RESEARCH HIGHLIGHTS

Selections from the scientific literature

CANCER

Spoilers of chemotherapy

Cancers often bounce back after the initial assault of chemotherapy. In breast cancers this is thanks, at least in part, to the activities of a class of immune cell called macrophages, say Johanna Joyce and her colleagues at Memorial Sloan-Kettering Cancer Center in New York.

The scientists treated tumour-bearing mice with high-dose paclitaxel (Taxol), a common breast-cancer chemotherapeutic. They found a higher influx of macrophages into treated than untreated tumours. This, in turn, resulted in elevated levels of enzymes called cathepsin proteases, which are made by the macrophages and are known to facilitate several disease processes, including tumour growth. Mouse cancer cells cultured with macrophages and treated with Taxol had significantly lower death rates than Taxol-treated cell lines cultured alone. Treating the cells with a cathepsin inhibitor called JPM completely reversed this effect.

Giving mice both Taxol and JPM significantly improved Taxol's efficacy against both primary and metastatic tumours.

Genes Dev. 25, **2465–2479 (2011)**

S. R. RON

BIODIVERSITY

Amazon frogs galore

The number of frog species living in the Amazon basin could be several times greater than currently recognized.

A team led by Chris Funk at Colorado State University in Fort Collins gathered and analysed genetic, morphological and acoustic data for 252 *Engystomops* frogs and 208 *Hypsiboas* tree frogs from across six Amazonian countries, focusing on Ecuador. The authors found that the two known species of *Engystomops* in fact encompass between five and seven species. Meanwhile, the two recognized *Hypsiboas* species represent between six and nine species (one undescribed species pictured).

The team concludes that more accurate estimates of biodiversity will improve risk assessments and conservation efforts.

Proc. R. Soc. B **http://dx.doi.org/10.1098/rspb.2011.1653 (2011)**

NEUROIMMUNOLOGY

A boost to the brain's barrier

A biochemical pathway involved in development also maintains a physiological brain-defence system that is implicated in the autoimmune disease multiple sclerosis (MS).

The blood–brain barrier (BBB) protects the brain by preventing cells and many molecules from entering it, and is disrupted in MS. Signalling between brain cells called astrocytes through the Hedgehog pathway promotes the maturation of cells lining the brain's blood vessels and formation of the BBB.

Alexandre Prat at the University of Montreal in Canada and his group found that inhibiting this pathway in an animal model of MS boosted immune-cell invasion of the brain and increased demyelination — loss of neurons' protective sheath, the hallmark of MS. Stimulating Hedgehog signalling in cultured human cells caused fewer inflammatory T cells to interact with and migrate across blood-vessel cells.

Many patients with MS experience cyclical inflammatory attacks of the brain, and they also have higher levels of Hedgehog signalling. The authors think that this pathway may be involved in rebalancing the immune response after each attack.

Science **http://dx.doi.org/10.1126/science.1206936 (2011)**

BIOENGINEERING

Two-in-one biofuel maker

A strain of the bacterium *Escherichia coli* has been genetically engineered to break down switchgrass into sugars, and then convert those sugars into three types of biofuel. This consolidated process, which does not require the addition of enzymes, could lower the cost of producing fuels from biomass.

Jay Keasling at Lawrence Berkeley National Laboratory

in Berkeley, California, and his colleagues designed their bacterium to produce four enzymes that digest cellulose and hemicellulose in switchgrass (*Panicum virgatum*) that has been pretreated with ionic liquids. They introduced into the *E. coli* three biochemical pathways that turn sugars into either fuel or fuel precursors for petrol, diesel and jet engines.

Further improvements, such as finding more and better enzymes, are needed to boost biofuel yields, the authors say.
Proc. Natl Acad. Sci. USA **http://dx.doi.org/10.1073/pnas.1106958108 (2011)**

ECOLOGY

The collapse of an invasive ant

Ecologists in New Zealand feared the worst when they first found the Argentine ant — one of the world's most invasive species — in the country in 1990. But their fears were overblown: by 2011, the ants (*Linepithema humile*, **pictured**) had disappeared, without any known human intervention, from 40% of the sites sampled by Meghan Cooling and her colleagues at Victoria University of Wellington.

