RESEARCH HIGHLIGHTS

CARDIOVASCULAR BIOLOGY

Gut microbes raise heart-attack risk

Gut microbes produce a chemical that enhances clotting in the arteries, increasing the risk of heart attack and stroke.

Stanley Hazen of the Cleveland Clinic in Ohio and his colleagues treated human platelets, which form blood clots, with a compound called TMAO. This is made in the body from a waste product of gut microbes, and has been linked to heart disease. The team found that TMAO made the platelets form artery-blocking clots faster. The researchers increased blood TMAO levels in mice by feeding them a diet that was rich in choline, a TMAO precursor, and found that the animals formed clots faster than did those with lower TMAO levels.

This effect was not seen in animals that lacked gut microbes or that were treated with antibiotics. When intestinal microbes from mice that produced high levels of TMAO were transplanted into mice with no gut microbes, the recipients' clotting risk increased. The results reveal a link between diet, gut microbes and heart-disease risk, the authors say.

Cell **http://doi.org/bdb2 (2016)**

CHEMICAL ENGINEERING

Waste gas makes liquid fuel

Waste gases containing carbon dioxide can be converted into diesel, thanks to a bacterium and an engineered yeast.

Gregory Stephanopoulos and his colleagues at the Massachusetts Institute of Technology in Cambridge developed a two-stage process that uses bioreactors to create liquid fuel out of gas mixtures containing CO_2. The first stage involves the bacterium *Moorella thermoacetica*, which converts mixtures of CO_2 and other gases such as carbon monoxide or hydrogen into acetic acid. An engineered yeast, *Yarrowia lipolytica*, then transforms the acetic acid into an oil that can be turned into diesel using existing industrial processes.

This method, with further enhancements to boost efficiency, could be used to produce fuel from the waste gases that are generated by industrial sites such as steel mills and coal-fired power plants, the authors say.

Proc. Natl Acad. Sci. USA **http://doi.org/bdb5 (2016)**

TAKAO ONOZATO/AFLO/GETTY

ANIMAL BEHAVIOUR

Order of notes is key in bird calls

A bird species derives different meanings from varying combinations of notes, just as humans understand complex meanings from words combined in different ways.

Toshitaka Suzuki of the Graduate University for Advanced Studies in Hayama, Japan, and his colleagues played recordings of four notes — A, B, C and D — in different orders for the Japanese great tit (*Parus minor*; pictured), which normally uses more than ten different notes in its calls. Playing ABC prompted the birds to scan horizontally for predators. On hearing a repeated D note, the birds approached the source of the calls. ABC–D calls elicited both behaviours, but playing D–ABC invoked little or no response.

The authors suggest that the order of the notes determines meaning, and say that this is the first experimental evidence for 'compositional syntax' in a wild animal.

Nature Commun. *7*, **10986 (2016)**

CANCER

Gene blocks anti-tumour response

A common cancer gene works in part by helping tumours to evade immune cells.

Dean Felsher of Stanford University in California and his colleagues studied the effects of *MYC* — a gene that is often overexpressed in cancer — in a mouse model of a type of leukaemia. They found that higher *MYC* expression levels increased the production of two proteins, PD-L1 and CD47, that help cancer cells to hide from the immune system. When *MYC* was inactivated, CD47 and PD-L1 levels dropped and tumour size decreased. Tumour data from humans showed a strong link between levels of *MYC* expression and levels of these immune-evasion signals.

People with cancers that overexpress *MYC* could benefit from treatments that

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boost the immune attack against tumours, the authors suggest.
Science **http://doi.org/bc7p (2016)**

NEUROSCIENCE

Altered sensations in anxiety

Anxiety disorders could involve not only cognitive, but also sensory changes in the brain.

