Green Power: God's solar power plants amaze chemists

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Green plants are a beautiful part of Earth's environment, and they are essential for life. God created them on the 3rd day of Creation Week (Genesis 1:10–13), before animals, and even before the sun.[1] At the beginning of creation, humans and all animals were herbivores (Genesis 1:29–30).

Even now, plants are the basis of the food chain, because they don't require their own food but make it from sunlight via photosynthesis. In this process, they also produce the oxygen (O_2) which is essential for all air-breathing life. Photosynthesis is therefore one of the most important chemical reactions on Earth. If we could duplicate it, it would probably solve all the world's energy problems. But even the most talented chemists have yet to match the ingenious machinery of the humble plant.

Water blasting problem

The key to photosynthesis is breaking up a molecule of water into hydrogen and oxygen. The hydrogen can then combine with CO_2 from the air to make sugars, which the plant (and herbivores) can use for food. All this occurs in the molecules called *chlorophylls*, which are responsible for the greenness of plants.

But breaking up water requires an enormous amount of energy—basically the amount released when hydrogen is burned to form water in the first place.

One problem is the very nature of light itself. Light is a form of energy, but it comes in 'packets' called *photons*. If the photon energy is not large enough to break the water molecule, then it won't matter how many of them there are (i.e. how bright the light is). But a photon that is energetic enough[2] to break water would also shatter most biological molecules in the process. Yet we don't see exploding leaves!

A few years ago, two chemists from Yale University, Gary Brudvig and Robert Crabtree, made an artificial system that managed to produce oxygen.[3] However, they had not worked out how to use light energy, so instead they used the chemical energy of powerful bleaches.[4] And even then, it produced only a hundred O_2 molecules before being destroyed. Yet it was a great achievement, by human standards, to make something that didn't fall apart immediately.[5]

Ingenious solution

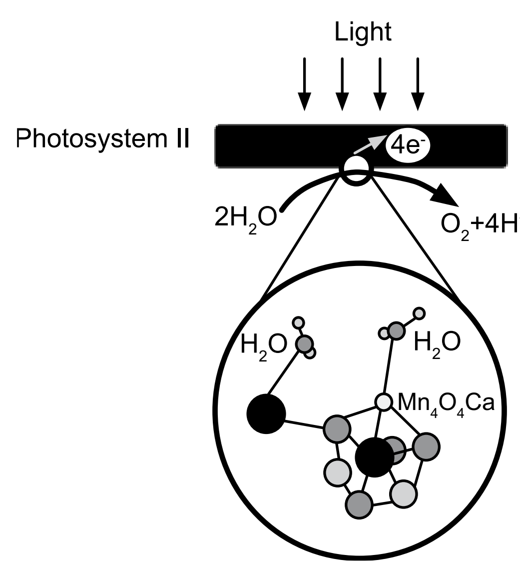
It turns out that there is a special assembly called Photosystem II (named because it was discovered second). A photon strikes this, and it is channelled into a type of chlorophyll called P680. There it knocks out an electron from an atom, and this energetic electron eventually helps make sugars from CO_2. But then, the P680 must replenish the lost electron. This is a big problem for artificial photosynthesis—chemists have also, so far, been unable to produce a system that replenishes the electrons knocked out by the photons. Photosynthesis would have quickly ground to a halt without this, so how are the electrons replaced?

They come from a special *catalytic core*, which removes the required electrons from water, again with the help of light. The light breaks two molecules of water into a molecule of oxygen, four electrons and four hydrogen ions.

The core has a unique arrangement of atoms, with an unusual cube of three atoms of Mn, one Ca and four O, attached to a single Mn. This core builds up enough energy, in the form of redox potential,[6] *in stages*, by absorbing four photons.

The redox potential of water is +2.5 V, while each photon raises the catalytic core's redox potential by 1 V. So after the third stage, there is enough energy for the single Mn to remove an electron from a water molecule, leaving an OH radical and H^+ ion. Then the catalytic core gets to the fourth stage, and provides the Mn atom with enough power to attack the OH radical and leaves a highly reactive O atom and another H^+ ion. At this moment, the Ca atom in the cube plays its essential role. It is holding another water molecule in just the right place, so it can be attacked by this O atom, producing an O_2 molecule, two more H^+ ions and two electrons.

