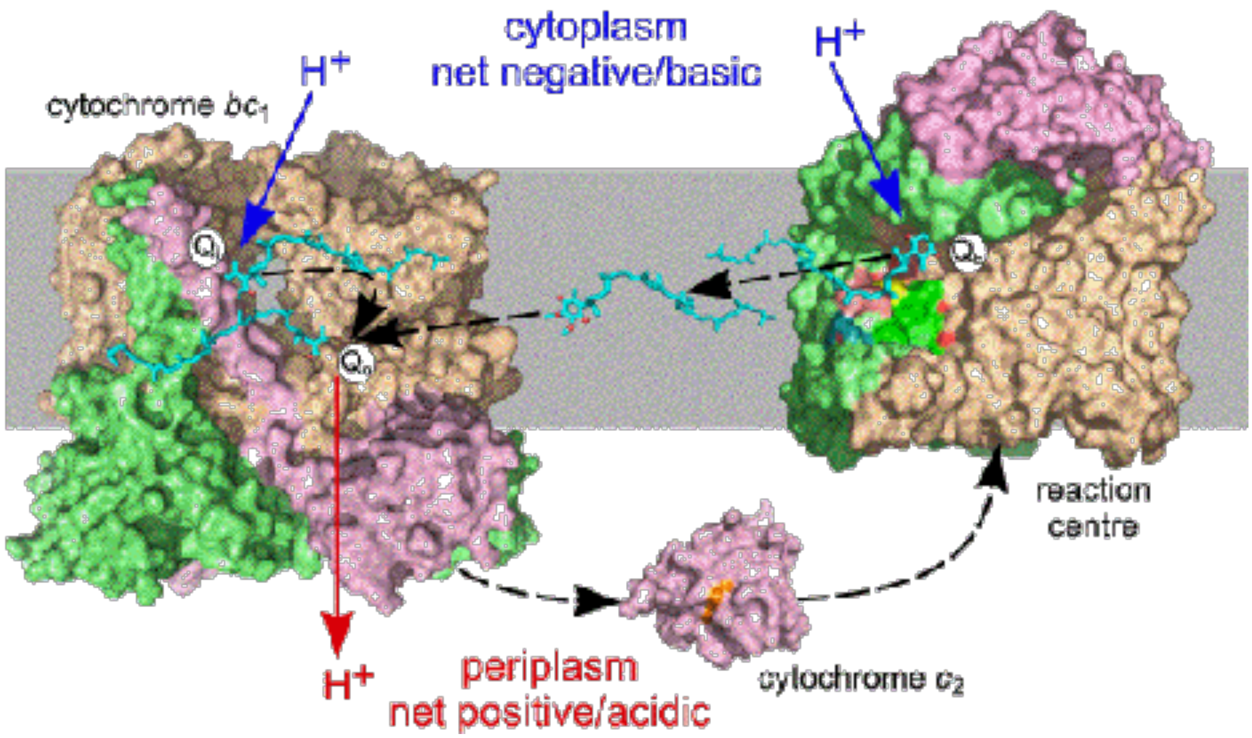


Photosynthesis begins with photons reaching phycobilisomes —the cyanobacteria antennas.

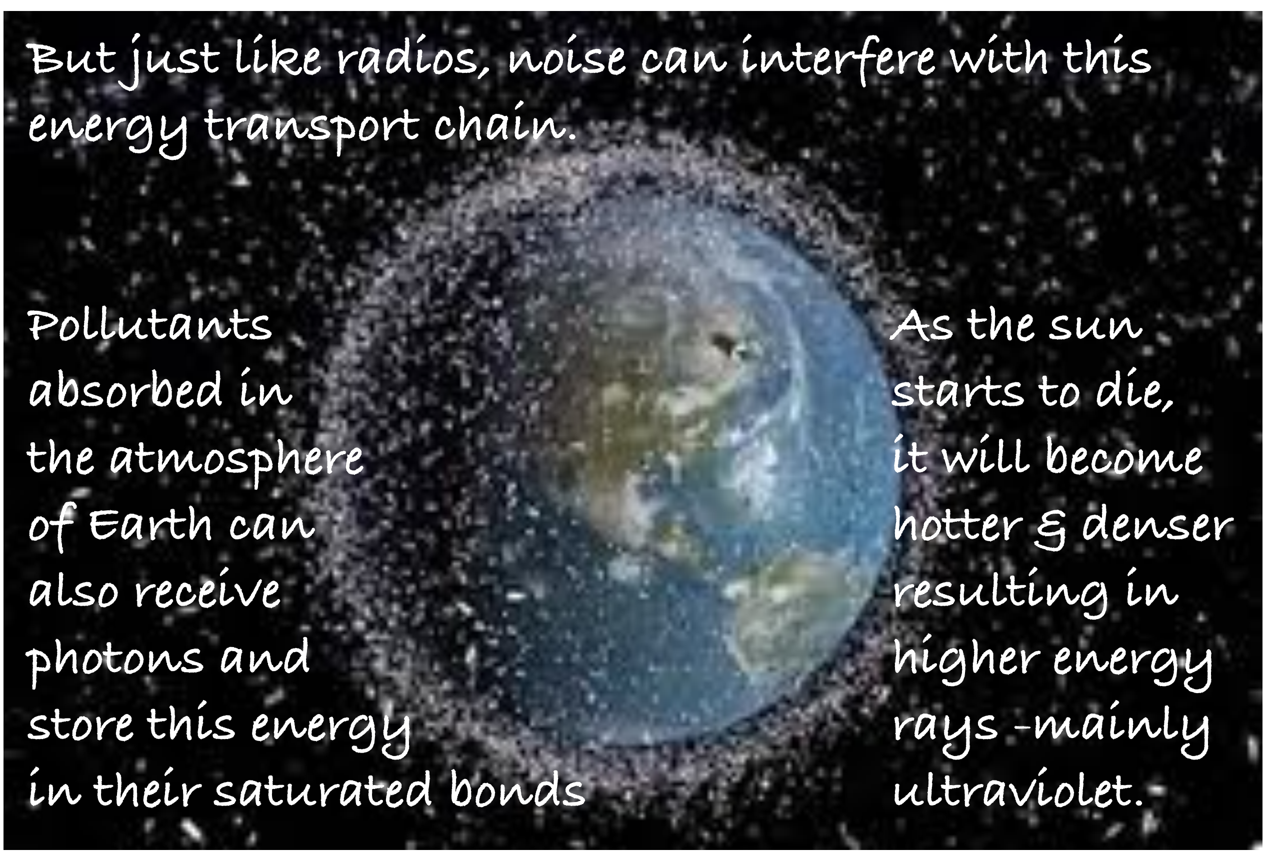


Antennas work by receiving an electric signal, which causes the electrons to vibrate through the antenna creating an electric current. This current recreates the same energy of the original signal.

