RESEARCH HIGHLIGHTS

Arid America

Science doi:10.1126/science.1139601 (2007)
The great American drought that spawned the Dust Bowl of the 1930s may become the new climatic norm for much of southwestern North America.

Researchers led by Richard Seager at Columbia University in New York have developed a model projecting the impact of anthropogenic warming on the climate and hydrology of the already arid regions of the United States and northern Mexico. Using 19 climate models, the team projects an increase in aridity over the next several decades comparable with that of the drought that marked America's Dirty Thirties (pictured). The findings are also applicable to other subtropical areas.

BETTMANN/CORBIS

GENETICS

The long and short of it

Genome Res. doi:10.1101/gr.6036807 (2007)
Do long RNA molecules that do not encode proteins have any function? A team at the University of Oxford, UK, presents evidence that suggests they do.

Gerton Lunter and his colleagues compared the genetic sequences of more than 3,000 long noncoding RNAs from the mouse with the equivalent genomic locations in humans and rats. They identified stretches of DNA related to the RNAs (RNA libraries have not been compiled for humans or rats yet) that were conserved across the species. These included the promoter regions that prime transcription of DNA into RNA. This implies that the long RNAs have some biological function that is worth preserving — although what that function is remains a mystery.

MATERIALS CHEMISTRY

Emerging patterns

Macromolecules **40,** 1594–1597 (2007)
Chemists have chanced upon a way to deposit metal atoms at the interfaces between different regions of a 'block co-polymer' — molecules that contain distinct segments of different types of polymer. The resulting patterns of atoms could be exploited in electronic devices.

A team led by Mitchell Winnik of the University of Toronto, Canada, and Ian Manners of the University of Bristol, UK, noticed that ruthenium tetroxide, a stain used for electron microscopy, concentrates at the interfaces in structures self-assembled from a certain diblock co-polymer. This unusual phenomenon probably results from the stain dissolving in one polymer type, then diffusing towards the other. It reacts with iron-containing groups in the second polymer and deposits ruthenium atoms.

ACOUSTICS

Unsound judgement

J. Acoust. Soc. Am. **121,** 2384–2395 (2007)
Violin-makers don't pick the materials shown by scientific measurements to be acoustically best, according to new research.

Christoph Buksnowitz of the University of Natural Resources and Applied Life Sciences in Vienna, Austria, and his co-workers asked 14 leading luthiers to grade 84 pieces of Norway spruce — a favourite material for violin soundboards — according to quality.

The results showed little correlation with laboratory tests of the materials' acoustic properties, but seemed instead to be guided by the wood's appearance. That's not totally damning, the researchers say, because a violin's performance may depend as much on what the luthier does with the wood as on its intrinsic properties. But it does suggest that violin-makers would benefit from a scientific definition of material quality.

CLIMATE SCIENCE

Mushrooming harvest

Science **316,** 71 (2007)
Climate change could make the autumnal fungus foray a year-round event, say Alan Gange of Royal Holloway, University of London, and his colleagues.

Analysing changes in fruiting patterns of more than 300 species of British fungus between 1950 and 2005, the team found that the autumn mushroom season has grown from about 33 days to nearly 75 days. And some species, such as the sulphur tuft (*Hypholoma fasciculare*) are fruiting in both spring and autumn.

The extended autumn season is due to warmer summers, wetter autumns and fewer frosts. The additional spring season is probably triggered by warmer weather in late winter and early spring.

A. WINKLER/REUTERS/CORBIS

IMMUNOLOGY

RAGE management

Nature Immunol. doi:10.1038/ni1457 (2007)
Researchers have identified one way in which the immune system turns against the body's own proteins to trigger inflammation and cause the common autoimmune disease systemic lupus erythematosus.

Anthony Coyle of MedImmune in Gaithersburg, Maryland, and his colleagues studied HMGB1, a DNA-packaging protein that is released from dying cells. They

show that it forms part of a complex that is recognized by the cell-surface receptor RAGE and taken up by immune cells. Once inside the cells, the complex stimulates Toll-like receptor 9, which normally causes inflammation by recognizing DNA from invading bacteria and viruses.

Antibodies that block human HMGB1 or RAGE cut the production of inflammatory signals from cells *in vitro*, suggesting a means of therapy.

