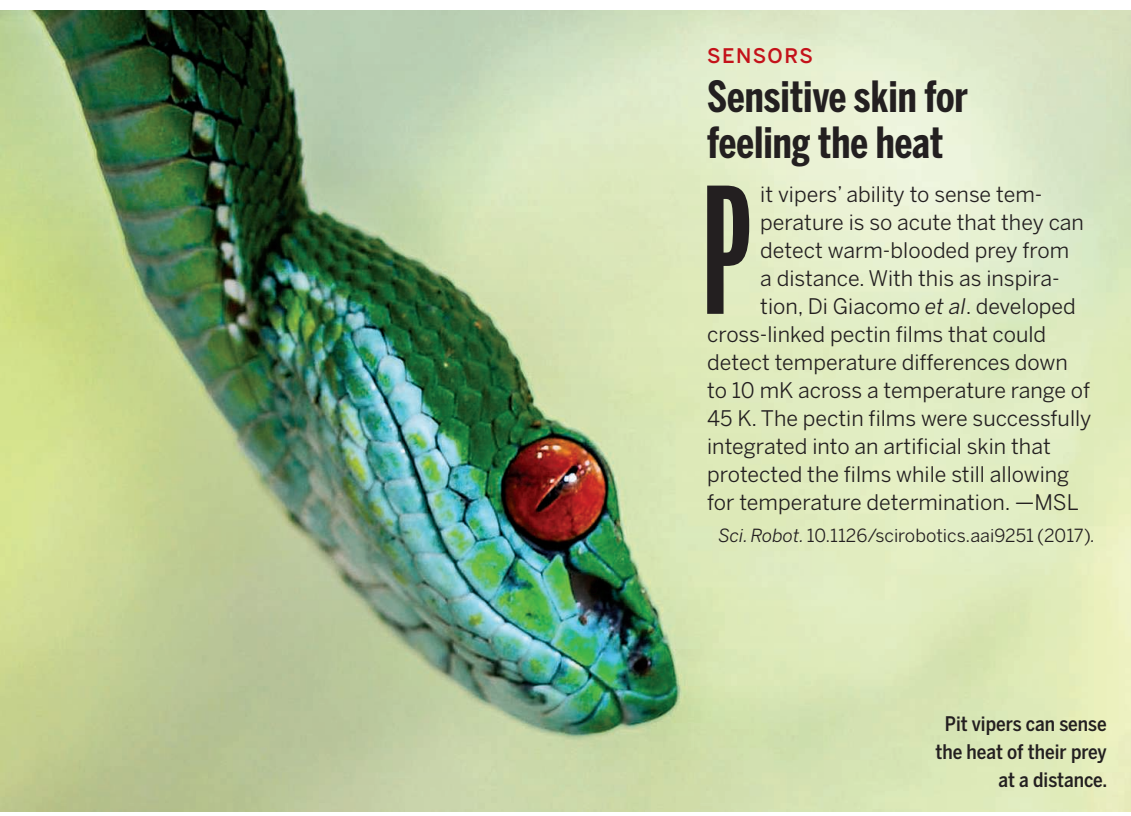
RESEARCH

Dissecting DNA double-strand break repair machinery

Sibanda et al., *p. 520*

IN *SCIENCE* JOURNALS

Edited by **Stella Hurtley**



Pit vipers can sense the heat of their prey at a distance.

SENSORS

Sensitive skin for feeling the heat

Pit vipers' ability to sense temperature is so acute that they can detect warm-blooded prey from a distance. With this as inspiration, Di Giacomo *et al*. developed cross-linked pectin films that could detect temperature differences down to 10 mK across a temperature range of 45 K. The pectin films were successfully integrated into an artificial skin that protected the films while still allowing for temperature determination. —MSL

Sci. Robot. 10.1126/scirobotics.aai9251 (2017).