In phycobilisomes, photons —elementary particles representative of light —are absorbed and create mini molecular wiggles within the tertiary and quartenary protein bindings that mimic an electric current. which provides energy for photosynthesis.



Many enzymes, like photosynthesis system complexes, can interpret currents as energy inputs for chemical signals and voltage-gated processes.



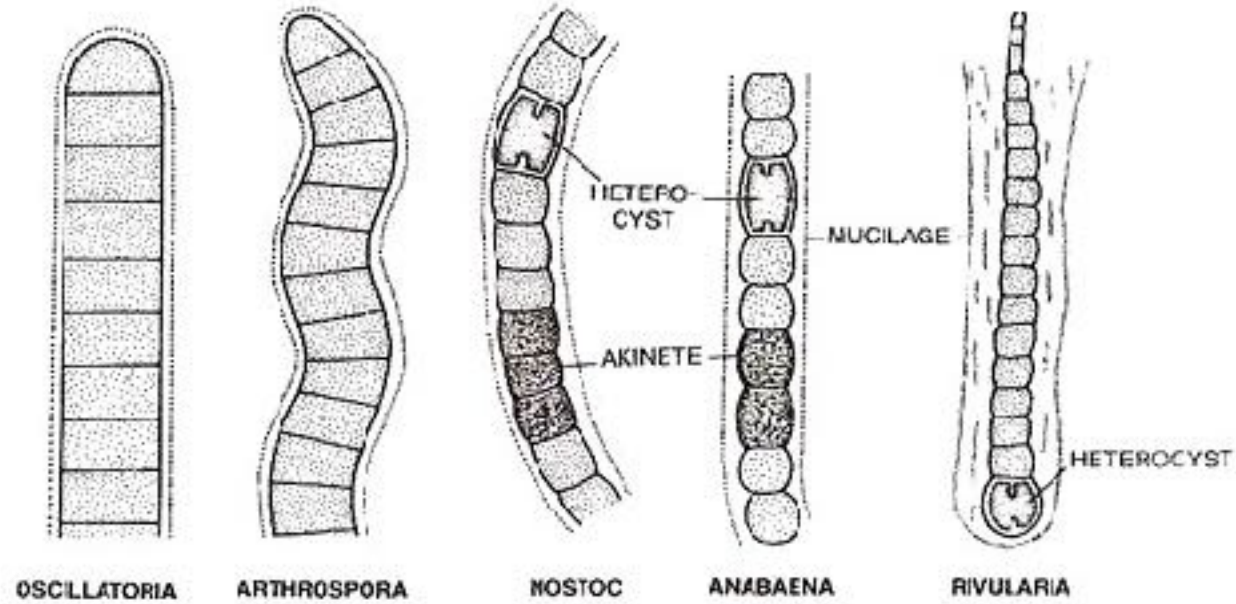
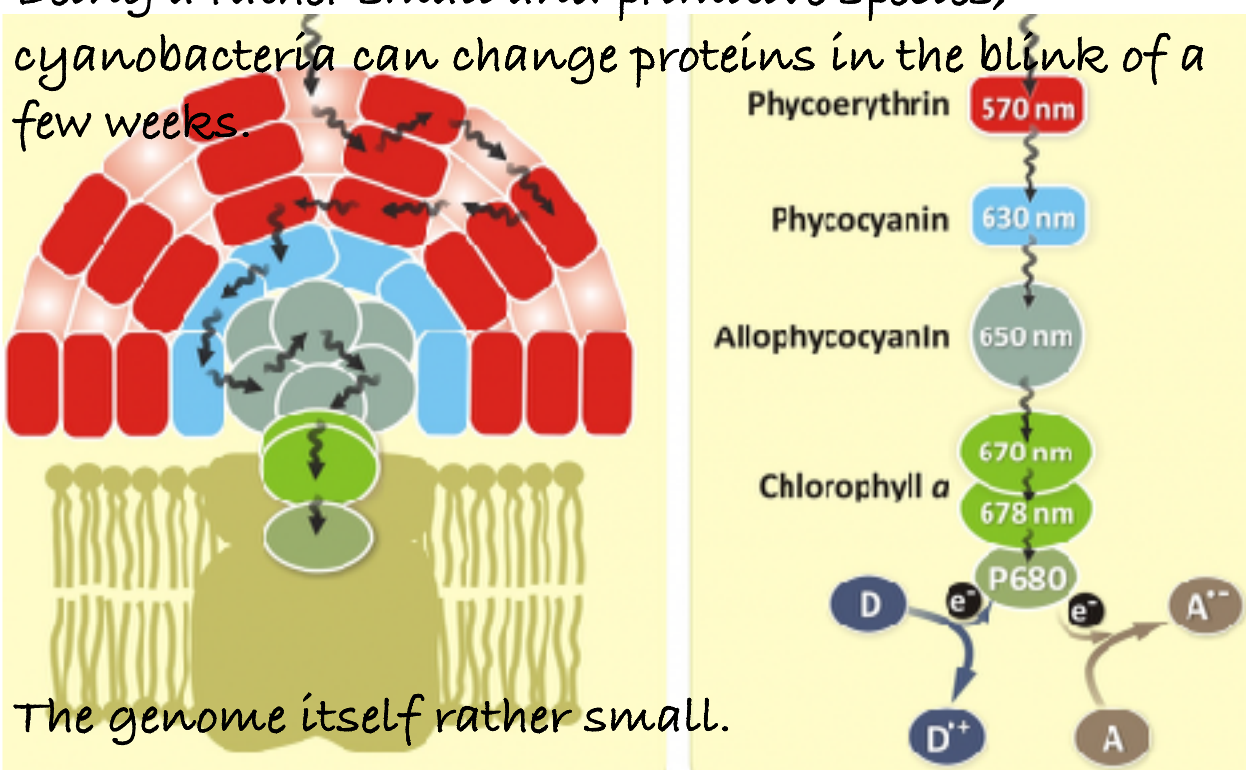


