

RESEARCH HIGHLIGHTS

Selections from the scientific literature

MEDICAL MICROBIOLOGY

HIV disrupts gut bacteria

The guts of people with HIV are enriched with microbes associated with inflammation — even if patients are on antiviral therapy.

Mike McCune and Susan Lynch of the University of California, San Francisco, and their colleagues characterized microbial communities associated with chronic inflammation in patients with HIV. Communities with a higher abundance of Proteobacteria (including *Escherichia*, *Pseudomonas* and *Salmonella* species) and a lower abundance of Bacteroidetes were linked with higher levels of inflammation and with increased activity in a metabolic pathway whose products regulate T cells. These results indicate that microbes in the gut mucosa may influence progression of HIV disease.

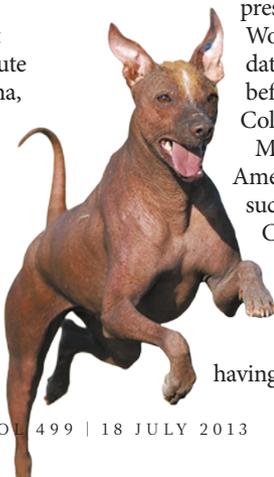
Sci. Transl. Med. 5, 193ra91 (2013)

GENETICS

Old origins for New World dogs

Ancestors of American dog breeds may have walked across the Bering Strait rather than being brought across the ocean.

Peter Savolainen at the KTH Royal Institute of Technology in Solna, Sweden, and his colleagues collected mitochondrial DNA from blood or cheek cells of 347 individuals of indigenous American breeds, such as Chihuahuas,



Peruvian hairless dogs (pictured) and Canadian Eskimo dogs. The authors compared this DNA to that of modern European and East Asian dogs, as well as to 24

preserved New World specimens dated to long before Christopher Columbus set sail.

Modern native American canines, such as the feral Carolina dog, still resemble their pre-Columbian American counterparts, having no more than

30% European heritage. These modern breeds descended from Asian breeds brought by human migrants as long as 15,000 years ago, the authors suggest.

Proc. R. Soc. B 280, 20131142 (2013)

MATERIALS SCIENCE

Liquid metal printed in 3D

Wires, fibres and elaborate stacks of droplets can be printed in liquid metal.

Most three-dimensional (3D) printing uses molten plastics that cool and harden.

This cooling period changes the plastics' mechanical properties, which limits the shapes that can be created. A team led by Michael Dickey at North Carolina State University in Raleigh produced patterns in liquid metal by extruding a gallium–indium alloy through a 3D printer's nozzle at room temperature. On exposure to air, the material instantly formed a roughly nanometre-thick oxide skin, which held the liquid in shape. This layer was sticky and so allowed the team to stack droplets into complex constructions (pictured). Although the structures were quite weak, the wires



CONSERVATION SCIENCE

Conserved coasts curb storm damage

Conserving the reefs and vegetation that buffer the US coast from waves might reduce by half the number of residents most at risk from storm surges and sea-level rise.

To work out where natural habitat provides the best defence, a team led by Katie Arkema at Stanford University in California used projections of future sea levels to estimate how vulnerable people and property would be to coastal hazards with and without intact natural habitats. Hazard indices calculated for every

square kilometre of the US coastline showed that ecosystems had the greatest protective impact in Florida, New York and California.

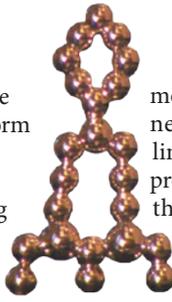
In places where natural habitats most reduce risks, conservation or restoration should be considered alongside expensive engineering projects for coastal defence, the authors suggest.

Nature Clim. Change <http://dx.doi.org/10.1038/nclimate1944> (2013)

For a longer story on this research, see go.nature.com/i8owbq

made this way could be encased in plastic to form a stretchable, flexible electrical connection between light-emitting diodes.

Adv. Mater. <http://dx.doi.org/10.1002/adma.201301400> (2013)



PHYSIOLOGY

Bulging muscles gain strength

A muscle that can bulge exerts more force than one held flat, partly because of changes in the amount of space separating its fibres.

