correlations to achieve superradiance (see the Perspective by Meschede). They dropped prepared atoms into a high-quality optical cavity and found that the number of photons within the cavity built up superradiantly as the atoms dropped through one by one. The method provides a versatile platform for generating nonclassical states of light. —ISO

Science, this issue p. 662; see also p. 641

CARDIOVASCULAR BIOLOGY

Protecting the heart by destabilizing mRNA

The CCR4-NOT complex removes polyadenylate tails from mRNAs that then undergo degradation. Yamaguchi *et al.* found that this complex was required to prevent cardiomyocyte death (see the Focus by Das). Mice deficient in a component of this complex had cardiac dysfunction and died of heart failure. Cardiomyocytes from these mice had less deadenylated *Atg7* mRNA, which resulted in the activation of cell death–associated genes. These results raise the possibility of cardiovascular side effects for autophagy-promoting drugs, which have been explored for the treatment of various diseases. —WW

Sci. Signal. **11**, eaan3638; see also eaar6364 (2018).

MATERIALS SCIENCE

Crystallography of sensitive materials

High-resolution transmission electron microscopy is an invaluable tool for looking at the crystalline structures of many materials. However, the need for high beam doses, especially as a sample is rotated to find the crystal axes, can lead to damage, particularly in fragile materials. Zhang *et al.* combined a state-of-the-art direct-detection electron-counting camera with ways to limit the overall electron dose to analyze delicate materials such as metal organic frameworks. With this approach, they could see the benzene rings in a UiO-66 linker and the coexistence of ligand-free (metal-exposing) and ligand-capped surfaces in UiO-66 crystals. —MSL

Science, this issue p. 675

BIOMECHANICS

Making quick turns

Hummingbirds are well known for their impressive maneuvering during flight. Dakin *et al.* used a computer vision approach to characterize the details of flight in >200 hummingbirds from 25 species (see the Perspective by Wainwright). Larger species had enhanced agility owing to increased muscle mass. In all species, muscles dictated transitional movement, whereas wing shape facilitated sharp turns and rapid rotations. Species, and individuals within species, played on their strengths by combining inherent traits and learned skills. —SNV

Science, this issue p. 653; see also p. 636

QUANTUM OPTICS

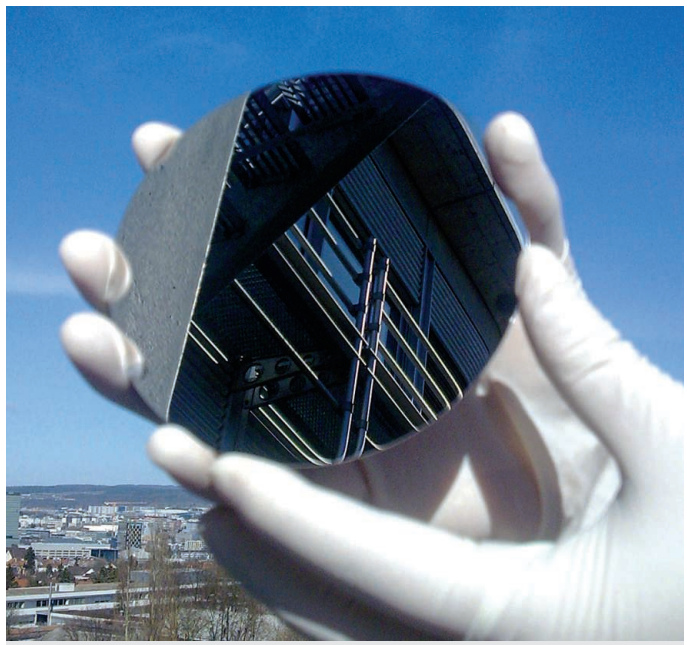
Connecting quantum emitters

Exploiting topological properties of a system allows certain properties to be protected against the disorder and scattering caused by defects. Barik *et al.* demonstrate a strong light-matter interaction in a topological photonic structure (see the Perspective by Amo). They created topological edge states at the interface between two photonic, topologically distinct regions and coupled them to a single quantum emitter. The chiral nature of single-photon emission was used to inject single photons of opposite polarization into counterpropagating topological edge states. Such a topological quantum optics interface may provide a powerful platform for developing robust integrated quantum optical circuits. —ISO

Science, this issue p. 666; see also p. 638

IN OTHER JOURNALS

Edited by **Sacha Vignieri** *and* **Jesse Smith**



Large-area hexagonal boron nitride nanomesh can be grown on a single-crystalline rhodium thin film substrate (shown here).

NANOMATERIALS

Scalable h-BN sheets

Growth of two-dimensional material in situ is a scalable route for device production, especially if the films can be transferred to another substrate. Cun *et al.* grew single crystals of hexagonal boron nitride (h-BN) on ~10-cm rhodium films supported on silicon wafers. After electrochemical treatment with an organic acid and spin-coating with a polymer layer, the h-BN was electrochemically exfoliated by generating hydrogen bubbles at the rhodium surface. These films could be transferred onto a germanium surface to prevent their high-temperature oxidation. Films in which nanovoids had been introduced into h-BN functioned as freestanding membranes after removal of the polymer support. —PDS

Nano Lett. 10.1021/acs.nanolett.7b04752 (2018).