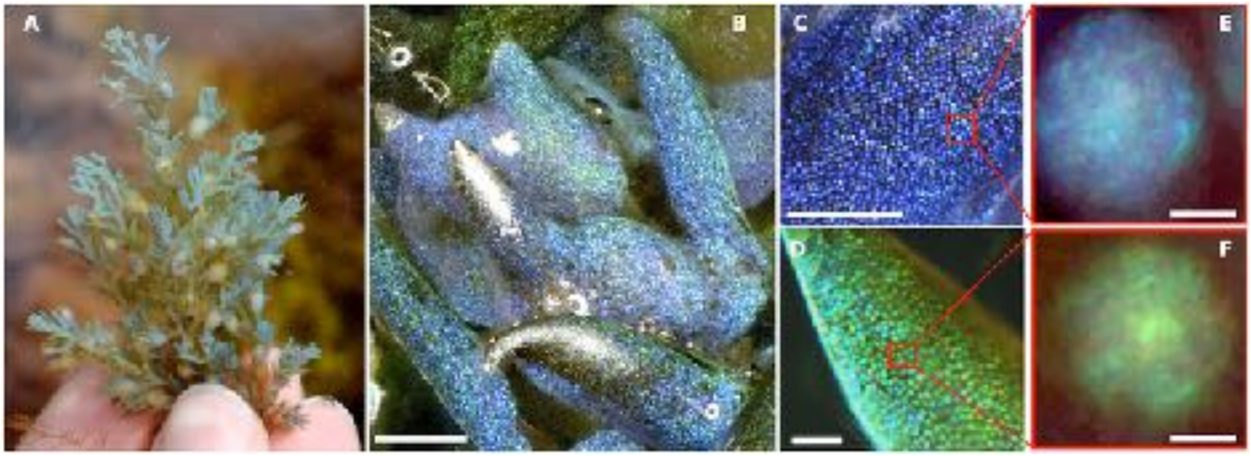
Fig. 2.17. Some common filamentous blue-green algae

Color in some of these monster mutations

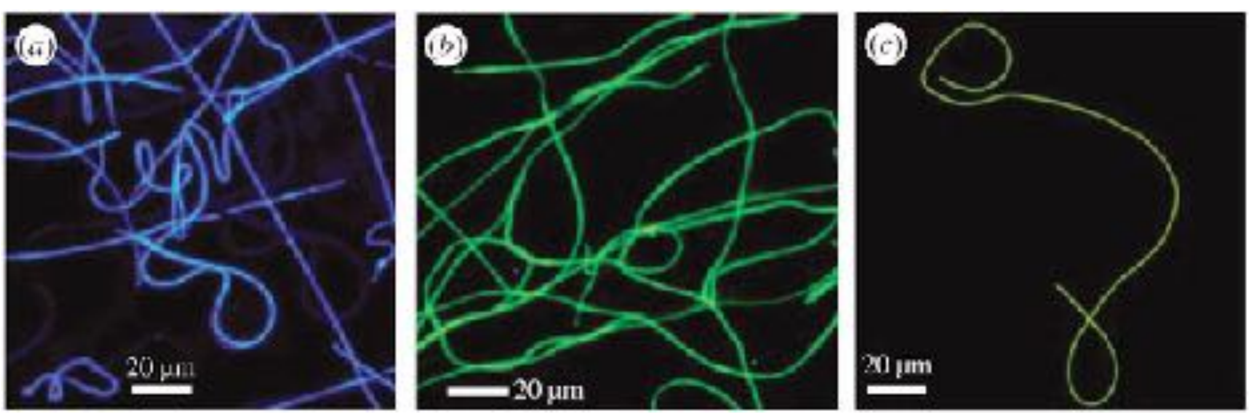
Being a rather small and primitive species, cyanobacteria can change proteins in the blink of a few weeks.



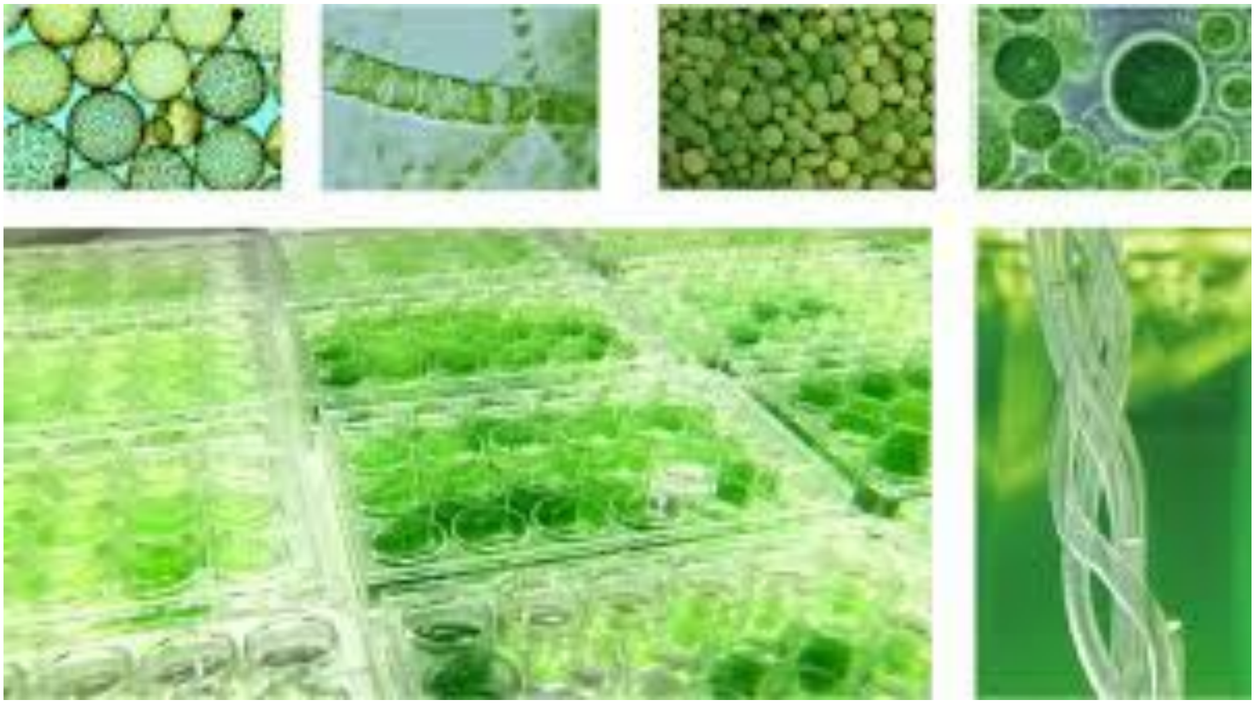
The genome itself rather small.



