findings represent a link between the synthetic polymer and its biological use: polymer particles are produced that are compatible with the aqueous environment in living organisms, have readily accessible binding sites for the target, and are able, like real antibodies, to neutralize its toxic effect. Despite this leap forward and the concurrent interest from industry regarding the commercial opportunities for MIPs, the proof of principle reported here is probably insufficient for future investment. What remains to be demonstrated is the general applicability of the approach, providing affinity and selectivity of MIPs for their targets under practical conditions, for example, in biological fluids and tissues. Other criteria, such as the integration of molecular imprinting within existing industrial fabrication processes, yields, costs, and the competitiveness of MIPs with existing affinity materials are equally important.

Although the main opportunities for MIP technology remain in analytical chemistry for now, hopefully these findings will encourage similar research in the field of biomedicine. Undisputedly, this remains a beautiful example of biomimicry. ❐

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MATERIAL WITNESS

QUANTUM LEAVES IN FACT AND FICTION

PHILIP BALL

"How your average leaf transfers energy from one molecular system to another is nothing short of a miracle. Quantum coherence is key to the efficiency, with the system sampling all the energy pathways all at once. And the way nanotechnology is heading, we could copy this with the right materials… ." This quote comes not from a grant proposal, but from Ian McEwan's latest novel *Solar* (Jonathan Cape, 2010), in which a young researcher at the fictional National Centre for Renewable Energy in the UK proposes to use quantum effects to improve the efficiency of photocatalytic water splitting, ushering in the vaunted hydrogen economy. As the 'McGuffin' for a tragicomedy set against the backdrop of energy research and global warming, it is an impressively well motivated idea.

McEwan is renowned for doing his scientific homework, and here he has evidently come across recent work[1,2] demonstrating that quantum coherence is used to assist energy transfer in the antennae of the light-harvesting complex of photosystem II (PS II). This protein–pigment complex converts light absorption into electron flow, initiating the photoelectrochemical processes that split water and drive the synthesis of the energy-storage molecule adenosine triphosphate (ATP).

Quantum coherence refers here to the way that electronically excited quantum states of the pigment chromophores called excitons maintain a correlated phase relationship for long enough to assist transfer of the excitation energy towards the reaction centre, where an electron is ejected from chlorophyll. These quantum dynamics depend on the precise nanoscale arrangement of the pigment molecules.

Quantum coherence is precisely what is sought in quantum computers, as it allows the creation of superposition states of quantum bits (qubits) that provide extra channels for storing and processing information, which are not available to classical devices. But in the technological prototypes produced so far, quantum coherence typically requires the physical carriers of qubits — electromagnetically trapped atoms or ions, for example — to be kept ultracold. Otherwise, interactions with the disorderly environment quickly destroy the coherence. Yet remarkably, in PS II coherence is maintained at room temperature for long enough to make the efficiency of the energy-transfer process almost perfect.

That, at least, is the assumption, for the earlier experiments were done only at cryogenic temperatures (77 K). But now Engel and co-workers have shown that at physiological temperatures (277 K), the coherence does indeed survive for at least 300 fs, which is long enough to be biologically relevant[3]. Meanwhile, Fleming *et al.* have shown that polarized electronic spectroscopy can be used to map out the excitation energies of each chromophore in the antenna array, determining the spatial, orientational and energetic factors that enable the quantum effect to operate so well[4].

Can this trick really be enlisted for solar-energy generation? Energy conversion efficiency is certainly high on the agenda for photovoltaics — very recently, a new record efficiency was claimed for one class of thin-film cell using layered semiconductors[5]. And mimicking photosynthesis in artificial nanostructures has a strong pedigree in solar-cell technology[6]. McEwan won't be the first to spot the technological potential, but it's a fair bet he has more readers than *Nature*. ❐

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