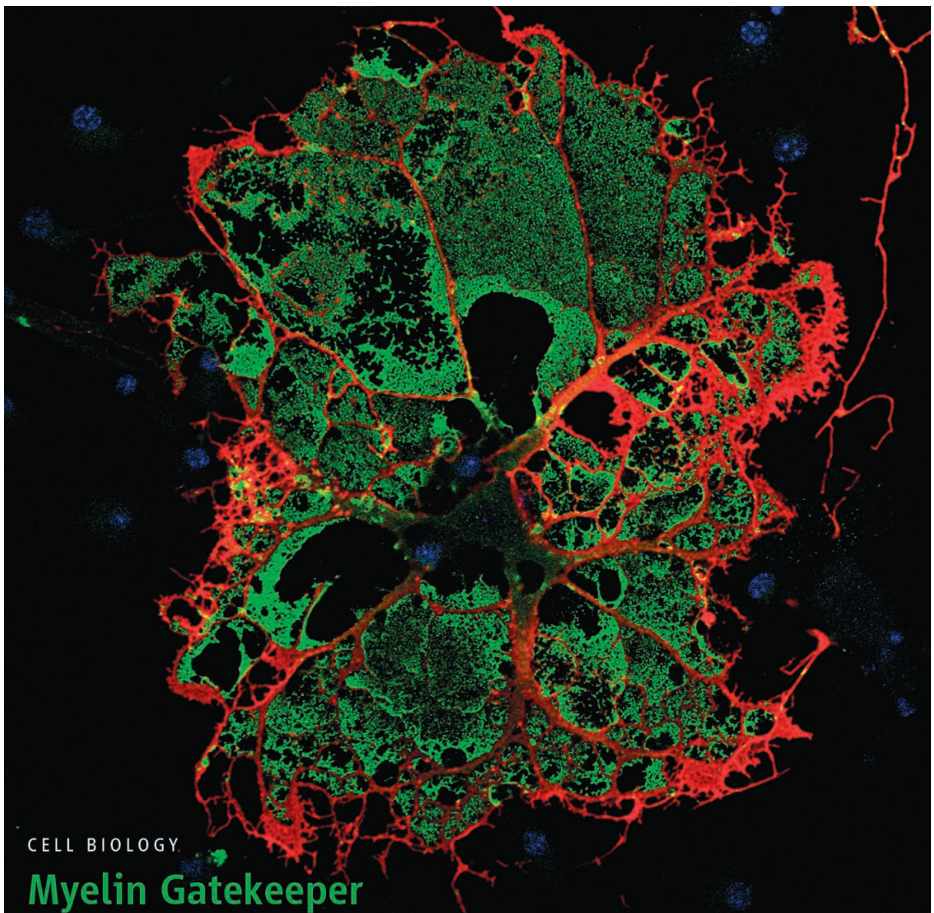

CELL BIOLOGY

Myelin Gatekeeper

The myelin membrane that wraps around axons is essential for the speedy transmission of electrical signals in the nervous system. Myelin is produced by oligodendrocytes and differs from most cellular membranes because of its unusually high lipid content and exclusion of large proteins: a composition that is optimized for the transmission of nerve impulses. Using an in vitro culture system, Aggarwal *et al.* studied how oligodendrocytes are able to create these specialized membranes. The membrane sheets are so thin that most cellular organelles cannot encroach, keeping them restricted to the fatter parts of the cell body. With vesicle transport excluded as a mechanism, the authors found that the composition of the membranes is regulated within the membrane domain, by myelin basic protein (MBP), which acts as a regulator of diffusion. In the absence of MBP, the exclusion of proteins with an overlarge cytoplasmic domain from the membrane was disrupted. Thus MBP, which appears to be spread throughout the myelin sheet, is critical for restricting access so that only a few, primarily small proteins are integrated into the myelin sheet. — PJH

Dev. Cell **21**, 445 (2011).

CREDIT: AGGARWAL *ET AL.*, DEV. CELL **21**, 445 (2011)

CELL BIOLOGY

Going Tubular

Lipids provide the building blocks for cell membranes but can also play a role in intracellular membrane trafficking and signaling. In nematodes, the gut develops from a tubular epithelium that has very distinct apical membranes that will be exposed to materials originating outside the organism, as compared with the basolateral membranes that communicate with the interior of the organism. Zhang *et al.* wanted to understand the role of lipids during the process of organ formation in *C. elegans*. By systematically targeting lipid biosynthetic pathways and examining changes in intestinal tubulogenesis, the authors confirmed an essential role for glycosphingolipids in maintaining epithelial polarity and thereby the integrity of the central lumen of the developing gut. Glycosphingolipids were involved in the sorting of lipids and membrane proteins to the apical plasma membrane and were key to the expansion of the apical domains required for intestinal lumen formation. — SMH

Nat. Cell Biol. **13**, 10.1038/ncb2328 (2011).