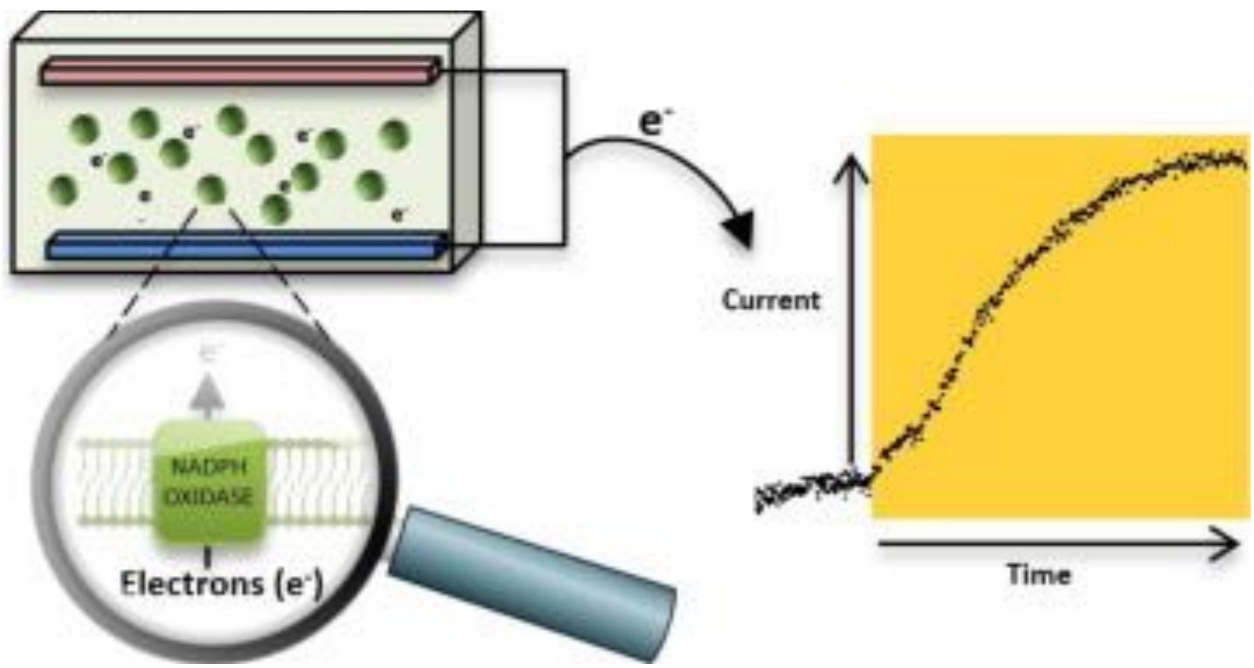
Two things can happen: with a slight decrease in light frequency, cyanobacteria can change colors and even increase oxygen production through the inability to continue into photosystem 2.



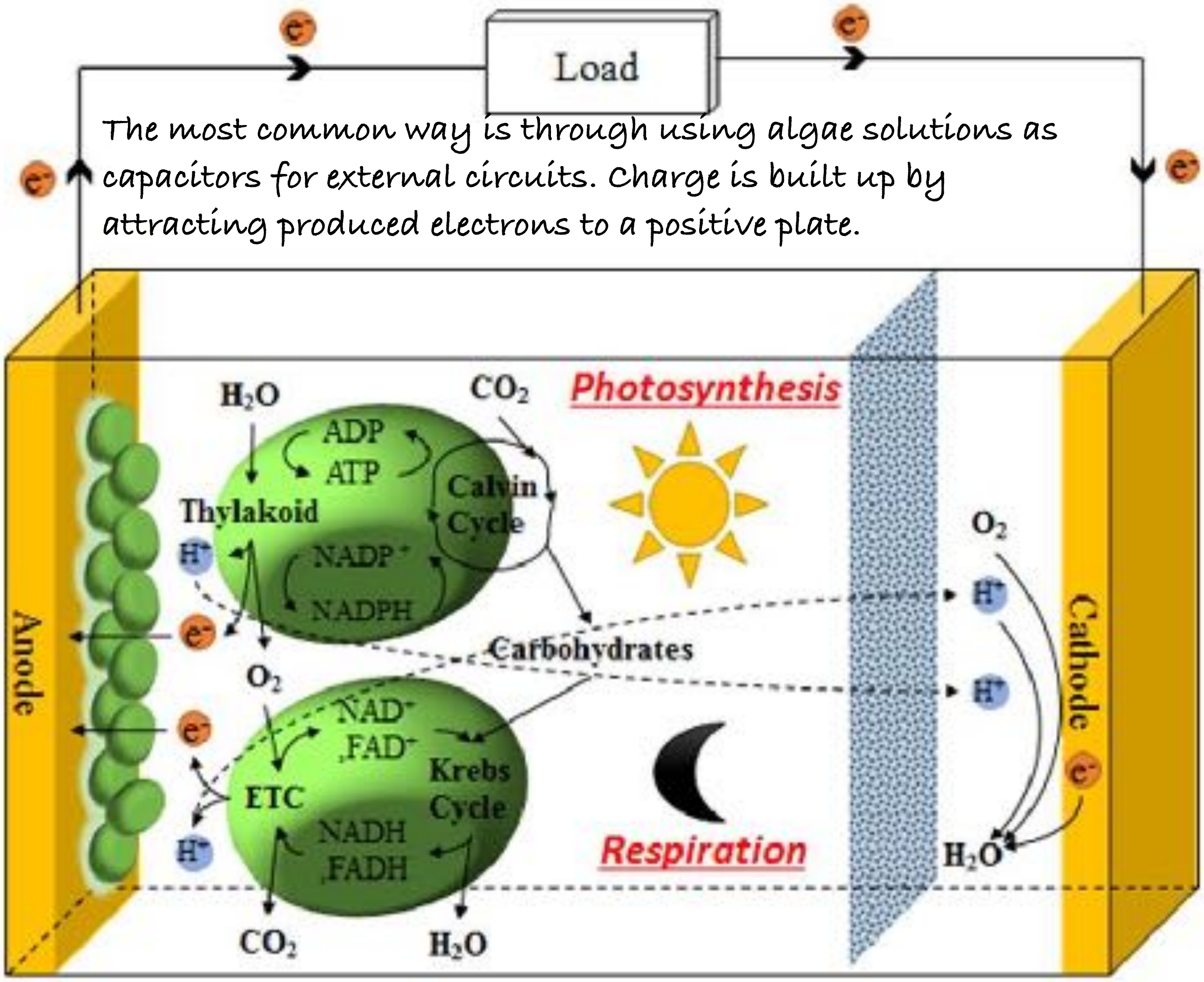
With drastic decreases in frequency, the energy rate is too high to be understood through enzymatic bonds. Instead, the bonds absorb and hold photons. This process is called photoluminescence.



