with an organic azide to form a pentavalent bis(imido) complex with two Fe=N bonds. One-electron oxidation then accessed the Fe(VI) oxidation state. Both compounds were sufficiently stable for crystallographic characterization. —JSY

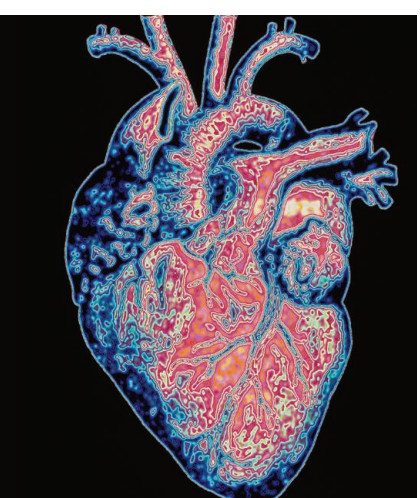
Science, this issue p. 356

PHYSIOLOGY

Metabolomics, at the heart

With heart failure a leading cause of death, a better understanding of metabolic function in the heart is a welcome advance. Murashige *et al*. measured more than 270 metabolites using liquid chromatography–mass spectrometry in human blood samples taken from an artery entering the heart and from a vein leaving it. Differences thus reflected the metabolic processes at work in the heart. Their results confirmed that hearts voraciously consume fatty acids. Hearts secreted, rather than consumed, amino acids, thus revealing active proteolysis. In patients with heart failure, ketone and lactate consumption increased, as did proteolysis. These findings could lead to strategies for fighting heart disease by altering metabolism. —LBR

Science, this issue p. 364



Artistic rendering of the human heart featuring exterior blood vessels, which deliver nutrients and oxygen to this energy-intensive organ

SPECTROSCOPY

The travel time of light in a molecule

There is currently considerable interest in experimental studies of various ultrafast processes. Of particular interest are the real-time dynamics of photoionization, one of the most fundamental processes caused by the light-matter interaction, in which the absorption of a photon leads to the ejection of an electron and the formation of anion. Using an electron interferometric technique, Grundmann *et al*. report a birth time delay on the order of a few hundred zeptoseconds between two electron emissions from the two sides of molecular hydrogen, which is interpreted as the travel time of the photon across the molecule. The proposed technique is generally applicable to more complex systems, and further studies are necessary to support this interpretation. —YS

Science, this issue p. 339

ECOLOGY

Species richness maintains mutualisms

Mutualistic communities of species that benefit each other are ubiquitous in ecosystems and are important for ecosystem functioning. However, the relationship between the persistence of mutualisms and species richness has remained unclear. Vidal *et al*. used a synthetic mutualism in brewer's yeast to experimentally test whether species richness buffers mutualistic communities against exploitation by species that do not provide benefits in return. They showed that richer mutualist communities survive exploitation more often than pairwise mutualisms and that higher species richness and functional redundancy allow mutualist communities to persist in the presence of exploiters. These results provide experimental support for the hypothesis that species richness is necessary for the function and maintenance of mutualistic communities. —AMS

Science, this issue p. 346

IN OTHER JOURNALS

Edited by **Caroline Ash** *and* **Jesse Smith**

PHYSIOLOGY

Enduring muscular courtship

Several species of male amphibians and reptiles hold tight to their partners, possibly to prevent them mating with their rivals. The southern alligator lizard (*Elgaria multicarinata*) clamps its mate's head in its jaws for hours. This extreme muscular performance runs counter to expectations of reptilian muscle resilience. Nguyen *et al.* tested the sustained bite force of the adductor muscles of the lizard's jaw for fatigue. Muscle fibers can specialize, in terms of performance, into fast-acting twitch fibers and into slow-acting tonic fibers that are capable of fatigue-resistant contraction. Tonic fibers also exhibit slow calcium fluxes and relax slowly. The lizards' jaw muscle appears to have evolved to comprise fast-twitch fibers for eating and slow-tonic fibers that can sustain an extended courtship grip. —CA

Proc. R. Soc. London Ser. B **287**, 20201578 (2020).

The southern alligator lizard *Elgaria multicarinata* will grip the head of its mate for hours, thanks to specialized jaw muscle fibers.

