EDITED BY GILBERT CHIN AND JAKE YESTON

CELL BIOLOGY

Under Surveillance

Proteins and lipids enter the secretory pathway via the endoplasmic reticulum (ER). Within the ER, newly synthesized secretory and membrane proteins are folded and assembled; under conditions of stress that lead to protein misfolding, the ER activates the unfolded protein response pathway. The ER itself is an organelle that the cell cannot generate de novo: During cell division, each daughter cell must be provided with its own complement of ER membranes that serve as a template for future growth. In budding yeast, ER membranes are distributed between the mother cell and the daughter bud by the actin cytoskeleton. Babour *et al.* have studied ER partitioning in dividing yeast cells under stress and discovered a surveillance pathway that helps to ensure that the daughter cell receives a functional complement of ER membranes. In stressed cells, signaling by the MAP kinase Slt2 is activated, which helps to delay cytokinesis and prevents the delivery of ER to the growing bud. In cells lacking Slt2 kinase, a stressed and therefore functionally compromised ER is transmitted to the daughter cell, leading to the death of both mother and daughter. — SMH

Cell **142**, 256 (2010).

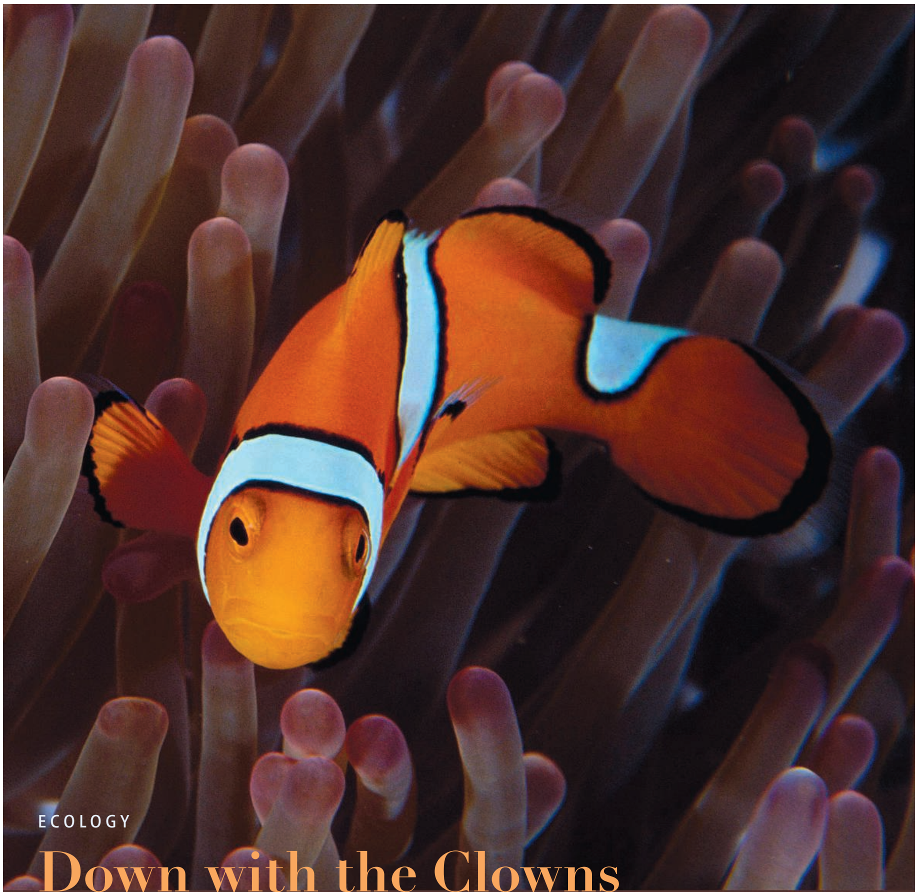
GEOCHEMISTRY

Vented Treasure

Mid-ocean ridges—vast mountain ranges on the sea floor where new oceanic crust is generated—contain numerous hydrothermal vents that input heat and a suite of chemical compounds into the ocean from Earth's interior. Here, myriad microorganisms with peculiar metabolisms take advantage of extreme chemical gradients, though humans have sampled only a small minority of such environments. German *et al.* discovered several new vents in the western Caribbean along the Mid-Cayman Rise—a unique, slow-moving ridge tectonically isolated from major mid-ocean ridges. One site, which the researchers named after deep-sea explorer Jacques Piccard, is the deepest hydrothermal field yet discovered (~5000 m below sea level). Geochemical sampling by a remotely operated underwater vehicle along a 100-km stretch of the ridge revealed that venting outputs are unexpectedly diverse. Pyrosequencing of cells collected at the venting sites suggested that sulfur-oxidizing bacteria thrive in the chemically reducing plumes. Also included among the abundant species was an exact match to uncultured bacteria previously isolated from the Pacific Ocean in the deepest trench on the sea floor. — NW

Proc. Natl. Acad. Sci. U.S.A. **107**, 10.1073/pnas.1009205107 (2010).

A vent's namesake.



