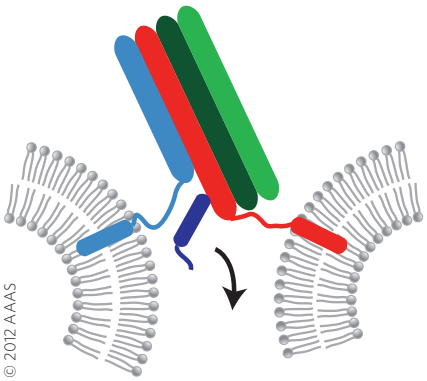
SNAREd bilayers

Science **336,** 1581–1584 (2012)



In neurons, neurotransmitter vesicles release their cargo at the synapse, a necessary step in the propagation of nerve signals. For this, the vesicles must first dock near release sites and then fuse with the presynaptic membrane — the membrane that faces the receiving cell. This process is known to be mediated by the SNARE (soluble *N*-ethylmaleimide-sensitive factor attachment protein receptor) family of membrane-bound proteins, each consisting of four-helix bundles that can assemble into complexes in a zipper-like manner. However, how the assembly of SNARE complexes in apposed lipid bilayers leads to docking, fusion intermediates and ultimately fusion of the vesicles remains unclear. Now, Javier Hernandez and colleagues perturbed the assembly of purified SNAREs reconstituted in liposomes to be able to arrest membrane-fusion intermediates. Their observations lead them to conclude that bilayer docking results from partial SNARE zippering, and that further zippering pulls the bilayers tighter, straining the lipids at the edges of an extended docking area. The researchers suggest that such an extended docking configuration is an intermediate state that initiates fusion. *PP*

Shaken lasers

Phys. Rev. Lett. **108,** 248002 (2012)

Unlike most other lasers that use mirrors to confine light into the active region of the laser, random lasers trap light through disorder, where the light is scattered by the random structures of the laser medium. Thus, stimulated emission can occur as in any other laser. Viola Folli and colleagues have now studied how a random laser made with small metal spheres is influenced when these are shaken. The metal spheres are immersed in an organic dye solution that is the active laser medium. When this set-up is excited by an external pump light, the random laser emits light at 600 nm wavelength. If the spheres are shaken at this point, a weaker second laser peak at 620 nm appears for some single camera shots. This suggests a favourable arrangement of a number of the spheres that for brief moments can support a second lasing mode. Further study of this effect promises insight into the dynamics of granular matter and random lasers. *JH*

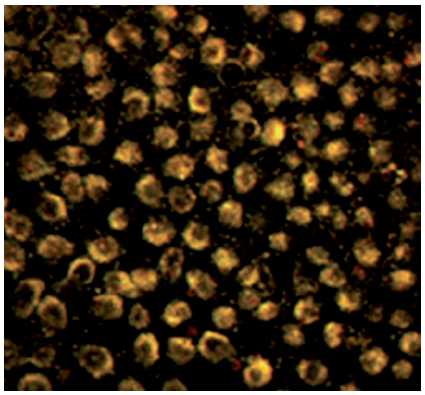
Dense and strong

Adv. Mater. **24,** 3692–3696 (2012)

Flexible organic electronic devices, which are generally sensitive to moisture and oxygen, need to be protected by mechanically strong barrier layers with low gas permeability to achieve both long-term stability and durability. Inorganic coatings are impermeable but brittle, whereas many polymer coatings do not offer sufficient protection from the ambient atmosphere. Karen Gleason and co-workers now report a route towards flexible, strong and oxygen-impermeable polymer coatings that could find applications in the protection of electronic devices. The researchers prepare films of an alternating copolymer of 4-aminostyrene and maleic anhydride by initiated chemical vapour deposition. Through chemical control, this process enables the slow deposition of uniform films even on non-planar substrates. During gentle heating, the amino groups can subsequently react with the anhydride groups in the copolymer to form a dense network of crosslinks. Compared with standard polymers, the final material shows significantly enhanced strength and scratch resistance as well as reduced oxygen permeation, which the researchers attribute to near-ideal molecular interconnectivity. *CM*

A flare for cancer

Angew. Chem. Int. Ed. http://doi.org/fz5db8 (2012)



The early diagnosis of cancer — for example, the identification of intracellular gene expression abnormalities — is critical to increase survival rates. Multiple tumour-related messenger RNAs (mRNAs) are often present at initial disease stages but methods so far have focused on single mRNA detection. Now, Bo Tang and colleagues report nanoprobes that can simultaneously detect three intracellular tumour-related mRNAs in living cells. The nanoprobes consist of gold nanoparticles functionalized with oligonucleotides hybridized to three reporter sequences with different dye molecules attached. The dyes' fluorescence is quenched in this configuration; however, in the presence of the three tumour-related mRNAs the recognition sequences present on the oligonucleotides hybridize with the mRNA targets and the dye-containing sequences are released, producing fluorescence signals. The nanoprobe can detect the presence of the three target mRNAs in human breast and liver cancer cells, and can discriminate between cancer cells and normal cells. The fluorescence intensity of the signals correlates with the concentration of the mRNA targets, and drug-induced changes in gene expression levels within cancer cells can be detected. *AS*

A marine makeover

Nature Nanotech. http://doi.org/h23 (2012)

The build-up of marine microorganisms on surfaces in contact with seawater is not only a problem for the object itself, for example a boat's hull, but there are also knock-on environmental effects. Materials that prevent the adhesion of, but are not toxic to, marine microorganisms are therefore of great commercial interest. Now, Wolfgang Tremel and colleagues report that surfaces coated with vanadium pentoxide (V_2O_5) nanowires show strong antibacterial activity, to both Gram-negative and Gram-positive bacteria, and prevent marine biofouling. The nanowires are less toxic than other chemical compounds already approved for use by the International Maritime Organization. The mechanism behind the biofouling properties of the V_2O_5 nanowires is similar to naturally occurring vanadium haloperoxidases — enzymes that prevent biofilm formation on seaweed. The antibacterial activity of the nanowires is preserved when formulated in paint, and a stainless steel plate covered with the nanowires remains without any biofouling when placed on a boat hull in seawater for 60 days, whereas control plates with commercially available paint become covered with marine life. *AS*

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