

Researchers find more evidence of quantum processes at work in photosynthesis

7 December 2011, by Bob Yirka

(PhysOrg.com) -- Researchers working together from the University of Chicago and Washington University in St. Louis, have found more evidence that suggests quantum effects are at play as plants use energy from the sun to turn carbon dioxide into organic compounds. As they write in their paper, published in the *Proceedings of the National Academy of Sciences*, there appears to be a link between coherence and the way energy flows in plants.

The team contrived an experiment based on prior research that has suggested, but not shown, a link between molecules separated in space that are able to interact with one another - but are not separated in time ([coherence](#)) and the way energy flows in plants that use [photosynthesis](#) to, in effect, create their own food from the air.

Prior to this new research, scientists have been able to observe coherence in the protein cells involved in harvesting light in certain bacteria, which appeared to last longer than it rightfully should have; first only at very cold temperatures, then later, in virtually all plants at room temperature. This caused physicists to theorize that there must be a very efficient system of transferring energy going on, whereby some means was allowing every conceivable chlorophyll path to be "mapped" simultaneously, allowing for a shortest route to be chosen before any processing actually began; hence the theorizing that [quantum effects](#) may be at work.

To find out for sure, the team studied the way lasers fluctuated as they moved through the antenna proteins, keeping track of the way the fluctuations shifted. In so doing they found an obvious link between the fluctuations and the way energy flowed that could easily be described by common trigonometric functions. This result means the team was able to demonstrate in a clear way, that coherence really is involved in the way that energy is transported during photosynthesis, which

means that as far as photosynthesis is concerned, micro-biologists are likely going to have to go back and take a new fresh look at what is really going on in a process that was up till now, thought to be rather well understood.

The research team, led by Greg Engel, sum up their findings by succinctly noting that the simple protein cells found in plants obviously play a more vital role in photosynthesis than anyone previously thought.

More information: G. Panitchayangkoon, D.V. Voronine, D. Abramavicius, J.R. Caram, N. Lewis, S. Mukamel, and G.S. Engel, "Direct Evidence of Quantum Transport in Photosynthetic Light-harvesting Complexes." *PNAS* (accepted) 2011

The Engel group page:
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via [Wired](#)

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APA citation: Researchers find more evidence of quantum processes at work in photosynthesis (2011, December 7) retrieved 31 October 2020 from <https://phys.org/news/2011-12-evidence-quantum-photosynthesis.html>

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