ELECTRON MICROSCOPY

Ultrafast studies using liquid cells

Advances in microscopy techniques aim to make it possible to study materials under more realistic conditions, such as in liquid cells, or to use fast probes to capture dynamics. Fu *et al*. combined liquid cell transmission electron microscopy with ultrafast pump-probe spectroscopy to perform time-resolved studies of nanoscale objects (see the Perspective by Baum). They successfully captured the change in rotational dynamics of coupled gold nanoparticles and also observed the dynamics as two particles fused together in a liquid environment. —MSL

Science, this issue p. 494; see also p. 458

VASCULAR BIOLOGY

Protected from atherosclerosis by TFEB

Atherosclerosis, or the buildup of fatty plaques in blood vessels, can lead to high blood pressure and heart attacks. Lu *et al*. found that in cultured endothelial cells, the transcription factor TFEB reduced oxidative stress and inflammation, processes that contribute to the development of atherosclerosis. When fed a high-fat diet, mice that overexpressed TFEB in endothelial cells developed smaller atherosclerotic lesions than their control littermates on the same diet. —WW

Sci. Signal. **10**, eaah4214 (2017).

POLITICAL SCIENCE

Using global data for election predictions

Assumptions underlying election result predictions have been questioned recently. Kennedy *et al*. assessed more than 650 executive office elections in over 85 countries and performed two live forecasting experiments. They analyzed a variety of potential predictors theorized to be of importance, ranging from economic performance to polling data. Elections were about 80 to 90% predictable, despite uncertainties with available data. Polling data were very important to successful prediction, although it was necessary to correct for systematic biases. Unexpectedly, economic indicators were only weakly predictive. As data sources improve and grow, predictive power is expected to increase. —BJ

Science, this issue p. 515

ASYMMETRIC CATALYSIS

Expressed preferences among methyl groups

Targeting just one of the two equivalent branch ends in Y-shaped molecules is a particular challenge for catalysis. Enzymes manage to do it by grasping the whole molecule, octopus-like, but often enzymes cannot tolerate minor structural variations. Wu *et al*. produced an amide-directed palladium catalyst that, armed with oxazoline-derived chiral ligands, could reliably attack just one methyl member of isopropyl groups. The reaction successfully replaced C–H bonds with C–C bonds in a wide variety of aryl and vinyl coupling partners. —JSY

Science, this issue p. 499

RIBOSOME

The yeast mitoribosome

Mitochondria are eukaryotic organelles that produce ATP, the energy source of the cell. They have dedicated ribosomes (mitoribosomes) that encode some of the membrane proteins that are essential to ATP

PHOTOS (FROM TOP): SIBANDA *ET AL.*; OSCAR DOMINGUEZ/ALAMY STOCK PHOTO

Published by AAAS

production. Desai *et al*. present a high-resolution structure of the 75-component yeast mitoribosome, determined by electron cryomicroscopy. Mitoribosomes share an ancestor with modern bacterial ribosomes. Comparing the structure of the yeast mitoribosome with mammalian mitoribosomes suggests how they have evolved differently to perform species-specific functions. —VV

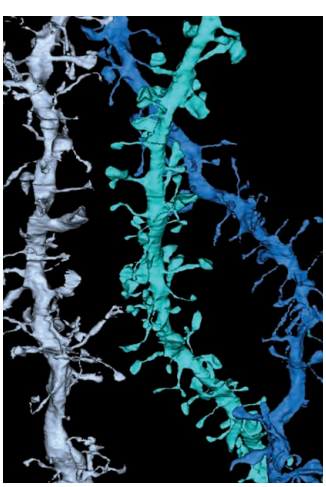
Science, this issue p. 528

SLEEP RESEARCH

Synapse remodeling during sleep

General activity and information processing while an animal is awake drive synapse strengthening. This is counterbalanced by weakening of synapses during sleep (see the Perspective by Acsády). De Vivo *et al*. used serial scanning electron microscopy to reconstruct axon-spine interface and spine head volume in the mouse brain. They observed a substantial decrease in interface size after sleep. The largest relative changes occurred among weak synapses, whereas strong ones remained stable. Diering *et al*. found that synapses undergo changes in synaptic glutamate receptors during the sleep-wake cycle, driven by the immediate early gene *Homer1a*. In awake animals, *Homer1a* accumulates in neurons but is excluded from synapses by high levels of noradrenaline. At the onset of sleep, noradrenaline levels decline, allowing *Homer1a* to move to excitatory synapses and drive synapse weakening. —PRS

