RESEARCH HIGHLIGHTS

Selections from the scientific literature

METABOLISM

Insulin's daily rhythm

The increased risk of type 2 diabetes and obesity seen in people who keep unusual hours may be tied to daily, or circadian, rhythms relating to the blood-glucose-regulating hormone insulin.

Carl Hirschie Johnson and his group at Vanderbilt University in Nashville, Tennessee, showed that mice are less responsive to insulin during the day — when they rest. The researchers disrupted the day–night cycles of mice by exposing them to continuous light or by knocking out a gene that is associated with the circadian clock. When fed a high-fat diet, the disrupted mice became fatter than non-disrupted animals.

The authors suggest that the human internal clock could be targeted to modify metabolic diseases.

Curr. Biol. **http://dx.doi.org/10.1016/j.cub.2013.01.048 (2013)**

MEDICINE

Stem cells guide Alzheimer's drugs

Neural cells grown from stem cells of patients with Alzheimer's disease could be used to evaluate drugs for subsets of patients.

Teams led by Haruhisa Inoue of Kyoto University, and Nobuhisa Iwata of Nagasaki University, both in Japan, generated induced pluripotent stem (iPS) cells from patients with inherited and non-inherited forms of the disease. Neurons derived from these cells were treated with the omega-3 fatty acid docosahexaenoic acid — which has previously failed in some clinical trials for Alzheimer's disease. The compound partially increased the survival time of neurons from a patient with an inherited form of the disease but had no effect on the survival of neurons from patients with non-inherited disease. Responses to cellular stress as well as accumulation of the protein amyloid-β, which is associated with the disease, also varied between neurons derived from different patients.

The authors suggest that patient-specific iPS cells could help researchers to explain variable clinical results and guide drug development.

Cell Stem Cell **http://dx.doi.org/10.1016/j.stem.2013.01.009 (2013)**

CHAO GAO

NANOMATERIALS

Solid carbon, springy and light

Two projects have produced elastic, ultra-light carbon foams without using a template.

Chao Gao and his colleagues at Zhejiang University in Hangzhou, China, freeze-dried solutions of carbon nanotubes and large sheets of graphene oxide, and then chemically removed oxygen to leave a conductive, elastic, solid foam (pictured with long-stemmed grass) with a density lower than that of air. These aerogels can absorb up to 900 times their own weight in oil — better than commercial absorbents.

Zongbin Zhao and Jieshan Qiu, at Dalian University of Technology in China and their colleagues have made similar, but slightly heavier aerogels, from graphene oxide sheets. Their aerogel is extremely elastic, bouncing back when compressed, so may be useful in absorbing energy and dampening vibrations for a variety of machinery. Although similarly light carbon aerogels have been made before, they have relied on template scaffolds that were later etched away, a technique that limits the size of the final structure.

Adv. Mater. **http://dx.doi.org/10.1002/adma.201204576; http://dx.doi.org/10.1002/adma.201204530 (2013)**

BIOGEOCHEMISTRY

Carbon cycles Down Under

Despite emissions from wildfires, changes in land use and extreme variability in carbon uptake from the biosphere, Australian ecosystems absorbed enough carbon to offset nearly a third of its fossil-fuel emissions between 1990 and 2011.

Vanessa Haverd of the Commonwealth Scientific and Industrial Research Organisation in Canberra and her colleagues combined a regional biogeochemical model with emissions data extracted from databases and the literature to produce a comprehensive carbon budget. Contributing to the offset, rising carbon dioxide

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levels and climate change increased carbon uptake by around 80 million tonnes per year, whereas fire and land-use change boosted carbon emissions by an average of 44 million tonnes per year. In addition, Australia exported 1.5 times more carbon in fossil fuels than it consumed over the two decades, and 2.5 times more from 2009 to 2010.
Biogeosciences 10, **851–869 (2013)**

MICROBIOLOGY

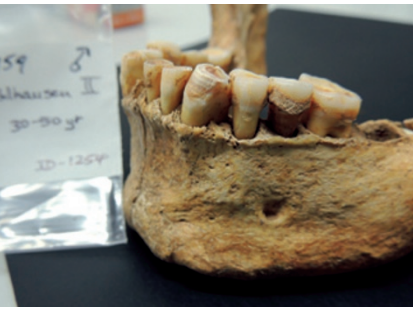
Healthier prehistoric plaque

When humans turned to agriculture, and later to modern starch- and sugar-filled diets, the microbes colonizing their teeth changed drastically.