ECOLOGY

Down with the Clowns

One consequence of rising levels of atmospheric carbon dioxide is an increase in the absorption of CO_2 by the ocean. This leads to a gradual decrease in oceanic pH, a change that has been predicted to have adverse effects on marine organisms such as corals because more acidic conditions may inhibit the accretion of calcium carbonate skeletons. Munday *et al.* show that the recruitment of reef fish populations may also be under threat, due to the effects of higher carbon dioxide levels on the olfactory systems of larval fish. Benthic fish larvae use chemical cues both to locate suitable habitats and to detect and avoid predators. Experiments with larval clownfish and damselfish showed that increasing carbon dioxide levels interfered with their normal aversion to chemical cues derived from predator fish, resulting in riskier behavior that led to increased larval mortality. — AMS

Proc. Natl. Acad. Sci. U.S.A. **107**, 12930 (2010).

MICROBIOLOGY

More Than a Gut Feeling

Shortly after birth, the human gut is colonized by 1000 microbial species, which eventually number hundreds of trillions of cells in an adult, far exceeding the total number of our own cells. Microbes colonize the gut to gain access to a rich food source, and in return they are known to improve human health by enhancing our digestive system and providing extra defenses against pathogens. However, they can also negatively affect the host immune response, and they have been linked to the development of autoimmune diseases,

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particularly those of the gut such as inflammatory bowel disease. To investigate how gut microbes can cause the development of an autoimmune disease elsewhere, Wu *et al.* used mice engineered to develop inflammatory arthritis. These mice were reared under germ-free conditions, thereby inhibiting microbial colonization of the gut, which was found to delay the onset of arthritis and to reduce its severity. Initiation of autoimmune arthritis in this model is driven by the adaptive immune response. Consistent with this, the authors found reduced T helper 17 (T_H17) cell capabilities in the germ-free mice. T_H17 cells can cause autoimmune disease, and gut microbes can induce the production of these cells in the intestine. The authors show that a single commensal gut microbe introduced in the germ-free mice promoted the differentiation of T_H17 cells and triggered arthritis, thereby linking a distal autoimmune disease to the gut microbiota. — HP

Immunity **32**, 815 (2010).

PHYSIOLOGY

Time to Eat

Sharks, like many other animals, are thought to track their prey by sensing differences in odor concentrations. Yet the diffusion of an odor in a freely moving fluid is unlikely to form a stable concentration gradient; rather, the odor dispersal field would look more like a river flowing over rocks—a series of chutes and eddies—making the odor plume intrinsically patchy and challenging the idea that animals could easily track food sources by detecting odor gradients. To resolve this conundrum, Gardiner and Atema fitted a small species of shark, *Mustelus canis*, with a device that delivered pulses of squid odor to the shark's nares. Simultaneous pulses of odor, which differed 100-fold in concentration, presented to both nares caused the sharks to turn to either side with equal frequency. When identical concentrations of odor were used, but the timing of the pulses to each naris was staggered, the sharks turned with greater frequency towards the side that received the pulse 0.1 to 0.5 s earlier. When a highly diluted odor was delivered to one naris 0.5 s ahead of a full-strength pulse to the other nostril, the sharks turned with greater frequency to the side of the dilute pulse, showing that odor arrival time, and not concentration differences, drives turning behavior. — GR

CREDIT: G. RIDDIHOUGH

Curr. Biol. **20**, 1187 (2010).

BIOMATERIALS

Sweet Sensing

Diabetics face the daily challenge of determining their glucose levels, which can fluctuate because of changes in diet, exercise, insulin intake, medications, and other factors. Gough *et al.* have engineered a sensor that could be implanted in pigs to transmit their glucose levels for over 1 year. Two enzymes, glucose oxidase and catalase, were immobilized within a cross-linked protein gel to transform glucose and oxygen into gluconic acid. Changes in oxygen level were then measured with a differential sensor, relative to background levels, ensuring that the device could work across a wide range of oxygen concentrations. A nonporous polydimethylsiloxane layer allowed for oxygen diffusion while preventing poisoning of the sensor by other compounds. Under diabetic conditions, the sensors accurately tracked fluctuations in glucose levels, but with time delays of approximately 10 min. The primary cause was the limit on the diffusion rates of glucose through the tissues. — MSL

Sci. Transl. Med. **2**, 42ra53 (2010).

APPLIED PHYSICS

Tuning Rainbows

Robust and fast, single photons are viewed as ideal carriers of quantum information for applications in secure communication (cryptography) and quantum computing. At the heart of these processes lie single-photon emitters, devices that would emit identical, indistinguishable photons and allow their interference and entanglement. Single atoms or ions are ideal emitters but do not lend themselves to easy manipulation or scale-up for practical application. Solid-state quantum dots alleviate these issues but suffer from the problem that no two dots are alike—the ladder of energy levels varies from one dot to the next, and so the output from an array resembles a pretty rainbow rather than a mundane yet useful single wavelength. Using a solid-state quantum dot array and a distribution of organic molecules embedded in a matrix, respectively, Patel *et al*. and Lettow *et al*. show that applying an electric field can render the colors of the emitted photons identical. In a different approach, Flagg *et al.* show that local strain surrounding quantum dots can be used to tune the emission. This suite of techniques should be invaluable in meeting the scale-up requirements for technological applications. — ISO

Nat. Photon. **4**, 10.1038/nphoton.2010.161 (2010); *Phys. Rev. Lett.* **104**, 123605; 137401 (2010).

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