Re-inventing nature for cheaper solar power

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A research team in Sydney has created molecules that mimic those in plants which harvest light and power life on Earth.

“A leaf is an amazingly cheap and efficient solar cell,” says Dr Deanna D’Alessandro, a postdoctoral researcher in the Molecular Electronics Group at the University of Sydney. “The best leaves can harvest 30 to 40 percent of the light falling on them. The best solar cells we can build are between 15 and 20 percent efficient, and expensive to make.”

“We’ve recreated some of the key systems that plants use in photosynthesis,” says Deanna.

Bacteria and green plants use photosynthesis to convert light energy into usable chemical energy. Wheel-shaped arrays of molecules called porphyrins collect light and transfer it to the hub where chemical reactions use the light energy to convert carbon dioxide into energy-rich sugar and oxygen.

“This process, which occurs in about 40 trillionths of a second is fundamental to photosynthesis and is at the base of the food chain for almost all life on Earth,” says Deanna.

“We have been able to construct synthetic porphyrins. More than 100 of them can be assembled around a tree-like core called a dendrimer to mimic the wheel-shaped arrangement in natural photosynthetic systems.”

These molecules designed by the team are about 1 billionth the size of a

soccer ball. But the large number of porphyrins in a single molecule means that a significant amount of light can be captured and converted to electrical energy – just like in nature.

“Since they are so efficient at storing energy, we think they could also be used as batteries – replacing the metal-based batteries that our high technology devices depend on today,” Deanna says.

“Our preliminary results are very promising. We are still in the early stages of building practical solar energy devices using our molecules,” said Deanna. “The challenge is immense, but is crucial to providing alternative energy solutions for Australia and the world.”

Now they’ve made the molecules, the team along with their Japanese collaborators at Osaka University are working to combine them in the equivalent of a plant cell. Then, over the next five years they will attempt to scale up the technology to commercial scale solar panels.

Source: Science in Public