Alan Cooper at the University of Adelaide, Australia, and his colleagues sequenced microbial DNA from the calcified dental plaque **(pictured)** of 34 mesolithic to medieval human skeletons. The oral microbial populations of individuals who lived in early farming communities were much less diverse than those of hunter-gatherers, and harboured more bacteria linked to diseases such as gingivitis.

Contemporary microbial populations are, in turn, less diverse than those of earlier communities and are dominated by bacteria linked to diseases such as those that cause cavities. The authors believe that the recent shift probably occurred during the Industrial Revolution, when processed sugar and flour became widely available.
Nature Genet. **http://dx.doi.org/10.1038/ng.2536 (2013)**

ALAN COOPER



ECOLOGY

Flower power guides bees

Along with colour and scent, electrical fields on flowers can guide bees' search for pollen and nectar.

Flowers often have a negative charge, whereas insects such as bumblebees (*Bombus terrestris*) tend to build up a positive charge as they fly. Daniel Robert and his colleagues at the University of Bristol, UK, placed electrodes in stems of petunias (*Petunia integrifolia*) and found that visits from bumblebees changed the flowers' electrical potential for a short time. The bees could sense such electrical cues and use them to recognize and remember which flowers provided them with a reward. Coating the flowers with coloured, charged particles (**pictured**) showed that the floral electrical fields were strongest at the outer edges of petals.

DANIEL ROBERT/DOMINIC CLARKE

Electrical signals could be a particularly versatile way for plants and pollinators to communicate, the authors say.
Science **http://dx.doi.org/10.1126/science.1230883 (2013)**
For a longer story on this research, see go.nature.com/nvjbli

HOLOGRAPHY

Liquid crystal movies

Holographic technology can produce three-dimensional images that can be seen without special eyewear and without causing visual fatigue, but the images are usually static.

Takeo Sasaki and his colleagues at Tokyo University of Science used liquid crystals made from organic compounds to produce a dynamic hologram. An electrical field applied to the liquid-crystal mixture alters how this medium bends, or refracts, the direction of incoming light. The researchers sent coupled laser beams through the crystal mixture to generate a holographic image.

Although small and monochromatic, the hologram exhibited more than seven times the light amplification of previous attempts, and refreshed every 8 milliseconds — fast enough to produce a smooth holographic movie. Such a technique could be used for three-dimensional displays.
Appl. Phys. Lett. 102, **063306 (2013)**

ANIMAL BEHAVIOUR

How monarchs know where to go

Migrating butterflies may use temperature to choose their flight direction.

Each autumn, monarch butterflies (*Danaus plexippus*) migrate more than 3,200 kilometres down eastern North America to overwinter in Mexico. The insects navigate by internal clocks that are calibrated by sunlight. But what halts the journey south? The answer is the cold.

Steven Reppert and Patrick Guerra of the University of Massachusetts Medical School in Worcester caught butterflies at the beginning of the autumn migration and kept them in the chilly temperatures that they would experience at sites in the mountains of central Mexico. When released after 24 days in the cold, the butterflies flew off northward, the direction they would normally take in spring. Simulating changes in day length did not have this effect.

Worryingly, if climate change obscures the cold signal, butterflies may keep flying south and not know when to return.
Curr. Biol. **http://dx.doi.org/10.1016/j.cub.2013.01.052 (2013)**

COMMUNITY CHOICE

The most viewed papers in science

NEUROSCIENCE

Lonely teen rats choose drugs

HIGHLY READ on www.cell.com/neuron in February

Socially isolated adolescent rats acquire amphetamine- and alcohol-associated memories faster — and in the case of amphetamine are slower to extinguish, or 'unlearn', them — than rats kept in groups.

Hitoshi Morikawa and his colleagues at the University of Texas at Austin found that isolated rats formed a preference for drug-associated stimuli after only one exposure, whereas rats housed in groups required repeated exposures. The researchers also showed that social isolation boosted signalling by certain neurons in a part of the brain that links behaviours with rewards. This boost was not reversed by returning the rats to a social environment.

Such effects may help to explain how pre-adult experiences can increase vulnerability to addiction, the authors suggest.
Neuron 77, **335–345 (2013)**

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