CELL BIOLOGY

Migration without a nucleus

When cells migrate, they normally do so by adopting a characteristic polarized morphology with the nucleus seemingly pushing from behind. The internal cytoskeleton forms well-organized arrays, and the mechanics within the cell, as well as the interactions with the surface on which the cell is moving, are well understood. It has been assumed that the nucleus itself is important for directed migration. Graham *et al.* examined the migration of enucleated mammalian cells and found that the nucleus was dispensable for directed migration, at least along flat surfaces. When it came to migration in three-dimensional (3D) environments, the lack of a nucleus was important. It seems

PHOTO: H. CUN *ET AL.*, *NANO LETT.* 10.1021/ACS.NANOLETT.7B04752 (2018)

Brittle stars detect light with a network of opsin-containing cells.

PHOTORECEPTION

Unfocused eyes in the stars

Imagine having a whole-body-surface visual system. The brittle star *Ophiocoma wendtii* and its relatives are decorated with a surface layer of calcite hemispheres. Although these have been implicated in light focusing, there has been little anatomical evidence of an underlying photoreceptor network. Sumner-Rooney *et al.* found a comprehensive network connecting opsin-containing cells across the entire body surface of the stars. However, these cells project past the calcite structures, which apparently are not acting as microlenses, as previously thought. The projecting photoreceptors are thus not eyes in the sense of image-forming vision. Rather, the opsin-containing cells detect high-contrast light changes, evidently to coordinate shade-seeking, predator avoidance, and color-changing reflexes. —CA

Proc. R. Soc. B **285**, 20172590 (2018).

that the mechanical interactions between the cytoskeleton and the nucleoskeleton provide the physical robustness required for cells to push their way through 3D environments. —SMH

J. Cell Biol. 10.1083/jcb.201706097 (2018).

LUNG DISEASE

COPD risk: Clues from the tree branches

Chronic obstructive pulmonary disease (COPD) is estimated to affect 250 million people worldwide. Smoking is a major risk factor, but intrinsic host factors likely also play a role. Smith *et al.* hypothesized that variations in central airway tree branching might affect COPD risk. They studied large multiethnic populations by chest computed tomography (CT) and found variant branching patterns in one-quarter of the study participants. Certain branch variants were associated with COPD susceptibility and with broad structural changes in the lungs. Thus, variations in central airway anatomy detected by CT scans could potentially identify individuals at risk of COPD. Whether such scans will prevent COPD and/or improve patient care will require future longitudinal studies. —PAK

Proc. Natl. Acad. Sci. U.S.A. 10.1073/pnas.1715564115 (2018).

EDUCATION

Chemistry assessments go 3D

Student assessments should support meaningful learning while supplying faculty with information about what students know. Underwood *et al.* provide an evidence-based approach to modifying typical assessment questions to align them with the three-dimensional learning framework of the Next Generation Science Standards. Specifically, the Three-Dimensional Learning Assessment Protocol (3D-LAP) can be used to help identify the core concept of the assessment question (core idea), the criteria to evaluate students' ability to use this knowledge (scientific practices), and how that knowledge can relate to other science disciplines (crosscutting concepts). The 3D-LAP enables faculty to adapt their existing assessments to elicit stronger evidence about what students know and can do, ultimately making this process easier and less time-consuming than designing questions from scratch. —MMc

J. Chem. Educ. 10.1021/acs.jchemed.7b00645 (2017).

IMMUNOTHERAPY

Monocytes may shed light on melanoma therapy

Checkpoint blockade immunotherapy has shown considerable promise for the control of metastatic melanoma. Despite the success stories, there are still many patients who do not respond at all. Thus, identification of molecular markers to predict which patients could have beneficial treatment outcomes is key. Krieg *et al.* used high-dimensional single-cell mass cytometry to analyze the peripheral blood of melanoma patients. Samples were analyzed before and after the patients' 12-week course of treatment with PD-1 immunotherapy. Those patients who responded better had increased activation and frequency of monocytes (defined as $CD14^{+}CD16^{-}HLA\text{-}DR^{hi}$ cells) in their blood before starting treatment. The researchers propose that monocyte profiling could be used to stratify patients before commencing PD-1 immunotherapy. —PNK

Nat. Med 10.1038/nm.4466 (2018).

DRUG DELIVERY

Synergistic approach to localized delivery

An improved remedy for osteoarthritis could involve localized delivery of an agent to the affected joints to reduce the disease progression, rather than the current use of systemic or local delivery of drugs that only treat the symptoms. Maudens *et al.* explored the potential for long-term delivery of kartogenin, a pathway activator that enhances articular cartilage protection, by combining two ideas for slow drug release. Using wet milling, they prepared nanocrystals of kartogenin, which dissolve over time, and then embedded them in biodegradable polymer microparticles. The drug-loaded particles were tested in vitro with human synoviocytes and in vivo in a mouse model, in which prolonged delivery and bioactivity of kartogenin were observed. —MSL

Small 10.1002/smll.201703108 (2018).

PHOTO: SARAH DAVIES