RESEARCH HIGHLIGHTS

Selections from the scientific literature

MICROBIAL GENOMICS

Sequencing spots killer microbes

Sequencing the genome of an antibiotic-resistant microbe can identify the most dangerous isolates, reports a team led by Ruth Massey at the University of Bath, UK.

Her group studied 90 isolates of methicillin-resistant *Staphylococcus aureus* (MRSA) that had varying levels of ability to stick to and kill cultured human cells. The researchers sequenced the isolates, and conducted a genome-wide association study to identify 121 genetic changes, including additions or deletions of DNA, that were linked to this toxicity.

A set of 50 of these variants could predict the most and least toxic of 30 of the isolates, although it was unable to predict the medium-toxicity isolates with any accuracy.

Genome Res. **http://dx.doi.org/10.1101/gr.165415.113 (2014)**

CLIVE LIMPKIN/ALAMY

EVOLUTION

Hummingbird species on the rise

In just 22 million years or so, hummingbirds have rapidly diversified from a single ancestor into more than 300 species, and some lineages are still generating new species at an extraordinary rate.

Jimmy McGuire at the University of California, Berkeley, and his colleagues compared the DNA sequences of 284 hummingbird species, including *Selasphorus flammula* (pictured).

They found that the birds first diverged from their sister group, the swifts, around 42 million years ago and have diversified into 9 major lineages in South America over the past 22 million years. Speciation has been particularly dramatic in the Andes mountains, which have a wide range of habitats and climates and are home to 40% of hummingbird species.

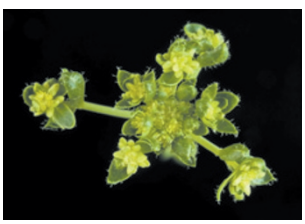
The researchers calculate that there could be as many as 767 species of hummingbird in the next several million years — more than twice the number that currently exist.

Curr. Biol. **http://doi.org/r6v (2014)**

PLANT BIOLOGY

How bacteria turn plants into zombies

Researchers have uncovered how certain bacterial pathogens that infect plants make them sterile and capable only of spreading disease.



JIC PHOTOGRAPHY

Phytoplasma pathogens are transmitted by sap-feeding insects that turn flowers (such as *Arabidopsis thaliana*, **pictured** top) into leaf-like structures (bottom) that do not produce seeds. Saskia Hogenhout at the John Innes Centre in Norwich, UK, and her colleagues studied *Arabidopsis* plants and found that a phytoplasma protein, SAP54, interacts with a class of plant proteins called RAD23 to degrade molecules that regulate floral development.

This interaction also seems to boost the attractiveness of infected plants to leafhopper insects, which spread phytoplasma from one plant to another.

PLoS Biol. **12, e1001835 (2014)**

MOLECULAR BIOLOGY

DNA regulator acts on RNA too

A DNA-binding protein that regulates several genes also attaches to RNA, revealing another way in which the protein acts as a 'master weaver' of the genome.

Félix Recillas-Targa of the National Autonomous University of Mexico in Mexico City, Danny Reinberg of New York University's Langone Medical Center and their colleagues discovered a region in the DNA-binding protein CTCF that binds to the RNA molecule Wrap53. This RNA regulates the tumour suppressor p53, a protein involved in DNA repair.

When the team mutated CTCF in human cells, CTCF could not bind to Wrap53 RNA and cells failed to trigger responses to damaged DNA, showing that CTCF controls p53 by binding to Wrap53. In a genome-wide screen, the team found CTCF attached to some 17,000 other RNAs.

CTCF could regulate many genes in this way, and binding to RNA could allow the protein to form short chains, which might influence how it creates loops in protein–DNA structures called chromatin, the authors suggest.
Genes Dev. 28, **723–734 (2014)**

PLANETARY SCIENCE

A moon of Saturn hides an ocean

Beneath Enceladus's south pole lies a watery ocean that could hold organic molecules that form the basis of life.

Luciano Iess at the Sapienza University of Rome and his colleagues analysed gravity measurements from the Cassini spacecraft during three flybys of this moon of Saturn in 2010–12. They found more mass than expected at the south pole, suggesting that something denser than ice was beneath the 30–40 kilometres of ice covering Enceladus's surface. The researchers think that a 10-km-thick layer of ocean covers the moon's rocky core.

In 2005, Cassini spotted water vapour and ice spraying through cracks in the icy shell near Enceladus's south pole. These jets could be carrying organic molecules and salts from this ocean to the surface, making the moon a place to search for possible extraterrestrial life.
Science 344, **78–80 (2014)**

CLIMATE SCIENCE

El Niño comes in many flavours

Different kinds of El Niño warming events in the tropical Pacific Ocean can have widely varying effects on global temperatures.

