

RESEARCH HIGHLIGHTS

Selections from the scientific literature

GENETIC ENGINEERING

Boosting 'gene drive' safety

Researchers have developed a way to reduce the risks of a method that genetically engineers entire populations with unprecedented speed.

'Gene drives' are genetic changes, based on inserting parts of the CRISPR-Cas9 genome-editing system into a host genome, that spread through a population more rapidly than do normal mutations. Gene drives could be used to wipe out disease-carrying insects, for example, but could also spread uncontrollably in an ecosystem.

To reduce this risk, Kevin Esvelt and George Church of Harvard Medical School in Boston, Massachusetts, and their team inserted the bacterial DNA-cutting Cas9 enzyme into a piece of DNA external to the *Saccharomyces cerevisiae* yeast genome, and put the guide RNAs for directing Cas9 to a specific DNA sequence into the genome. This separation ensured that the gene drive would not spread exponentially if the strain was released into the wild.

Nature Biotech. <http://doi.org/89h> (2015)

ANIMAL BEHAVIOUR

Polarized light as a secret signal

Some crustaceans can detect polarized light, using it as a covert signal that is



invisible to predators.

Yakir Luc Gagnon at the University of Queensland in Brisbane, Australia, found that the bodies of mantis shrimps (*Gonodactylaceus falcatus*; pictured) reflect a distinctive pattern of circular polarization (pictured in red) that is visible only to other shrimps. When presented with different burrows in the laboratory, mantis shrimps avoided or delayed entering those that were lit with circularly polarized light compared with those under unpolarized light. This suggests that the shrimps use polarized light cues to sense whether potential burrows are occupied.

In another study, Martin

How at the University of Bristol, UK, found that male fiddler crabs (*Uca stenodactylus*) detected polarized targets in the wild from farther away than non-polarized ones. The animals' sensitivity to polarized light could be boosting the visual contrast between crabs and their mudflat habitat. *Curr. Biol.* <http://doi.org/89c> (2015); <http://doi.org/89d> (2015)

MICROBIOLOGY

Antibiotics make MRSA worse

Antibiotics could help a drug-resistant pathogen to worsen inflammation.

Methicillin-resistant *Staphylococcus aureus* (MRSA) resists most β -lactam antibiotics by acquiring a protein that modifies the cell wall. David Underhill, George Liu and their team at Cedars-Sinai Medical Center in Los Angeles, California, thought that this modification might also boost the production of inflammatory molecules called cytokines in the host. They exposed mouse and human immune cells to MRSA and found that the host cells made higher levels of a cytokine called IL-1 β when MRSA had been grown in the presence of β -lactams. In mice, treatment with a β -lactam caused more immune cells to flood the site



CONSERVATION

How to save a species

Common factors such as law enforcement contribute to the success or failure of species-recovery programmes, suggesting that conservation lessons could be generalized across different populations or species.

Jennifer Crees at the Zoological Society of London and her colleagues analysed 48 mammalian conservation programmes, ranging from the successful protection of the golden lion tamarin (pictured) to the failed attempt to save the Yangtze River dolphin.

Whereas national-level legislation did not necessarily lead to good outcomes, intensity of local law enforcement did. Moreover, reducing the threats to animals — such as habitat loss and hunting — was crucial for long-term survival.

No link was found between the outcomes of recovery programmes and biological factors such as body mass and habitat type, suggesting that well-designed conservation programmes should work across different species.

Conserv. Biol. <http://doi.org/87v> (2015)

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of an MRSA skin infection, resulting in more inflammation and larger abscesses than in MRSA-infected mice that were not treated with the antibiotic.

MRSA infections are still sometimes treated with β -lactams, but these should be used with other antibiotic classes, the authors write. *Cell Host Microbe* 18, 604–612 (2015)

MUSCLE BIOLOGY

Dog saved from muscular disease

A golden retriever with the mutation for Duchenne muscular dystrophy was found to have working muscles because of a compensatory mutation in another gene.

The dog, Ringo, was bred by researchers to have the mutated version of a protein called dystrophin, but he still had normal muscles. Louis Kunkel at Boston Children's Hospital in Massachusetts, Mayana Zatz at the University of São Paulo in Brazil and their team analysed the genomes of Ringo and one of his male offspring that also had the mutation and normal muscles. They identified a separate mutation in a development gene, *Jagged1*, that resulted in higher levels of Jagged1 in Ringo and his son than in 31 affected dogs.

