NANOSTRUCTURES

Blind to blue

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The colours observed in many organisms are due to the absorption of certain wavelengths of light by pigments and/or light scattering from nanostructures. Because most of these colours evolve through both sexual and natural selection, it is difficult to study how colour evolves in natural populations. To exclude the influence of sexual selection, Bor-Kai Hsiung and colleagues have now used tarantulas with limited visual function to show that the blue reflectance is evolutionarily conserved despite them having a diverse set of nanostructures.

The researchers — who are based at the University of Akron and the University of California, San Diego — surveyed the colours of several genus of tarantulas and found that blue is more common than green. Looking closely at specialized hairs on these tarantulas using electron microscopy, they found at least three different morphologies: smooth cylindrical hairs, irregular blade-like protruding hairs, and symmetric lobe-like protrusions. Beneath the cortex of the hairs were nanostructures that had either quasi-ordered spongy structures, or organized multilayered structures. The blue hairs from different tarantulas showed reflectance peaks distributed around 450 nm, and had very little iridescence. Theoretical modelling confirmed that the blue colour is due to both the quasi-ordered and multilayered structures. Given the poor visual acuity and the lack of visual courtship in tarantulas, the blue colour is not a sexual signal and its function remains unknown.

Hsiung and colleagues suggest that understanding the evolution of structural colour under natural selection could help in the design of new photonic nanostructures. *ALC*

NANOTECHNOLOGY AND FOOD

What people think

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For an emerging technology to have a constructive impact on society it is important to understand how society perceives its potential benefits and risks. For example, if nanotechnology is going to be used in the food industry, it is essential to appreciate whether potential consumers would accept nanotechnology food products and whether they would be willing to pay for them. Unfortunately, there are only a limited number of studies aimed at exploring these aspects. Emma Giles and colleagues from Teesside University and the University of Newcastle have now performed an extensive review of existing literature on the topic to draw a comprehensive picture of the current situation.

The researchers assessed 32 papers, and 8 main themes were identified, including the benefits and risks of nanotechnology in food, the variations in perception due to social or demographic influences, and the level of information that the public has access to. The assessment suggests that overall the public is more willing to accept the use of nanotechnology in food packaging, rather than in food. However, the use of nanotechnology in food production does not seem to have the type of negative reaction from the public that might have been anticipated in light of the rejection of other food processing technologies such as genetic modification. While these overall conclusions seem clear, the study also reveals a need for more structured and detailed work to explore which benefits of nanotechnology in food the public is aware of, as well as what they understand to be the risks. *FP*

PHOTOVOLTAICS

Self-cleaning solar cells

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The central component of a solar cell is the absorber layer, and the more photons that can hit this layer, the more power the cell will generate. However, regardless of its intrinsic absorption ability, the efficiency of a solar panel will deteriorate over time due to the accumulation of dust and dirt on its surface. Kun-Yu Lai, Jr-Hau He and colleagues from KAUST and the National Central University in Taiwan have now developed high-efficiency silicon solar cells that offer excellent self-cleaning capabilities.

The researchers enhanced the performance and lifetime of the cells by covering the devices with nanostructured packaging glass. In particular, hierarchical nanostructures were created on the surface of the glass by combining large honeycomb nanowalls with ultrathin nanorods. The dimensions of these structures were specifically selected to maximize the overall light absorption efficiency: the nanorods serve to reduce the surface reflectance and facilitate light penetration into the cell; the honeycomb structures enhance photon absorption by acting as effective scattering centres. Furthermore, due to its extreme hydrophobicity, the nanostructured packaging glass efficiently repels dust particles, preventing drops in efficiency over time. *OB*

SELF-ASSEMBLY

Frozen forms

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There are numerous ways to synthesize nanostructures, from top-down lithographic techniques to bottom-up chemical self-assembly. However, these methods struggle to provide the levels of control and sophistication that can be found in biological systems and new approaches are constantly sought. Stoyan Smoukov and colleagues from the University of Cambridge and Sofia University have now shown that complex structures can be formed by simply cooling droplets of oil.

The researchers used droplets of linear alkanes with 14–20 carbon atoms, which were dispersed in water with the help of surfactant molecules. By slowly cooling the samples, the spherical droplets transformed into a series of different micro- and nanoscale shapes, including regular octahedra, hexagonal platelets, triangular platelets and, ultimately, thin fibres. The shapes formed were dependent on the cooling rate, the initial droplet size, and the type of surfactant used, and each could be selectively frozen into the corresponding solid structure.

The droplet transformations are due to an internal phase-transition process. In particular, before freezing, the alkanes form a series of metastable plastic 'rotator' phases in which the molecules have long-range translational order, but rotate freely around their long axis; thin layers of these rotator phases are formed next to the surface of the drops and drive the transformations observed. *OV*

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