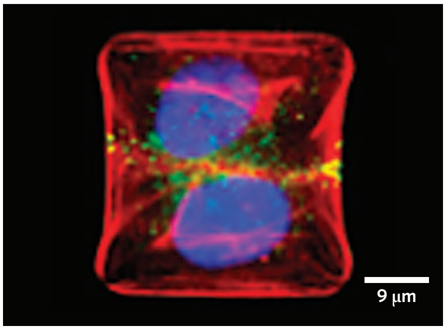
Tension at cell–cell junctions

Proc. Natl Acad. Sci. USA **109,** 1506–1511 (2012)



The extracellular matrix (ECM) is a dynamic, heterogeneous scaffold known to regulate many aspects of cellular behaviour, such as cell shape, cell migration, stem-cell differentiation, and cell–cell junction remodelling. Now, experiments show that the spatial distribution of the ECM can also regulate the positioning of cells. By imaging cell doublets (formed by daughter cells after mitosis) placed on predesigned ECM micropatterns, Qingzong Tseng and colleagues found that the cells move so as to place their intercellular junction above regions deprived of ECM. Moreover, traction-force measurements revealed that the ECM also controls the magnitude of intra- and intercellular forces. Using numerical simulations of a model of cell adhesion and contractility, the authors suggest that cells organize their relative position to minimize tension. Although the mechanism by which the ECM modulates such forces still needs to be determined, ECM-induced cell–cell junction positioning could explain processes occurring during the morphogenesis of (cell-packed) epithelial tissues, such as the relocalization of intercellular junctions away from the ECM in tubulogenesis. *PP*

Protein stopwatches

Nano Lett. http://doi.org/hpx (2012)

The strong enhancement of light fields by surface plasmons in metallic nanostructures has been widely used for label-free molecular-sensing applications down to the single-molecule limit. A significant advance in the capability of such sensors has now been achieved by Carsten Sönnichsen and colleagues, who demonstrate single-molecule detection with high-temporal resolution by measuring small shifts in the plasmon resonance of a single gold nanorod when a protein binds to its surface. The experimental set-up is straightforward and involves measuring the light scattered by a gold nanorod. Because the nanorods are kept stationary within a glass capillary, any changes in plasmon resonance can be tracked on the millisecond scale. This way, the authors could conclusively identify several single-molecule binding incidents of the blood plasma protein fibronectin. By varying the nanorod size the sensitivity could be further enhanced towards the detection of smaller molecules. Even though the identification of proteins in mixed solutions has not been shown, such experiments could represent a valuable strategy towards resolving the dynamics of protein binding events on surfaces. *JH*

One by one

Phys. Rev. Lett. **108,** 016101 (2012)

Charge-stabilized colloidal particles are in a delicate balance of attractive and repulsive interactions; variations in the particles' surface charge can lead to changes in interparticle distance and the destabilization of a colloidal suspension. Understanding charge transfer at the solid/liquid interface is not only of fundamental but also of practical importance, for example in applications such as electrophoretic inks. Filip Beunis and colleagues now reveal the charging dynamics of poly(methyl methacrylate) microspheres in dodecane using an improved optical tracking method. The researchers trap a microsphere with optical tweezers and record its oscillatory motion in a varying electric field. Sampling the oscillation amplitude at a high rate enables the researchers to detect charging in steps of the elementary charge and to study the dynamics of the process. They propose that charging is mediated by a few tens of surface sites on the microspheres. The researchers suggest that, with further improvements, their method could also be used to study charging in polar liquids. *CM*

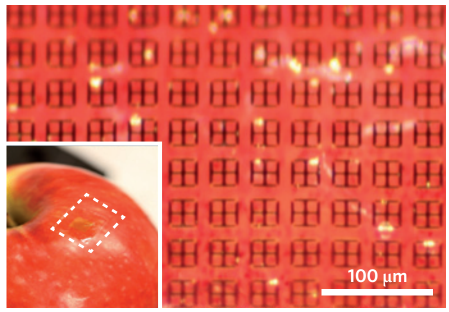
Stripy graphene

Nano Lett. http://doi.org/hp4 (2012)

Finding a facile route for the growth of large-area graphene sheets seems to be the most important challenge before this material can be used in commercial electronic devices. But what should not be underestimated is the necessity of patterning these large sheets in a scalable way. Tae Young Kim and colleagues demonstrated a patterning technique based on the so-called evaporation-induced self-assembly method. A single layer of graphene was laid on a substrate and placed in a poly(methyl methacrylate) (PMMA) solution. A cylinder was then rolled on the surface while the PMMA evaporated. During the rolling, the contact line between the cylinder, PMMA and graphene alternated between pinning and capillarity, effectively leaving equidistant stripes of non-evaporated PMMA, which protected the underlying graphene. Finally, simple plasma etching of the unprotected graphene and removal of the left-over PMMA left equidistant stripes of graphene behind. The team fabricated field-effect transistors using the graphene stripes and observed characteristics comparable with those of commercial devices. The approach is possibly the simplest non-lithographic technique proposed so far, and could lead to easily scalable patterning of large-area graphene. *FP*

Ready to eat

Adv. Mater. http://doi.org/dnp393 (2012)



A tiny sensor may soon be able to tell you if the food you are about to eat is safe for consumption, as Fiorenzo Omenetto and collaborators show in a proof-of-principle demonstration. They monitored the ripening of fruit, the bacterial contamination of a piece of cheese and the spoilage of milk by placing their sensor — essentially a nano- or micro-receiver antenna — in intimate contact with the food. The resonance frequency of the antenna, which can be tuned in the megahertz to terahertz range, depends on the chemical and physical properties of the surrounding environment, allowing the design of experiments for monitoring the quality of the food over time. The electronic circuit of the device is made out of gold imprinted on top of an all-protein silk substrate. The silk confers both the robustness and flexibility necessary for the antenna to withstand handling and conform to the food surface. The device adheres onto the food by activation of the bottom surface by water vapours, which is then deposited in place by gentle pressure. Biodegradable, potentially edible sensors, such as this one, may offer a convenient way to directly monitor the quality of individual food items remotely. *AM*

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