Science, this issue p. 457, p. 507; see also p. 511



3D reconstructions of mouse neuronal dendrites

PHOTOS (FROM LEFT): DE VIVO *ET AL*.; SUDRES JEAN-DANIEL/HEMIS.FR

CHROMOSOMES

Tethering DNA for packing purposes

Condensin protein complexes are critical for chromosome segregation and compaction. They form ring-shaped structures that encircle and topologically constrain DNA strands. Wang *et al*. show that *Bacillus subtilis* condensin complexes hold the two arms of the circular chromosome together (see the Perspective by Sherratt). The complexes seem to do this by encircling individual DNA duplexes and then tethering the two duplexes together by "handcuffing." The complexes actively travel along the DNA and function to enlarge DNA loops processively, leading to chromosome compaction. —GR

Science, this issue p. 524; see also p. 460

PHYSICS

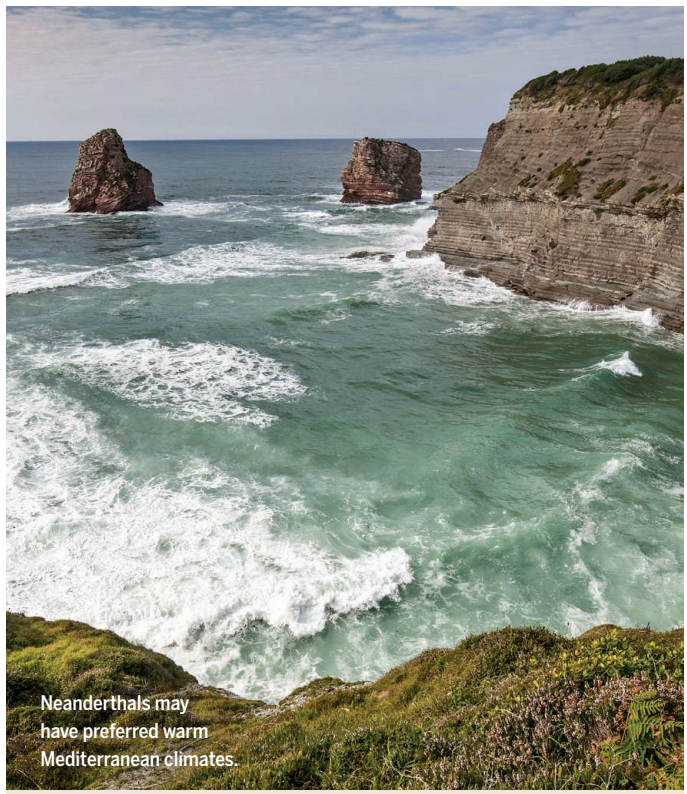
Getting a sense of atomically thin materials

Two-dimensional materials such as graphene and transition metal dichalcogenides provide a powerful platform for optoelectronic applications. As the materials get thinner, however, characterizing the electronic properties can present an experimental challenge. Lovchinsky *et al*. demonstrate that atomic-like impurities in diamond can be used to probe the properties of 2D materials by nanometer-scale nuclear quadrupole resonance spectroscopy. Coherent manipulation of shallow nitrogen-vacancy color centers enabled probing of nanoscale ensembles down to several tens of nuclear spins in atomically thin hexagonal boron nitride. —ISO

Science, this issue p. 503

IN OTHER JOURNALS

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



Neanderthals may have preferred warm Mediterranean climates.

PALEOANTHROPOLOGY

Interglacial Neanderthal habitats

Despite burgeoning research in Neanderthal archaeology in recent years, much remains to be discovered about their interactions with the paleoenvironment. Using a species distribution modeling approach, Benito *et al*. studied how climate and topography shaped Neanderthal distribution in Europe during the Last Interglacial optimum around 120 thousand years ago, when the climate was warmer than it is today. Archaeological records and paleoclimatic data indicate that Mediterranean coastal regions with locally varied topography and mild summers were the most favored habitat. Montane regions such as the Alps and Pyrenees, as well as the central European plains, once thought to be the core Neanderthal habitat, were suboptimal because of low winter temperatures. —AMS