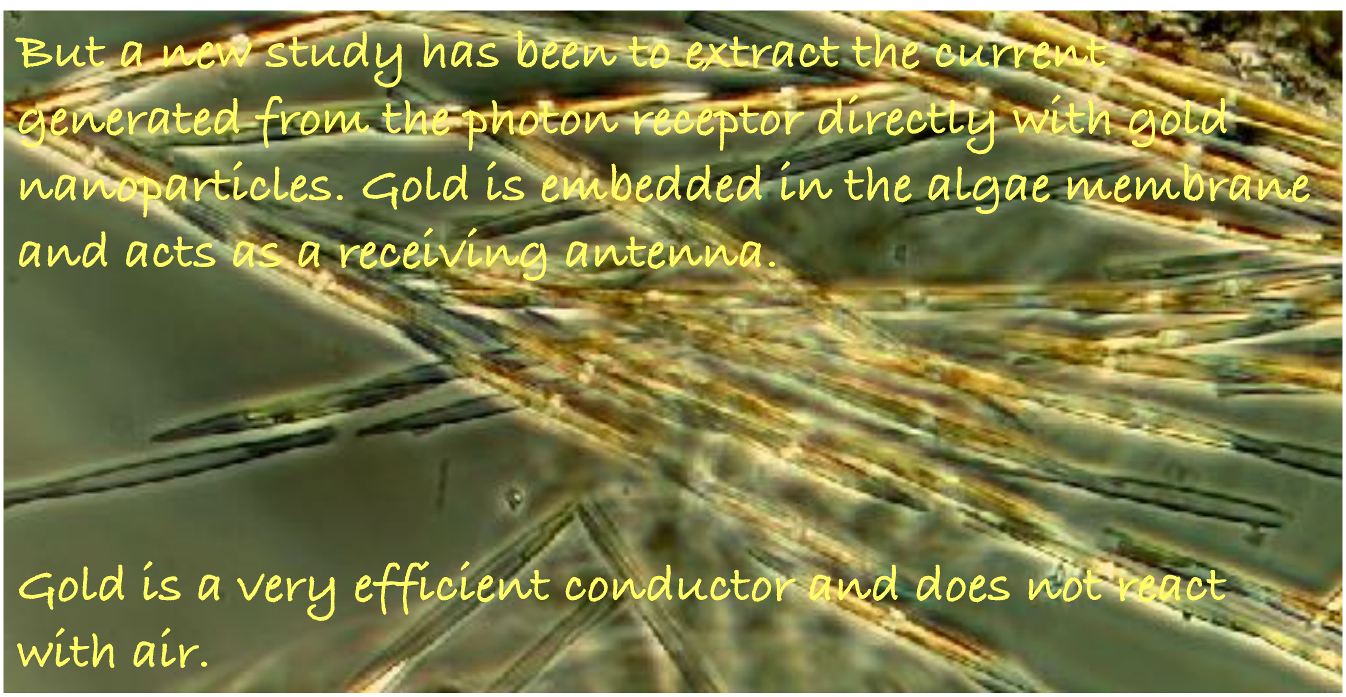
So, what is the solution?



Scientists have been working hard to harness the energy of algae.

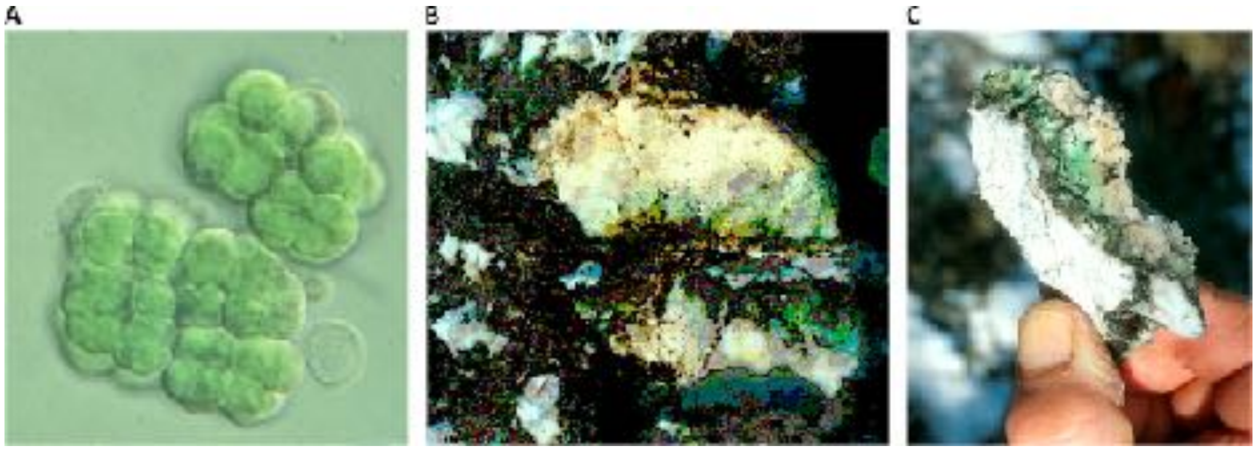


The most common way is through using algae solutions as capacitors for external circuits. Charge is built up by attracting produced electrons to a positive plate.