Recent studies have suggested that people with anxiety, after learning a negative stimulus, respond negatively to similar but neutral stimuli more often than healthy people. Rony Paz at the Weizmann Institute of Science in Rehovot, Israel, and his colleagues found that individuals with anxiety disorders also perceive these stimuli less precisely than healthy people do. After learning to associate a tone with either monetary gain or loss, participants were asked to decide whether a series of other sounds were a match to the previous ones or were new. People with anxiety disorders mistook a wider range of frequencies for the tones they had learned, compared with healthy people. Learned tones and neighbouring sounds triggered brain activity that showed greater similarity in people with the disorders than in healthy people. This effect was in the brain's auditory cortex and in the amygdala, which processes fear.

The findings suggest that people with anxiety have altered perception of certain stimuli, the authors say.
Curr. Biol. **http://doi.org/bc3z (2016)**

MATTIAS LANAS

MICROBIOLOGY

Bacterial toxins invite infections

Certain pneumonia-causing bacteria produce compounds that help other pathogenic bacteria to spread through the lungs.

Bret Sellman at MedImmune, a biotechnology firm in Gaithersburg, Maryland, and his colleagues infected mice with a variety of bacterial species, either individually or in combination with *Staphylococcus aureus*, which can cause respiratory and other infections. Mice that were co-infected with *S. aureus* had higher levels of both microbe species in their lungs, and were more likely to die than animals infected with a single pathogen. The team found that a protein produced by *S. aureus*, called α-toxin, aids the growth of several bacterial species by impairing immune-cell function. Early treatment with an antibody against α-toxin helped to eliminate *S. aureus* and prevented other pathogens from multiplying.

The authors suggest that antibody-based treatments targeting a single bacterial species could help some people who are infected with multiple pathogens.
Sci. Transl. Med. 8, **329ra31 (2016)**

BIOMECHANICS

How flying beetles waterski

The waterlily beetle exploits properties of the interface where air and water meet to glide quickly across the surface of ponds.

Manu Prakash at Stanford University in California and his colleagues filmed waterlily beetles (*Galerucella nymphaeae*; **pictured**) at 3,000 frames per second to characterize the mechanics of the insect's unusual mode of flight on the two-dimensional surface. They found that the claws on the beetles' legs remain submerged during flight, anchoring the insects to the water.

Keeping four of their six legs on the water, the insects use the fluid's surface tension to support their body weight and move by flapping their hind wings, cruising along the water's surface at speeds of up to half a metre per second. Moving any faster would render them airborne, because the ripples they produced on the water would release their anchors.
J. Exp. Biol. 219, **752–766 (2016)**

ESO/F. CHAR

ASTRONOMY

Milky Way's bulging waistline

The mass of stars in the Milky Way's central bulge (**pictured**) is about 20 billion times the mass of the Sun — a much higher estimate than in most previous studies.

The central bulge protrudes from the Galaxy's main disk like the yolk of a fried egg and hosts a large density of stars. To estimate the mass of those stars, Elena Valenti at the European Southern Observatory (ESO) in Garching, Germany, and her team used a catalogue of stars of a particular type. The data are from ESO's Visible and Infrared Survey Telescope for Astronomy (VISTA) at the Paranal Observatory in Chile. The team also did a deeper study of all the stars in a small region of the bulge, in part using the Hubble Space Telescope.

Valenti says that this is the first study of the bulge based entirely on observation, without the help of theoretical models.
Astron. Astrophys. 587, **L6 (2016)**

LONGEVITY

Genetic switches for long life

Researchers have homed in on the genetic control points that allow nematodes to live longer when they are on a low-calorie diet.

A team led by Jing-Dong Han of the Chinese Academy of Sciences in Shanghai analysed gene-expression changes over time in the nematode *Caenorhabditis elegans*. The worms were subjected either to caloric restriction or to intermittent fasting, both of which extend worm lifespan.

The team identified changes in the expression of various genes at different times, with metabolism genes responding early during the diet, and those linked to cell division and DNA repair changing later on. The researchers then used an algorithm to identify three sets of genes that regulate this altered expression. Changing the activity of the pathways controlled by these genes extended the lifespan of the worms, mimicking the effect of dietary restriction.
Cell Metab. 23, **529–540 (2016)**

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