IMAGES: (LEFT TO RIGHT) ALFRED PASIEKA/SCIENCE SOURCE; NHMLA COMMUNITY SCIENCE PROGRAM/CC BY-NC

SINGLE-CELL METHODS

Watching information flow inside cells

Each human cell has an information network like a subway system underpinning the function of one of the world's major cities. Instead of human couriers, within our cells, messenger RNAs (mRNAs) carry information. Thousands of mRNAs emerge from the cell's nucleus with instructions

for cellular functions and disappear into the cytoplasm when their duties are fulfilled. Because of the development of single-cell sequencing techniques, we are now very good at counting these messengers, which are specific to each cell type in our body. Qiu *et al.* developed a new method to watch the movement of mRNAs. The technique can distinguish newly synthesized mRNAs from older ones and track each mRNA with a specific tag. This method provides a picture of the information flow inside cells and shows how they become disrupted by genetic perturbations that can cause cancer. —DJ

Nat. Methods **17**, 991 (2020).

IMMUNOLOGY

Imaging antigen-specific T cells

Positron emission tomography (PET) has previously been exploited to trace immune responses in living animals. However, its use has been largely limited to cells expressing surrogate markers recognized by radiolabeled antibodies or cells genetically modified to take up radiolabeled substrates. Woodham *et al.* now report a nonintrusive, in vivo method to track antigen-specific T cells that recognize known antigens presented by major histocompatibility complex (MHC) molecules. The authors made a class of radiolabeled peptide-bound MHC dimers linked to antibody Fc regions, which they called "synTacs." In a mouse model of cancer, they were able to follow $CD8^+$ T cells within tumors that recognized a particular oncoprotein. They could also detect influenza virus (IAV) nucleoprotein–specific $CD8^+$ T cells in the lungs of IAV-infected mice. This work may help pave the way for future tools to noninvasively track human T cell responses during interventions such as vaccination and cancer immunotherapy. —STS

Nat. Methods **17**, 1025 (2020).

METALLURGY

Nature's guide for alloy design

Metallic alloys composed of many different elements are often hard to identify and isolate because of the large number of potential combinations. Wei *et al*. started with a nine-element mixture and assessed the phase-separated zones that arose from natural mixing. They used the phase composition for designing a titanium-vanadium-niobium-hafnium refractory alloy with attractive ductility. This strategy provides a method for screening and isolating complex element compositions that may have outstanding properties. —BG

Nat. Mater. 10.1038/s41563-020-0750-4 (2020).

CONSERVATION

Plastic trade-offs

In just over 100 years, plastics have become both a necessity and a scourge, replacing natural materials in a myriad of uses and becoming a ubiquitous contaminant both in ecosystems and within organisms. For human populations in and around tropical forests, natural materials are available to process and store food. Bitariho *et al.* looked at trade-offs between using wild climbing plants to make baskets and winnowers and using plastic containers and devices. The authors accounted for food security, potential for plastic pollution, and the conservation status of 15 species of climbing plants around Bwindi Impenetrable National Park, Uganda. Families that had permission to collect wild climbing plants had more food storage and processing devices than those who did not. Although this study identified the risks of overharvesting one vulnerable climber species, it also showed that families with access to natural materials experienced greater food security and less plastic use and waste. —SNV

Conserv. Sci. Pract. **2**, e275 (2020).

OPTOELECTRONICS

Directing the flow of photocurrent

The next generation of information-processing devices is expected to be more energy efficient if the spin or valley degrees of freedom of a material is used to encode and carry information. Rasmita *et al.* show that circularly polarized light can induce a directional photocurrent in heterostructures of the two-dimensional transition metal dichalcogenides MoS_2 and WSe_2. The authors show that the direction of current flow is dependent on the polarization state of the light, and further control can be achieved with back-gating and an in-plane electric field. Combined with the possibility of engineering the heterostructures and the number of materials available with different properties, this work demonstrates that the monolayer transition metal dichalcogenides can serve as a versatile platform for future optoelectronic device technology. —ISO

Optica **7**, 1204 (2020).

ARCTIC OZONE

The hole truth

Ozone loss in the Arctic stratosphere has never been as severe as that in the Antarctic ozone hole, but during the past year, it declined to a level a bit closer to that of its southern counterpart. Wohltmann *et al*. report that during the northern spring of 2020, Arctic stratospheric ozone levels fell to near zero in some places. This unprecedented depletion, caused by unusually cold and stable conditions in the Arctic stratosphere, could become more frequent or extensive if the recent trend toward colder Arctic winters continues. —HJS

Geophys. Res Lett. 10.1029/2020GL089547 (2020).

PHOTO: ANDREW AITCHISON/ALAMY STOCK PHOTO

The people who live around Bwindi Impenetrable Forest are skilled craftsfolk who select climbing plants for materials to make food-storage containers, thus avoiding the use of plastic alternatives that are not biodegradable.