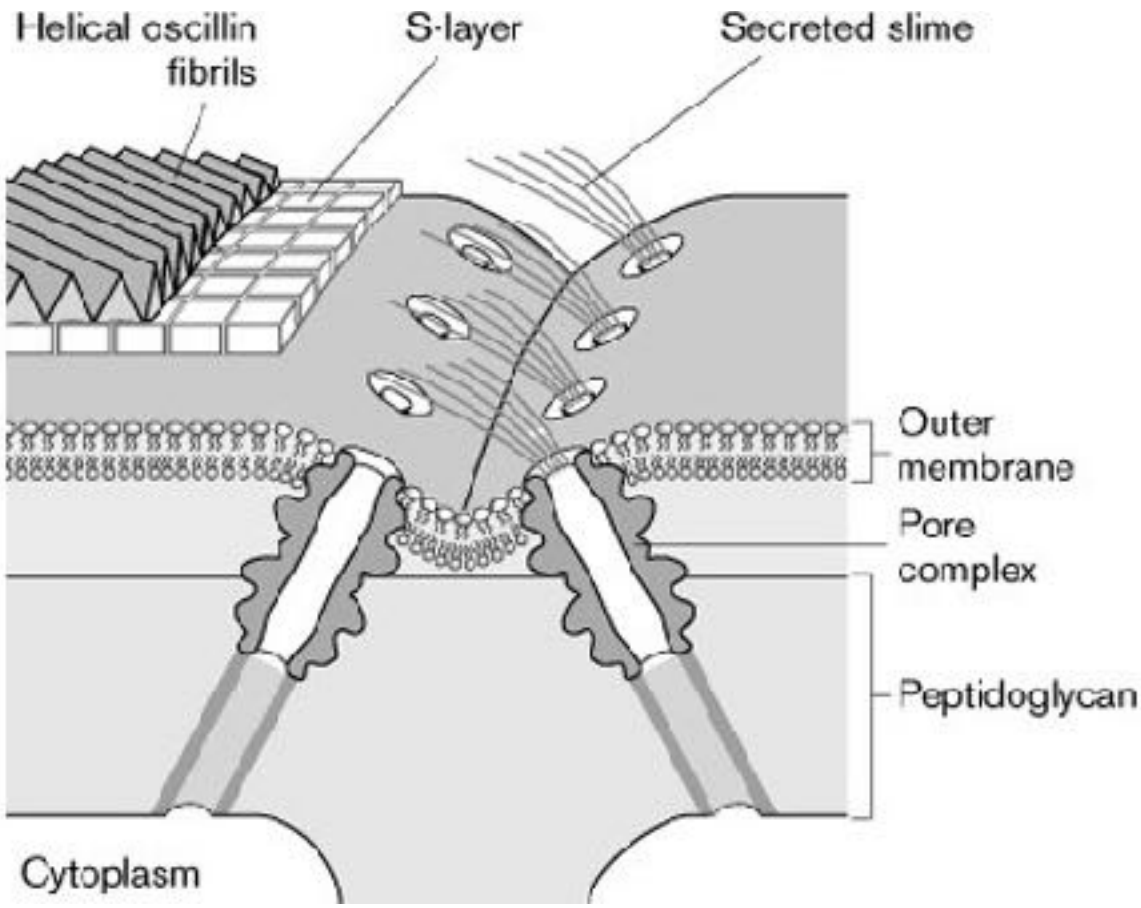


But a new study has been to extract the current generated from the photon receptor directly with gold nanoparticles. Gold is embedded in the algae membrane and acts as a receiving antenna.

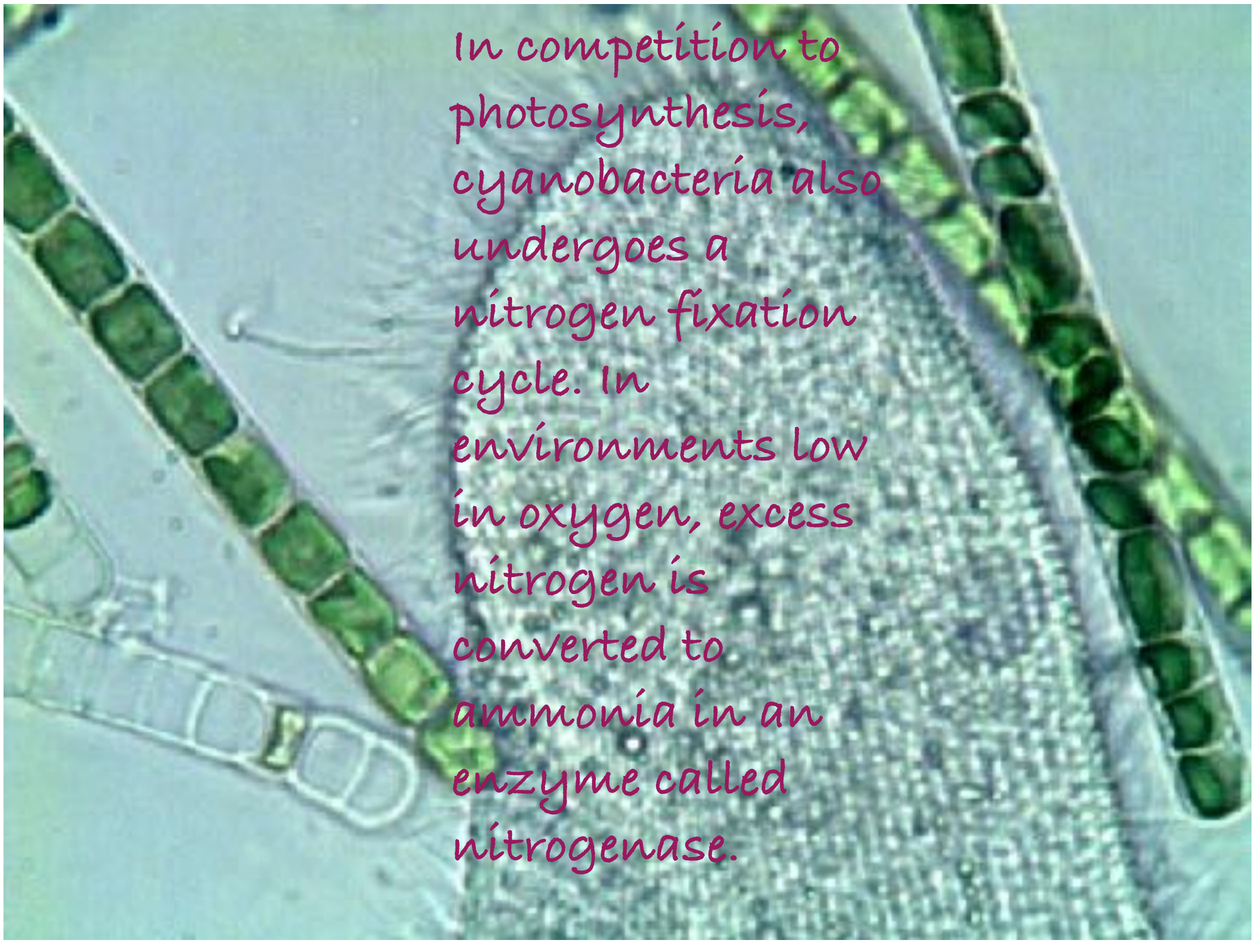
Gold is a very efficient conductor and does not react with air.