The unique Mn_3CaO_4–Mn arrangement is present in all plants, algae and cyanobacteria, which suggests that this arrangement is essential. Not surprising, because it has to be able to store the energy from four photons, and hold water molecules in just the right positions. This structure had to be complete, otherwise it would not work at all—in splitting water and replenishing electrons. Therefore, it could not be built up gradually by small changes by natural selection. This is because an incomplete intermediate system is no use at all, so it would not



After *New Scientist* **182**(2445):30, 2004.

The catalytic core at the heart of photosynthesis, responsible for splitting the water molecule and releasing the oxygen we breathe

Photosynthesis occurs in most plants, including this Sabal Palmetto *(cabbage palm), which catches much sunlight in its fan-like leaves.*

be selected.

And even this core would be useless without many other coordinated features. For example, as above, the energy involved is damaging for biological molecules. Yet there are key proteins required which must be constantly repaired, so these mechanisms must be in place, too. In fact, instability of these proteins made it hard to work out the core's structure.[7]

If the most intelligent human designers can't duplicate photosynthesis, then it's perfectly scientific to believe that photosynthesis had a far more intelligent designer. This is especially so since Darwinian processes could not have generated photosynthesis, because there are too many intricate mechanisms necessary for it to work at all.[8]

Recent research indicates that there was oxygen even in the 'oldest' rocks on Earth, which evolutionists 'date' to 3.7 Ga.[9] This, in turn, suggests that there were green plants to produce it. However, evolutionists claim that the earth was being bombarded by meteorites till about 3.8 Ga.

Yet this latest research within the evolutionary paradigm shows that life existed almost as soon as the earth was able to support it. There is just no room for 'billions and billions of years' for life to evolve. And this life was not just the simplest type, but was advanced enough to photosynthesize.

Also, this research is devastating for chemical evolutionary theories of the origin of life.[10] The famous gas discharge experiments by Stanley Miller must exclude free oxygen, because oxygen destroys organic molecules, and makes them impossible to form in the first place. But if oxygen is as old as the oldest rocks, there is no geological evidence to support the hypothetical oxygen-free atmosphere required.

References

1. Leading early Christian writers, such as Basil the Great, pointed out that God's *real historical* creation of plants before the sun showed the futility of pagan sun worship. Jewish and Reformed writers likewise agreed that the sun was created on a literal 4th day. See Sarfati, J., *Refuting Compromise*, pp. 84–86, Master Books, Green Forest, AR, 2004.
2. The energy E is related to the frequency ν by E = hν, where h = Planck's Constant = 6.6262 x 10^{-34} Js. A photon energetic enough to break water would be in the ultraviolet region of the electromagnetic spectrum.
3. Burke, M., Green miracle, *New Scientist* **163**(2199):27–30, 1999.
4. Interestingly, humble single-celled organisms in the root nodules of legumes use a far better chemical energy mechanism to break apart the nitrogen molecule, even tougher than water. See Demick, D., The molecular sledgehammer, *Creation* **24**(2):52–53, 2002.
5. See ref. 3; *cf.* Plant energy miracle, *Creation* **22**(1):9, 1999.
6. Redox (reduction/oxidation) potential measures how strongly a molecule or ion attracts electrons. The more electron-loving, the more positive; the more electron-releasing, the more negative. Redox potential is measured in volts. Water's redox potential is high, so needs a very strong electron remover, such as an oxygen atom, to remove one of its electrons.
7. By X-ray crystallography—see Zouni, A. *et al.*, Crystal structure of photosystem II from *Synechococcus elongatus* at 3.8 Å resolution, *Nature* **409**(6821):739–743, 2001.
8. See also Swindell, R., Shining light on the evolution of photosynthesis, *TJ* **17**(3):74–84, 2003.
9. Rosing, M.T. and Frei, R., U-rich Archaean sea-floor sediments from Greenland—indications of >3,700 Ma oxygenic photosynthesis, *Earth and Planetary Science Letters* **217:** 237–244, 2004. The evidence was fairly indirect—certain carbon isotope ratios were typical of phytoplankton, and the presence of uranium suggested that it was transported in solution by oxidized ocean water.
10. See <www.answersingenesis.org/origin> for problems with chemical evolution.

Erratum *TJ* 17(3)

Article entitled *The sun is not an average star*: on p. 41, reference number 23 should have read 'Maran, S.P., When all hell breaks loose on the sun, astronomers scramble to understand, *Smithsonian* **20**(12):37, 1990.'