NEUROSCIENCE

Seizure stopper

J. Neurosci. **27,** 3618–3625 (2007)

The low-carbohydrate 'ketogenic' diet used by some people to control their epilepsy may work by boosting the activity of ATP-sensitive potassium (K_{ATP}) channels, scientists propose. This would inhibit excessive electrical activity in the brain.

The ketogenic diet causes tissues to use ketone bodies (the by-products of fat breakdown) instead of sugar as fuel. Gary Yellen and his colleagues at Harvard Medical School in Boston, Massachusetts, report that ketone bodies reduce electrical activity in rodent brain slices, particularly in cells with high firing rates. The effect is lost when K_{ATP} channels are pharmacologically blocked, and does not occur in the brains of transgenic mice lacking K_{ATP} channels.

D. HOSKING/FLPA

METROLOGY

Current affairs

Nature Phys. doi:10.1038/nphys582 (2007)

A new way to define the ampere, the unit of electrical current, is in prospect thanks to a microelectronic device built by Mark Blumenthal of the University of Cambridge and the National Physical Laboratory in Teddington, UK, and his co-workers.

At present, the ampere is defined as the current required to create a particular force between two parallel wires a metre apart. Physicists would rather define it as the passage of a particular number of electrons per second past a fixed point, but they first need a quantum device that can reliably create a current of known electron flow to serve as a standard.

Blumenthal and his colleagues have built a 'pump' that operates at gigahertz frequencies — transmitting around 3.4 billion electrons per second. This equates to about half a nanoamp of current, close to that required for a reliable standard.

TAXONOMY

Death of an order

Biol. Lett. doi:10.1098/rsbl.2007.0102 (2007)

Termites should be classed with the cockroaches in the order Blattodea, and not granted their own order Isoptera, say researchers who have carried out the most comprehensive molecular study of these creatures' relationships so far.

It was known that the two groups were closely related. In fact, the termites' family tree falls entirely within that of the cockroaches, say Paul Eggleton of the Natural History Museum in London, UK, and his colleagues.

The researchers sequenced five genes from 107 species in the group Dictyoptera, which consists of termites, cockroaches and mantids. The termites' closest roach relative is the woodroach *Cryptocercus*, suggesting that wood eating was a key innovation on the termites' road to sociality. The picture (above) shows a termite mound.

CHEMISTRY

Running rings

J. Am. Chem. Soc. **129,** 4148–4149 (2007)

Two fiendishly complex molecules isolated from the clubmoss *Lycopodium complanatum* have succumbed to synthesis in the lab, six years after the first of the pair was described.

The challenge in synthesizing the compounds, known as (+)-Lyconadin A and (–)-Lyconadin B, lay in constructing the five interlinked rings that form the molecules' core. Four of these rings are loops of six atoms, and one is a five-membered ring that contains four chiral centres, meaning the groups around them must have a particular symmetry.

The strategy that Douglas Beshore and Amos Smith of the University of Pennsylvania in Philadelphia devised to build this structure includes one step that creates a three-ring system from a molecule that begins with only one ring.

JOURNAL CLUB

Kornelia Polyak
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A geneticist rebuts criticism of cancer genome projects.

What do you learn if you sequence 13,000 genes in 11 breast and 11 colorectal cancer samples? The question taps into an intense debate about how best to identify genes relevant to human cancer.

Last year, researchers reported the results of a survey such as the one described (T. Sjöblom *et al. Science* **314,** 268–274; 2006). They found that each tumour contains, on average, 90 mutant genes — an unexpectedly high number. They also defined mutation spectra that were specific to colon and breast tumours, including the intriguing observation that the DNA letter sequence CG was swapped for GC at high frequency in breast tumours. This could be due to an uncharacterized DNA repair defect or differential carcinogen exposure.

I consider this report a step towards answering key questions in cancer biology, such as how many genes are mutated in cancer, how many mutations are required for cancer, and whether accumulation of genetic alterations in cancer cells drives tumour progression.

But others disagree. Many labs see large-scale sequencing of cancer genomes as unfocused and expensive fishing experiments. I have been doing genomics experiments since the dawn of this era, and have often faced this criticism.

But just this one study has identified more genes mutated in human cancer than thousands of investigators have found over past decades. And another recent, large-scale sequencing project pinpointed close to 120 mutant kinase enzymes that may have a role in human cancers (C. Greenman *et al. Nature* **446,** 153–158; 2007).

Both cases show that the outcome of unbiased, genome-wide studies may not be what we expect, which is exactly why they're worth doing.