David Williams of the University of Washington in Seattle and his colleagues used X-ray diffraction measurements taken from insect flight muscles (a common model for skeletal muscle) to calibrate a theoretical model of contracting muscle. When muscles contract and bulge, the spreading that occurs between muscle fibres increases the angle at which muscle's thick myosin filaments tug on thin actin filaments, boosting the amount of force that can be exerted. Up to half of a muscle's peak strength can be accounted for by this mechanism, the researchers say.

Proc. R. Soc. B. 280, 20130697 (2013)

CANCER BIOLOGY

Nerves spur prostate cancer

The development of nerve fibres may encourage prostate cancer to grow and spread. Claire Magnon and Paul Frenette at the Albert Einstein College of Medicine in New York City and their colleagues used a battery of genetic, pharmacological and surgical techniques to disrupt specific interactions between nerves and tumours in a mouse model of prostate cancer. One type of nerve fibre promoted tumour growth through the neurotransmitter noradrenaline. Another type made cancer

more invasive by releasing the neurotransmitter acetylcholine. An analysis of 43 human prostate-cancer samples found that more aggressive disease was correlated with more nerve fibres.

Interventions that block the growth of nerve tissue could provide a way to stall prostate cancer, the researchers suggest.

Science 341, 1236361 (2013)

For a longer story on this research, see go.nature.com/e2enib

SYMBIOSIS

Citrus pest's little helper

A notorious agricultural pest harbours a bacterium that produces a toxin which may deter its predators.

Orange-grove farmers dread the Asian citrus psyllid (*Diaphorina citri*), a small insect that carries the bacterial disease huanglongbing, which ruins citrus crops. Atsushi Nakabachi at Toyohashi University of Technology in Japan and his colleagues sequenced the genome of a second bacterium that lives inside the insect. Tentatively dubbed 'Candidatus Proffittella armatura', the microbe's genome is so tiny that it can probably exist only within its host. About 15% of the genome is dedicated to the synthesis of a polyketide compound, which might protect the insect. The authors suggest that the genes that produce the toxic polyketide may have 'jumped' into the symbiont from another bacterial species.

Curr. Biol. <http://dx.doi.org/10.1016/j.cub.2013.06.027> (2013)

MOLECULAR BIOLOGY

Designer gene knockdowns

A molecular tool borrowed from bacteria could provide a targeted way to switch genes on or off in human cells.

Species such as *Streptococcus pyogenes* can cleave DNA at

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BIOPHYSICS

Sounds of red blood cells

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In less than a second, a laser pulse can show whether a red blood cell is squashed, swollen or abnormally shaped — all of which can signal disease or infection.

Eric Strohm and his colleagues at Ryerson University in Toronto, Canada, showed that when struck with a laser beam, red blood cells emit sound waves — albeit of a frequency too high for human ears to hear. Researchers used the amplitudes and frequencies of the waves to accurately determine the size and shape of these cells. The technique may one day be useful for diagnosing chemical imbalances, malaria, certain types of anaemia or other blood-related disorders, the authors say.

Biophys. J. 105, 59–67 (2013)

specified sites using a protein called Cas9 and strands of RNA that guide Cas9 to its target. Jonathan Weissman of the University of California, San Francisco, and his colleagues have modified this system to control transcription — the production of a specified RNA from its DNA template.

Although many guide RNAs were ineffective, the system worked in yeast and human cells, in one case reducing expression of a targeted human gene by up to 80% with minimal effects on other genes. The method, called CRISPR interference after the bacterial system it involves, can silence a wider variety of sequences than the popular RNA-interference technique.

Cell <http://dx.doi.org/10.1016/j.cell.2013.06.044> (2013)

ANIMAL BEHAVIOUR

Cricket winners show off

Wild male crickets act more aggressively in fights and put on flashier victory displays if other crickets are watching.

Lauren Fitzsimmons and Susan Bertram at Carleton University in Ottawa placed pairs of male spring field crickets

(*Gryllus veletis*, pictured) together to fight. For some of the contests, the authors added a third cricket that could watch and hear the pair through a transparent, perforated wall. Wild-caught crickets' behaviour changed in the presence of spectators, becoming considerably more aggressive. Those that won fights also engaged in more flamboyant strutting (jerking their bodies and chirp-



ing) if a third male cricket was present. Lab-reared crickets did not exhibit such marked behaviour, suggesting that it might be shaped by social experience.

Although audience effects are well-documented in vertebrates, this is the first evidence that invertebrates modify contest behaviour in the presence of an observer, the authors say.

Biol. Lett. 9, 20130449 (2013)

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