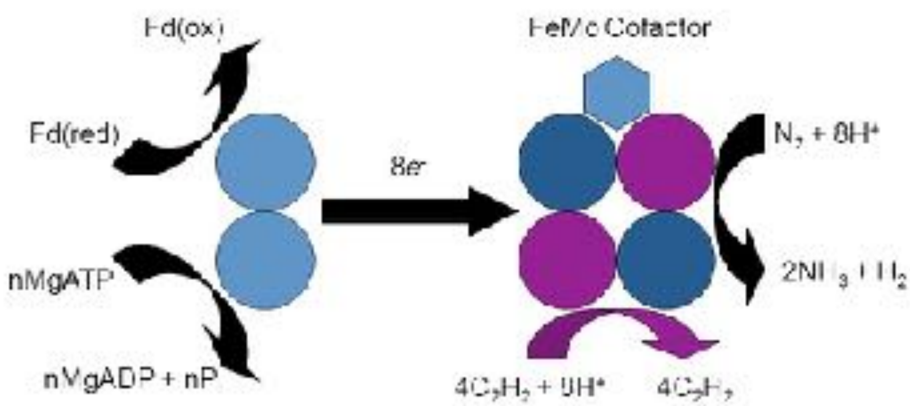
But scientists need to work fast! Photosynthesis is under pressure from the very environment it was started in.



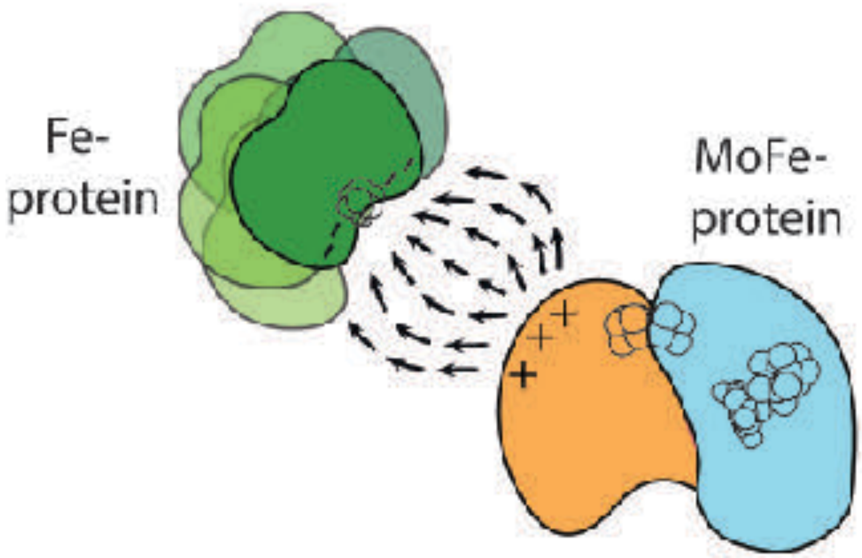
Here is where the action happens! Color this cell!



In competition to photosynthesis, cyanobacteria also undergoes a nitrogen fixation cycle. In environments low in oxygen, excess nitrogen is converted to ammonia in an enzyme called nitrogenase.



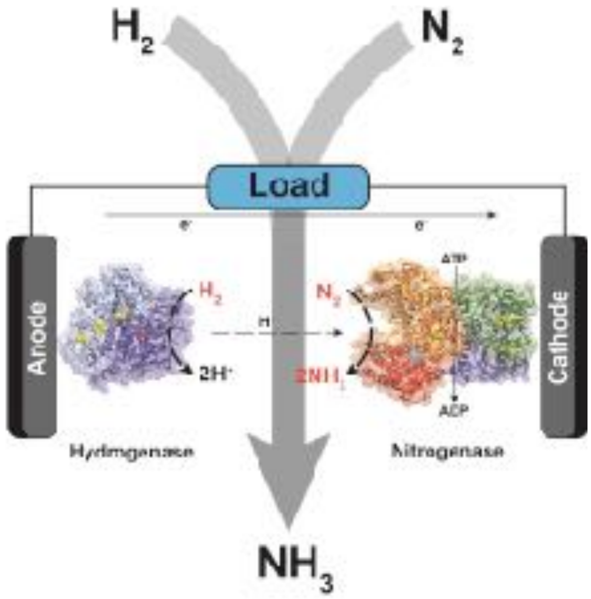
But, for nitrogenase to be activated, instead of light to create an activating current, it needs the reduction of ferredoxin to iron.



