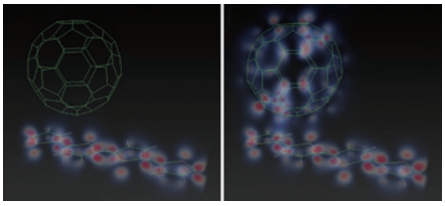
Durable delivery

Nature Nanotech. http://doi.org/s3p (2014)

The concurrent silencing of multiple genes requires highly efficient siRNA delivery and, until now, has only been observed in hepatocytes. Now, Daniel Anderson and colleagues demonstrate the efficient delivery of siRNA to endothelium, both *in vitro* and *in vivo*, using a polymer–lipid nanoparticle delivery system. These siRNA-loaded nanoparticles simultaneously silence five endothelial genes and reduce endothelial gene expression by 90% at low doses (0.10 mg kg^{-1}). In the case of hepatocytes, pulmonary immune cells and peritoneal immune cells minimal reduction in gene expression was seen. The *in vivo* efficacy of this polymeric delivery system is demonstrated in animal models in the therapeutic areas of emphysema and lung cancer. In the latter, a reduction in both primary tumour growth and lung metastases is seen. The potent delivery of siRNA, in particular to pulmonary endothelial cells, is evident from the long duration (several weeks) of gene silencing in these models. Although the precise mechanism involved in the multiple silencing has yet to be determined, Anderson and colleagues propose the involvement of serum proteins. *AS*

The importance of coherence

Science **344,** 1001–1005 (2014)



AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The exact mechanism explaining how incident light is converted into free charges in organic bulk-heterojunction films is still under debate. Studies on biological systems have recently highlighted the role of quantum coherence in the separation of charges in natural photosynthetic processes. Now, Sarah Maria Falke and colleagues observe that coherent oscillations between the donor and the acceptor in organic blends are also important for the efficiency of light conversion in solar cells. They studied the ultrafast response to optical stimulation of films of a conjugated donor polymer, of a fullerene-derivative acceptor and of a mixture of the two materials. Only in the latter sample, did they observe the onset of an additional oscillation, revealing the coupling of vibrational modes between the polymer and the fullerene. A simplified model of this system confirms that the energetic levels of the donor and acceptor coherently oscillate on the same femtosecond timescale of these vibrational modes, periodically increasing the charge-transfer probability when the levels resonate at the same energy. *LM*

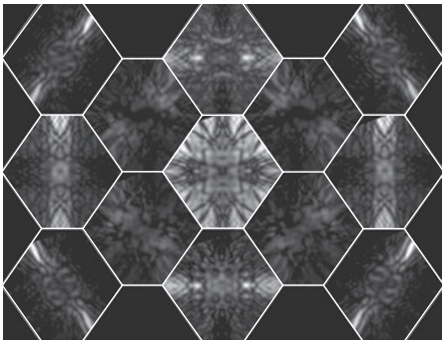
E-cadherin-guided migration

Cell **157,** 1146–1159 (2014)

In vivo, cells often migrate as a collective. For example, cell sheets can move to heal a wound, migrating multicellular strands may form a branching duct in angiogenesis and, in cancer, poorly differentiated multicellular clusters can become invasive. Epithelial cells moving as a group are connected by epithelial cadherin (E-cadherin), a transmembrane protein that, together with other cell–cell adhesion proteins, helps cells maintain polarity and contributes to tissue organization. However, the role of E-cadherin in collective cell migration *in vivo* has remained unclear. Now, Denise Montell and colleagues show that the transmembrane protein helps stabilize directionally persistent cell migration. By taking advantage of transgenic *Drosophila* ovary cells expressing E-cadherin proteins that incorporate an optical sensor for mechanical tension (a molecular spring containing a fluorescent protein), the researchers found that the E-cadherin reinforces the activity of a Rho GTPase signalling protein (Rac) for border-cell migration. They conclude that E-cadherin acts as a mechanotransducer in a mechanochemical feedback loop between actin assembly and Rac signalling to stimulate the polarization of cell clusters and their forward-directed movement. *PP*

Wide angle vision

Phys. Rev. B **89,** 174102 (2014)



AMERICAN PHYSICAL SOCIETY

Piezoelectric effects coupling electrical and strain fields in materials are crucial for a wide range of applications including sensors, actuators, capacitors, memories and medical diagnostic devices. As the most widespread piezoelectrics tend to be lead-based, there is at present a concerted effort to bring environmentally friendly lead-free piezoelectric materials to the market. The most promising of these is thought to be the perovskite system $Na_{0.5}Bi_{0.5}TiO_3$ (NBT). Frustratingly, however, a definitive understanding of its structural properties has been elusive. The oxygen octahedra that form the backbone of its structure tend to tilt away from the ideal rhombohedral symmetry, and these tilts are notoriously difficult to detect using conventional X-ray and neutron diffraction approaches. Techniques based on electron diffraction overcome this problem, but typically only provide data over a restricted angular range. Now, thanks to a technique recently developed by Richard Beanland and colleagues, this difficulty may be a thing of the past. By capturing many electron diffraction patterns as a function of beam tilt, they are able to dramatically increase the angular range, and therefore improve the ease of interpretation of a structure. In the case of NBT, the technique provides unique insights into its symmetry, including unequivocal proof that in defect-free regions of the material, the rhombohedral structure persists down to the length-scale of a few nanometres. *AT*

3D skyrmion imaging

Nature Nanotech. **9,** 337–342 (2014)

Skyrmions are nanometre-sized spin textures of topological origin, found in several magnetic materials. They recently attracted the attention of the scientific community as potential information carriers in spintronics devices, resulting in their in-depth characterization both in real and reciprocal space. Now, Huyn Soon Park and co-workers report the first direct measurement of the three-dimensional spin configuration of a skyrmion lattice in $Fe_{0.5}Co_{0.5}Si$ thin samples. Furthermore, with the combination of electron holography and an ingeniously engineered stepped sample, Soon Park and co-workers were able to identify a linear correlation between the skyrmion holographical phase shift and the sample thickness at a particular step, thus visualizing for the first time the magnetic flux of a skyrmion. *ON*

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