This mutation may compensate for the muscle-regeneration problems caused by a lack of dystrophin, the authors suggest. *Cell* <http://doi.org/87s> (2015)

BIOTECHNOLOGY

Adult cells edited and reprogrammed

A one-step procedure can correct genetic mutations in body cells and reprogram them into stem cells.

Stem cells derived from patients' tissues could generate replacement tissue that is not rejected by the immune system. Current methods have stem-cell yields of only 0.5–0.9%, and require extra steps to correct any mutations. Sara

Howden, now at the Murdoch Children's Research Institute in Parkville, Australia, and her team introduced into cells a mix of genes that induce stem-cell formation and encode the components of the CRISPR–Cas9 gene-editing system.

They targeted mutations in cells from two people — an adult with a degenerative retinal disease and an infant with severe combined immunodeficiency — and made stem cells without the defect. The method produced stem cells with 5–8% efficiency. *Stem Cell Rep.* <http://doi.org/87t> (2015)

NATURAL HISTORY

Selenium linked to mass extinctions

Plummeting ocean reserves of selenium could have played a part in past mass extinctions.

Selenium and other trace elements help certain enzymes to function and perform other essential biochemical duties in organisms. John Long at Flinders University in Adelaide, Australia, and his team estimated ocean selenium levels over the past 560 million years by analysing it in marine pyrite samples. Selenium concentrations fluctuated drastically, but sharp drops coincided with several mass extinctions — including one at the end of the Triassic 200 million years ago.

Crashes in selenium levels may have acted in concert with changes in oxygen and carbon cycles to drive mass extinctions, the authors say. *Gondwana Res.* <http://doi.org/834> (2015)

MATERIALS

Super-thin superconductor

A layer of niobium diselenide (NbSe_2) just a few atoms thick can conduct electricity with zero resistance.

Most 3D superconducting materials lose this ability once they are in their 2D form. Miguel Ugeda at the

SOCIAL SELECTION

Popular topics on social media

How to judge scientists' strengths

When the director of a research institute asked his Twitter followers for a practical way to dig out promising candidates from the hundreds of applications sitting on his desk, they responded in spades. Ewan Birney, co-director of the EMBL European Bioinformatics Institute in Hinxton, UK, tweeted that he was procrastinating over how to shortlist the applications, which together listed around 2,500 research papers. (The process is ongoing, so Birney would not say exactly what the researchers were applying for.) He tweeted: "I get *genuinely* stuck here. If I am not going to use journal title as a proxy for quality, what do I do?"

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Yoav Gilad, a geneticist at the University of Chicago, Illinois, tweeted: "Read the abstracts. Read the papers. Yes, if it means 2500 papers, then get a larger committee."

nanoGUNE research centre in San Sebastian, Spain, Michael Crommie at the University of California, Berkeley, and their colleagues studied the behaviour of electrons in a single layer of NbSe_2 , grown on a bilayer of atom-thick carbon.

As the team lowered the temperature to below -271°C , the material's resistance fell to zero. The authors say that the results confirm that NbSe_2 is a true 2D superconductor, a class of materials that could one day be used in tiny quantum computers and other devices.

The team also saw ripples in electron density while the material was superconducting — an effect that some theories predict should not be possible. *Nature Phys.* <http://doi.org/89g> (2015)

ENVIRONMENTAL SCIENCE

Chemicals hinder oil-eating microbes

Chemical dispersants added to spilled oil from the 2010 Deepwater Horizon disaster in the Gulf of Mexico (pictured) may have made little difference to the rates at which microbes broke down the oil.

The dispersants broke up the oil into smaller droplets to help sea-dwelling microbes to degrade it further. To study the chemicals' effect on the



microbes, Samantha Joye at the University of Georgia in Athens and her colleagues created bottled mixtures of sea water, oil and dispersants that simulated environmental conditions during the spill.

Mixtures of oil and sea water were dominated by *Marinobacter* species, which can degrade a wide range of hydrocarbons. But these populations dropped when dispersant was added, whereas *Colwellia*, which degrades dispersants, increased in abundance. Adding dispersants did not seem to change the rate at which hydrocarbons were broken down in the bottled samples. *Proc. Natl Acad. Sci. USA* <http://doi.org/89f> (2015)

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