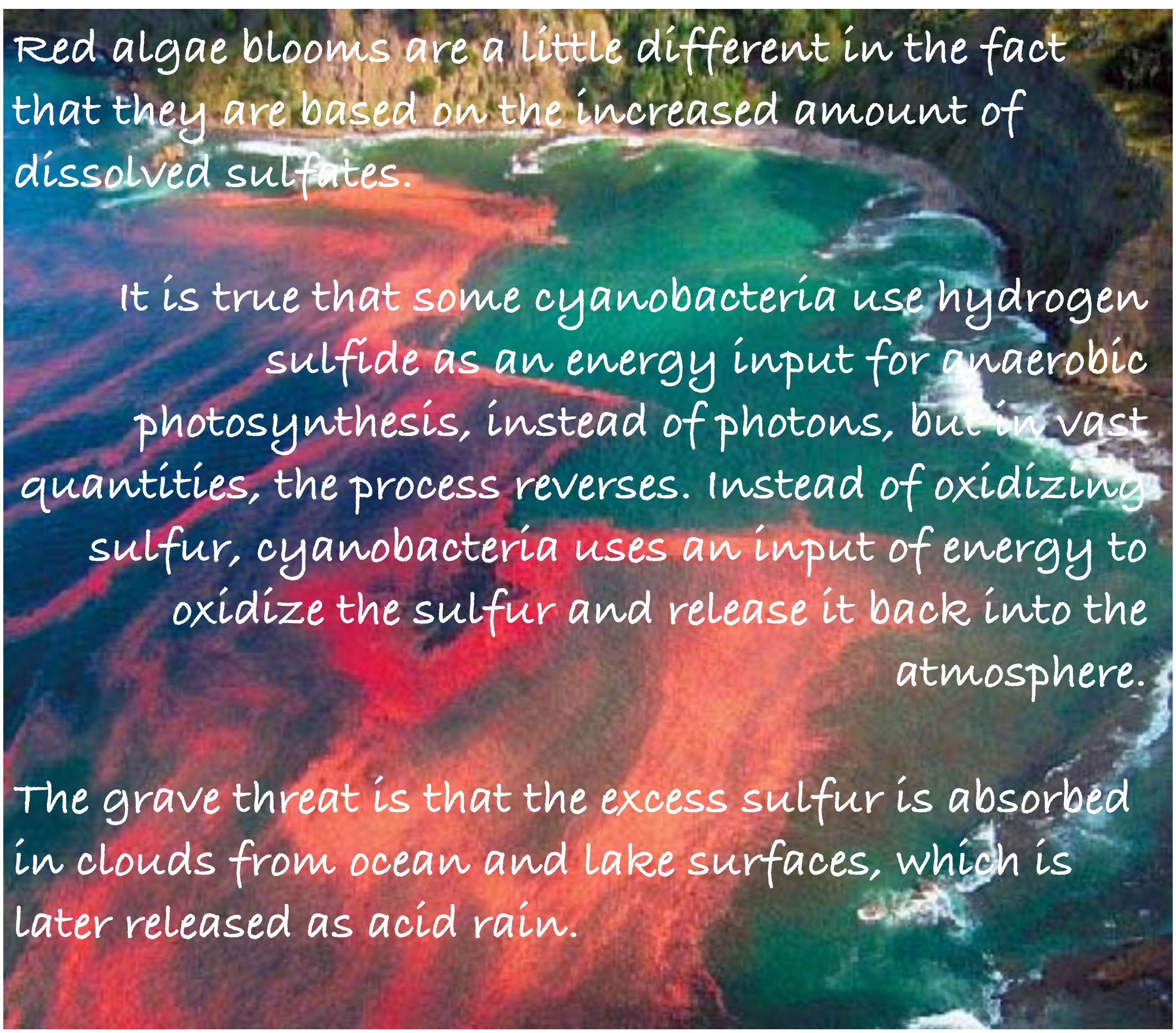
A signal from change in electric field is often times understood by the nitrogenase as the enzyme itself is slightly positive, while iron is slightly negative. Nitrogenase is a cathode in this reaction.

As seen with prior, this enzyme is also being used in bioreactors.

The Haber process is run under high heat and pressure.



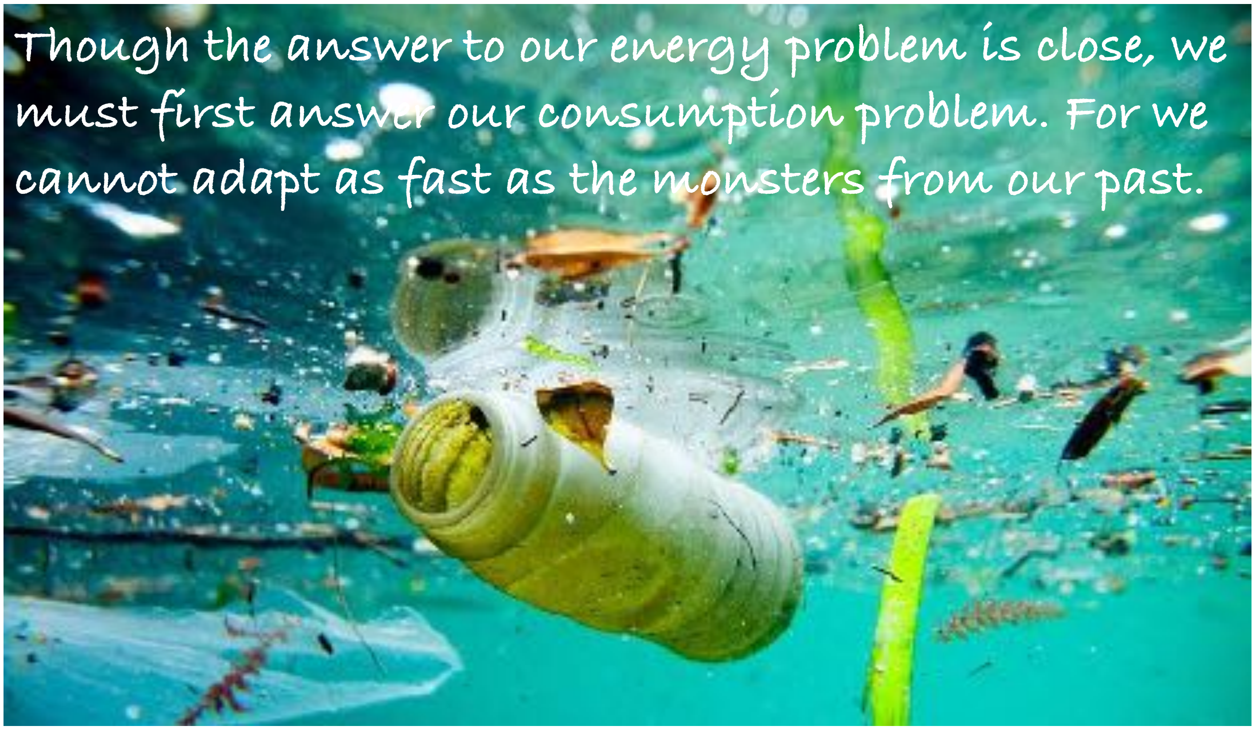
Genetic modifications with cyanobacteria have been performed to be less energy inefficient.



Red algae blooms are a little different in the fact that they are based on the increased amount of dissolved sulfates.

It is true that some cyanobacteria use hydrogen sulfide as an energy input for anaerobic photosynthesis, instead of photons, but in vast quantities, the process reverses. Instead of oxidizing sulfur, cyanobacteria uses an input of energy to oxidize the sulfur and release it back into the atmosphere.

The grave threat is that the excess sulfur is absorbed in clouds from ocean and lake surfaces, which is later released as acid rain.


Though the answer to our energy problem is close, we must first answer our consumption problem. For we cannot adapt as fast as the monsters from our past.