BIOCHEMISTRY

Synchronized Stepping

Inside the cell, ensembles of different myosin proteins attached to a single cargo molecule allow for bidirectional transport along actin tracks. To gain insight into the coordination that must be required to deliver the cargo to its destination, Ali *et al.* labeled myosin V (myoV) and myosin VI (myoVI), which move in opposite directions, with different colored quantum dots. They coupled the motors through a third quantum dot cargo and used total internal fluorescence microscopy to determine the stepping dynamics of each individual motor. Though the motors have similar stall forces, myoV dominated ~80% of the time, probably because it has a higher unbinding force than myoVI. Regardless of which motor won, its movement was significantly slowed by the losing motor which, interestingly, took continuous backward steps coincident with the forward steps of the winning motor. In the presence of micromolar concentrations of ADP, myoVI dominated by acting as an anchor that prevented myoV from stepping forward. The dominant motor could also be shifted by varying the myoV:myoVI:cargo conjugation ratio, consistent with regulation by varying the ratio of motor types bound to cargo. Such approaches that provide a mechanochemical understanding of motor coupling will be valuable in efforts to model the regulatory mechanisms that govern intracellular transport. — VV

Proc. Natl. Acad. Sci. U.S.A. **108**, E535 (2011).

APPLIED PHYSICS

Directing Single Photons

Photons are ideal carriers of bits of information—they are fast, robust, and can travel long distances. For secure applications such as quantum key distribution for cryptography, the information is conveyed by single photons. Compared with classical keys, an attack on the communication channel by an eavesdropper that uses a quantum key is readily detected. Quantum dots are useful sources of single photons and can be integrated into on-chip waveguides that direct where the single

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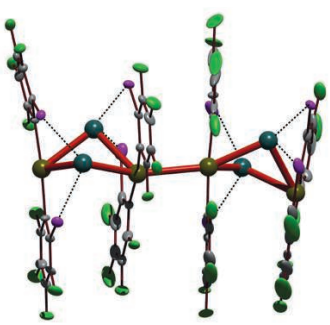
photons go. However, extracting the photons from the waveguide into an external communication channel (such as an optical fiber) is often inefficient because the photons undergo internal reflection at the waveguide's interfaces. Davanco *et al.* have designed a system whereby a tapered fiber waveguide is coupled to a semiconductor waveguide that contains quantum dots. The geometry of the semiconductor waveguide is designed so that the properties of the generated single photons can be selected and matched to that of the tapered fiber. This matching enhances the extraction of the single photons from the semiconductor waveguide into the tapered fiber. — ISO

Appl. Phys. Lett. **99**, 121101 (2011).

CHEMISTRY

Controlling Cluster Color

Strongly photoluminescent materials that respond to changes in their environment, such as mechanical stress or chemical solvation, are useful in sensing applications. Lasanta *et al*. synthesized gold-silver clusters by reacting gold bearing a halogenated phenyl ligand (2-C_6F_4I, R^{II}) with silver trifluoroacetate [Ag(tfa)]. Crystallographic analysis revealed that the resulting anionic compound, $[Au_2Ag_2(2\text{-}C_6F_4I)_4(tfa)_2]^{2-}$, forms through metallophilic interactions—the



bridging silver atoms each bear a tfa ligand and coordinate to two gold atoms—and through halogen bonds between iodine and gold atoms. This compound has strong green luminescence, but the addition of a coordinating solvent such as acetonitrile initially creates a dimeric form of the compound through gold bridging interactions. In this yellow luminescent material, the silver atoms bear no coordinating solvent. After a few minutes, the final polymeric form, a red emitter, forms through additional gold bridges and coordinates acetonitrile at the silver atoms. The monomeric form could be recovered by aging for several hours or by grinding the polymer in excess tfa. — PDS

J. Am. Chem. Soc. **131**, 10.1021/ja206845s (2011).

CREDIT: PANCE NAUMOV AND JOSE MARIA LOPEZ DE LUZURIAGA

MATERIALS SCIENCE

Mining for Pores

Porous networks within coal can determine its value as a fuel; porosity helps define how well certain types of coal burn and whether methane in the pores can be extracted efficiently from coal beds as an additional source of energy. Determining the porosity of complex natural materials such as coal is difficult, because a sample may contain many networks of pores that can be often disconnected from each other and from the surface of samples. Although several techniques for measuring porosity exist, Melnichenko *et al.* used small-angle neutron scattering to examine the interconnectivity of pores within coal samples as a function of pore size in a noninvasive and quantitative manner. They compared the scattering profiles of a coal sample in a vacuum and the same sample saturated with contrast-matching gases that fill accessible pores and make them invisible to the neutron beam. The analysis confirms that the proportion of isolated and accessible pores varies widely based on coal type, but also shows that pore accessibility varies with gas overpressure. These results may eventually help determine the feasibility of enhanced methane recovery from coal beds by injecting CO_2 gas at high pressure. — NW

Fuel **90**, 10.1016/j.fuel.2011.06.026 (2011).

BIOMEDICINE

Targeting Asthma

Asthma is a major public health problem. There are a variety of causes of asthma, and the pathogenesis of the disease is quite heterogeneous. Despite this, most patients are treated with broadly immunosuppressive glucocorticoids, which do not always control disease. Thus, there is substantial interest in developing more targeted therapies that may be used to treat specific clinical subtypes of patients.

Interleukin-13 (IL-13) is a cytokine that is associated with the T helper 2 type responses seen in many asthma patients and in a subset of patients remains elevated even in the face of glucocorticoid treatment. In a placebo-controlled phase II clinical trial, Corren *et al.* now show that treatment of adult asthma patients on glucocorticoid therapy with a monoclonal antibody against IL-13 significantly improved lung function. Patients with higher IL-13 levels showed the greatest effect. Although the trend toward reduced disease exacerbations in treated patients did not reach statistical significance, this study does suggest that a targeted approach to asthma therapy is worth pursuing. — KLM

N. Engl. J. Med. **365**, 1088 (2011).

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Directing Single Photons

Ian S. Osborne

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