Simon Donner and Sandra Banholzer of the University of British Columbia in Vancouver, Canada, used historical sea surface temperature data to classify El Niño events into three groups on the basis of the location of ocean warming: the eastern Pacific, the central Pacific and a mixture of both. They then compared their results with three data sets of global temperatures. Although El Niños are commonly associated with warming, the duo found that only the more powerful eastern Pacific El Niño was linked to higher global temperatures.

These varying El Niño effects could explain some of the temperature trends seen in the Pacific Ocean since the late 1880s, such as periods of both accelerated and slow warming.
Geophys. Res. Lett. **http://doi.org/r6z (2014)**

BIOTECHNOLOGY

Altered trees make digestible wood

Genetically engineered poplars can make a modified polymer in their wood that breaks down more easily than natural forms. Such trees could one day be sources of biofuels.

Current methods for digesting the tough, resistant polymer called lignin involve concentrated chemicals at high temperatures. John Ralph at the University of Wisconsin–Madison and his colleagues inserted a gene into poplar trees (*Populus* spp.) that produces a molecule that is incorporated in the lignin polymer chain. The molecule forms an ester chemical bond in the growing chain, which can be broken down by mild chemicals at lower temperatures, aiding bioethanol production later.

The modified poplars produce normal amounts of lignin and seem to be healthy, but they have not yet been tested in the field.
Science 344, **90–93 (2014)**

AGRICULTURE

Rising carbon saps wheat quality

A field experiment shows that wheat exposed to higher carbon dioxide levels converts less of the nitrogen it absorbs into protein. This could result in decreased food quality this century.

Arnold Bloom at the University of California, Davis, and his colleagues compared nitrate concentrations and the relative amounts of heavy and light nitrogen isotopes in leaves from wheat (*Triticum aestivum* L.) grown under elevated and normal CO_2 conditions. They found that increased CO_2 slows down the assimilation of nitrate into proteins in leaves.

The predicted rise in CO_2 over the next few decades could decrease protein levels in crop plants by about 3% without sophisticated new approaches to nitrogen fertilization, the authors say.
Nature Clim. Change **http://doi.org/r7j (2014)**

COMMUNITY CHOICE

The most viewed papers in science

CLIMATE CHANGE

European hotspot in a warmer world

HIGHLY READ on iopscience.iop.org in March

Even if the global temperature rise is held to a limit of 2 °C, most of Europe will probably warm by substantially more.

A team led by Robert Vautard at the Pierre-Simon Laplace Institute in Gif-sur-Yvette, France, combined 6 global climate simulations with 15 simulations that focused on Europe. The team found that, in winter, warming in northern and eastern Europe would be more intense — with temperatures rising by up to 3 °C — whereas southern Europe would become much hotter in summer.

Winter precipitation would increase over central and northern Europe, and there would be less summer rain in the central and southern parts of the continent, the authors found.
Environ. Res. Lett. 9, **034006 (2014)**

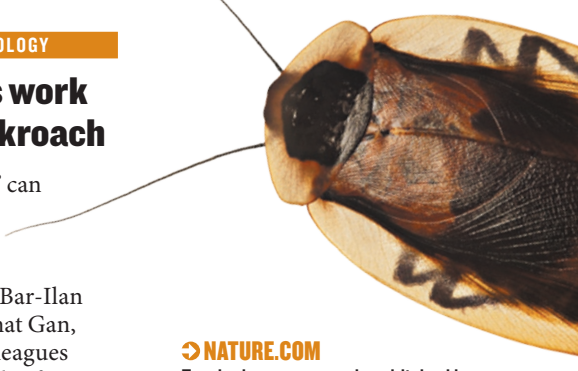
NANOTECHNOLOGY

DNA robots work in a live cockroach

Molecular 'robots' can perform complex logic tasks inside a living organism.

Ido Bachelet of Bar-Ilan University in Ramat Gan, Israel, and his colleagues used folded strands of DNA to create a suite of nanorobots that open, close and coordinate with each other in response to various interactions with certain proteins. When the robots were injected into a living cockroach (*Blaberus discoidalis*; **pictured**), different robot combinations created seven kinds of logic gate that each delivers a different outcome — such as releasing various antibody payloads — on the basis of specific protein cues.

The authors suggest that the technique might eventually be used to control drug delivery in humans.
Nature Nanotechnol. **http://dx.doi.org/10.1038/nnano.2014.58 (2014)**



DALY AND NEWTON/IMAGE BANK/GETTY

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