Early this year, the researchers examined 150 sites and compared their findings with records from the time of the ants' first appearance. They calculated that Argentine ant populations had survived for an average of 14 years. At sites where the invasive ants had disappeared, resident ant populations were showing signs of recovery.

Furthermore, a climate-change model predicted that rising temperatures and declining rainfall will boost Argentine ant survival by only a few years — hardly a substantial increase on an ecological timescale.
Biol. Lett. **http://dx.doi.org/10.1098/rsbl.2011.1014 (2011)**

P. LESTER

DEVELOPMENTAL BIOLOGY

Stem cells from the heart

The hearts of mice contain a trove of adult stem cells. These resemble the mesenchymal stem cells found in bone marrow and other tissues, which can transform into bone, muscle or fat.

Richard Harvey at the Victor Chang Cardiac Research Institute in Darlinghurst, Australia, and his team isolated the cells in the hearts of adult and developing mice. The heart stem cells can divide repeatedly over long periods in culture, and bear surface proteins that resemble those found on other mesenchymal stem cells. Other experiments suggest that the heart stem cells develop from the same cells that form the heart during development. The study showed that the cells could develop into tissues including fat, cartilage and muscle.

It is unclear whether the stem cells naturally regenerate heart tissue, but they might provide a source of certain cell types for cardiac repair, the authors say.
Cell Stem Cell 9, **527–540 (2011)**

APPLIED PHYSICS

Moving micro magnets

Researchers in Germany have developed a sensor that can detect tiny magnetic signals. Applications for such a device could include helping to diagnose disease by detecting magnetically labelled substances in the body.

The sensor picks up very small signals from low-frequency magnetic fields. Franz Faupel at the University of Kiel and his colleagues made it by coating an oscillating cantilever (**pictured**) with a material that changes shape in a magnetic field. This causes the cantilever to move at different frequencies as the magnetic field changes. A laser measures the cantilever's movement.

The device works at room temperature and does not require the external magnetic field that other magnetosensors need to detect small signals.
Appl. Phys. Lett. 99, **223502 (2011)**

AM. INST. PHYS.

ECOLOGY

Bacteria pass through plants

Rickettsia bacteria are found in many animals, and are sometimes spread by blood-feeding insects. But the bacteria can be found in herbivorous insects too — because, it turns out, they can be transferred between insects via plants.

Einat Zchori-Fein at the Agricultural Research Organization in Ramat-Yishay, Israel, and her colleagues found that whiteflies (*Bemisia tabaci*) lacking the bacteria that were kept in isolation on the same leaf as those carrying Rickettsia acquired the bacteria within days. The team also show that the bacteria are present in the leaves of plants such as cotton and basil, where they survive in the phloem cells that carry nutrients, apparently without harming the plant.

The authors suggest that plants may also mediate the transmission of other bacteria that reside within insects.
Proc. R. Soc. B **http://dx.doi.org/10.1098/rspb.2011.2095 (2011)**

COMMUNITY CHOICE

The most viewed papers in science

MOLECULAR EVOLUTION

Pathogens put the pressure on

HIGHLY READ on www.plosgenetics.org in November

Pathogens have driven genetic adaptation in humans more than climate or diet has.

Matteo Fumagalli, now at the University of California, Berkeley, and his colleagues calculated the frequency of different genetic variants in more than 1,500 people across 55 populations. They then developed a statistical model to predict the distribution of these variants across the populations. The model incorporates three potential selective pressures on the human genome: climate, diet regimes and pathogen load. Genetic variation correlated most strongly with local pathogen diversity.

Nearly one-quarter of the 103 genes most closely linked to pathogen diversity are involved in immunity. Many also seem to increase susceptibility to autoimmune diseases such as multiple sclerosis and type 1 diabetes. The authors suggest that adapting to cope with pathogens has made humans susceptible to autoimmune diseases when those pathogens are absent.
PLoS Genet. 7, **e1002355 (2011)**
For a longer story on this research, see go.nature.com/d4es4b

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