J. Biogeogr. **44**, 51 (2017).

CANCER

Regulator loop enabling cancer cell growth

It is not easy being a cancer cell, so such cells may need help from factors other than oncogenes that contribute to the cancer cell phenotype. Bublik *et al*. identify such a factor in protein fibroblast growth factor 13 (FGF13). FGF13 does not function like a regular growth factor. Instead, it acts in the nucleolus to repress transcription of ribosomal RNA and inhibit protein synthesis. Furthermore, it is tightly linked to the action of

ALSO IN *SCIENCE* JOURNALS

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CELL BIOLOGY

Peroxisome inheritance and differentiation

For normal tissue structure and function, cells exert strict control over growth versus differentiation. Poor wound healing and aging can result from too little proliferation. Conversely, the development of cancer can involve excessive cell growth. Asare *et al*. looked for regulators that balance proliferation and differentiation in the epidermis (see the Perspective by Gruneberg and Barr). They observed differences in the transcript profile of epidermal progenitors, their differentiating progeny, and epidermal cancers. Epidermal progenitors that were deficient in the peroxisome-associate protein Pex11b did not segregate peroxisomes properly among dividing cells. This led to a delay in mitosis that perturbed polarized divisions. These events skewed daughter cell fate and resulted in a defective skin barrier. Thus, peroxisome inheritance appears to play a role in normal mitosis and cell differentiation. —BAP

Science, this issue p. 493; see also p. 459

DNA REPAIR

Activating DNA repair

DNA double-strand breaks must be repaired efficiently to avoid cell death or cancer. The break ends can either be directly ligated by nonhomologous end joining (NHEJ) or more accurately repaired by homologous recombination that uses information from the sister chromatid. Sibanda *et al*. present a high-resolution x-ray structure of a key component of the DNA repair machinery, the DNA-dependent kinase catalytic subunit (DNA-PKcs), bound to a C-terminal peptide of Ku80. The structure suggests that Ku80 presents the DNA ends for repair to a DNA-PKcs dimer and that activity is modulated by interactions between the monomers. Binding of either Ku80 or BRCA1, which may compete for the same binding site on DNA-PKcs, could provide a switch between NHEJ and homologous recombination. —VV

Science, this issue p. 520

FOREST RESTORATION

From lofty goals to on-the-ground success

Global initiatives call for the restoration of vast areas of deforested landscapes worldwide, particularly in the tropics. In a Perspective, Holl highlights the disconnect between these ambitious goals and the reality on the ground, where forest restoration must compete with numerous other land uses. Many studies of forest restoration have been performed at small scales, making it difficult to apply their results. Furthermore, efforts to restore forests in productive agricultural landscapes often meet with local resistance. Examples from the Atlantic Forest Restoration Pact in Brazil and from Colombia point the way to successful forest landscape restoration approaches that balance ecological and human welfare goals. —JFU

Science, this issue p. 455

HIV

Engineering HIV immunity

For rapidly mutating viruses such as HIV, antibodies that can neutralize more than one strain may have real therapeutic potential. Williams *et al.* examined the origin of broadly neutralizing antibodies (bnAbs) that recognize a part of the membrane-proximal external region (MPER) of HIV-1 gp41. They found similar clonal lineages of a MPER bnAb from both memory B cells and plasma, highlighting the viability of plasma as a source of bnAbs. These lineages shared an autoreactive unmutated common ancestor, suggesting that tolerance must be overcome for bnAb induction. The authors then engineered chimeric antibodies from the plasma and memory B cells that successfully neutralized most HIV-1 strains. —ACC

Sci. Immunol. **2**, eaal2200 (2017).

CANCER

Stem cells on a mission

Healthy neural stem cells can infiltrate and help treat brain tumors because they naturally migrate toward gliomas in response to tumor-derived chemotactic signals. Obtaining neural stem cells from a patient can be difficult, however, and donor stem cells pose a risk of immune rejection and other safety concerns. Bagó *et al.* discovered a way to avoid these risks by taking normal human skin fibroblasts and transdifferentiating them into neural stem cells. The entire process took only 4 days to complete, yielding autologous patient-derived neural stem cells. The authors engineered these stem cells to infiltrate and effectively treat brain tumors in multiple mouse models. —YN

Sci. Transl. Med. **9**, eaah6510 (2017).