THE YEAR IN SCIENCE

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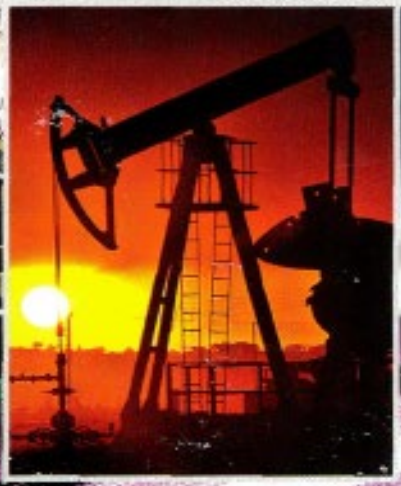

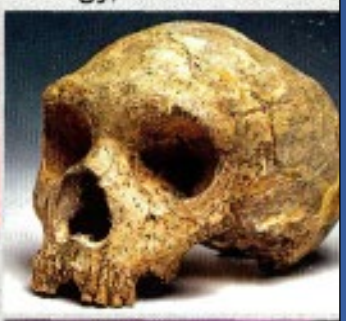

## 100 TOP SCIENCE STORIES OF 2008

**ENERGY**
Supercharged Solar Cells, No-Gas Cars

**ASTRONOMY**
Saturn's Mystery Moon, Dueling Black Holes

**MEDICINE**
Gene Therapy for Blindness, AIDS Immunity

**PHYSICS**
On the Trail of the God Particle

**EVOLUTION**
Gigantic Fossil Rat, Europe's First Humans

**PLUS**
The Science of Ignorance

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## 88 Bacteria Are Key Rainmakers

**While airborne dust** is known to be an abundant component in the formation of rain and snow, a study in February found that bacteria lofted into the atmosphere might also be a big part of the rainmaking mix.

For more than 20 years, scientists have tossed around the idea that bacteria play a role in precipitation. The speculation began because of the curious case of the bacterium *Pseudomonas syringae*, a plant pathogen that promotes frost damage on crops. A protein on the cell surface of *P. syringae* binds water in a way that mimics the structure of an ice crystal, and this helps start the transformation of cold water into ice. Moreover, studies suggest that bacteria travel from one patch of farmland to another by evaporating into the sky and then raining back down.

But are bacteria abundant enough to affect the weather the way dust does? Microbial ecologist Brent Christner of Louisiana State University collected fresh snow from across the globe and tested it for biological particles that could induce ice formation. He found them in all 19 samples, including snow taken from Montana in the dead of winter, when there is almost no deciduous vegetation, and even in samples from Antarctica.

The results suggest that bacteria can travel far from their plant hosts while maintaining the ability to make ice; they also hint at how airborne bacteria could play a role in the spread of plant disease. The next step is to collect bacteria directly out of clouds and identify the different species. "There are likely to be a whole fleet of organisms that can do this that we don't know about," Christner says.

**Susannah F. Locke**

## 89 World's Oldest Arrowheads

**In May researchers reported** the discovery of the world's oldest arrowheads, on the east coast of present-day South Africa. Some 60,000 years ago, at a time when other Stone Age people were heaving spears at their prey, the members of a culture known as Howiesons Poort were setting their weapons aloft with a bow, 20,000 years before the bow and arrow caught on for good. Archaeologist Lyn Wadley of the University of the Witwatersrand in South Africa first uncovered the bone tools two years ago, at the mouth of Sibudu Cave. Wadley's colleague Lucinda Backwell immediately noticed a striking resemblance to the arrowheads fashioned by Late Stone Age, Iron Age, and Bushman cultures, all of which flourished much later.

Using a microscope, Backwell could see traces of the stone used to whittle a pinkie-size arrowhead into a highly symmetrical point. Bone is ideally suited to arrowheads, she says, because it is lightweight and easy to manipulate. By firing arrows from afar, prehistoric hunters could shoot down forest-dwelling prey that would be frightened off by an onrushing, spear-wielding human.

Their invention didn't take hold, however. "You would imagine that the technology would continue, but it truly disappears," Backwell says, and doesn't reappear for 20,000 years. The bone tools suggest that rather than cropping up and then sticking around, "modern human behavior and innovation can come and go."

**Jocelyn Rice**

## 90 Platypus Genome Is a Mash-Up

**The platypus** has always been considered odd. Not only does it have webbed feet, a tail like a beaver's, a coat of fur, and a large bill, but it also lays eggs and nurses its offspring through a set of glands on its abdomen. Biologists classify the platypus as a monotreme, an egg-laying mammal with a single opening for reproduction and excretion. But is it truly a mammal?

A draft of the genetic sequence of Glennie, a female platypus in Australia, answers the question. "We found that the platypus has reptilian, avian, and mammalian genome features in one organism," says Mark Batzer, a biologist at Louisiana State University. "It looks like a car that was built on a Friday. They used the parts they had left to put it together." This mix of genes, he says, supports the classification of the platypus as a unique and very early mammal. Among its oddities: 52 chromosomes, including 10 sex chromosomes, as well as the highest number of repeated segments in the genome of any mammal sequenced so far.

The repeats are mobile elements called transposons, also known as jumping genes, which can trigger mutations in the genes around them and lead to genetic disorders. "Learning when transposons first appeared may give us some insight into how they spread through the mammalian lineage and how they are expressed in humans," Batzer says.

**Jane Bosveld**


*Genome analysis of the platypus reveals unique signatures of evolution.* Nature 452:175-183 [2008 cover article].

**Editorial Summary -- The platypus genome**

The duck-billed platypus (*Ornithorhynchus anatinus*) is a unique egg-laying mammal, with lactation, venom and a bill. It even has an electrosensory system for foraging underwater. Platypuses are monotremes descended from the most basal branch of the mammalian lineage and combine aspects of both reptilian and mammalian biology. Now an international consortium reports the sequence and analysis of the platypus genome. It is an amalgam of reptilian, mammalian and its own unique characteristics that provides clues to the function and evolution of all mammalian genomes. As well as helping uncover the origins of genomic imprinting, analyses show that platypus and reptile venom proteins have been co-opted independently from the same gene families; milk protein genes are conserved; and immune gene family expansions are directly related to platypus biology. The sequence provides an invaluable resource for comparative genomics, and it will be important for monotreme conservation. The cover image shows the bill with electrosensory pits, eye and ear opening behind the eye.