Abstractions

LAST AUTHOR

Geoffrey Woods found some remarkable people in northern Pakistan — six individuals who simply could not feel pain. Woods, who studies genetic disorders of the nervous system at the Cambridge Institute for Medical Research, UK, believes that their condition is probably different from previously reported examples of insensitivity or indifference to pain. On page 894, Woods and his team reveal that mutations in the gene *SCN9A* are responsible for the Pakistanis' condition. In doing so, the group has stimulated the search for an analgesic that could play a significant role in pain management.

How do your subjects differ from other cases of pain-perception disorders?

There has been confusion over whether, in fact, this is a separate condition from the hereditary sensory and autonomic neuropathies. Subjects with these neuropathies, for example, are born with a lack of small nerve fibres, which can result in an inability to sweat or to appreciate temperature differences, and they show indifference or insensitivity to pain. But the boy we first knew about in Pakistan has a complete inability to experience pain. He was infamous for putting knives in his arms and walking on burning coals during street fairs — injuries that put him in the hospital, but he never complained.

How rare is the disorder you describe?

It has to be quite rare — not even one per million. Looking through the literature, there have been just a handful of subjects described. We've looked hard and come across only four families.

Can we live without pain?

I think we've realized that pain teaches you how to look after your body, and avoid tissue damage. Risk taking is controlled by how painful something is or isn't. These children have a real problem in their first few years of life because they self-mutilate, sometimes biting through their tongues.

If *SCN9A* is essential for experiencing pain, is everyone's individual pain threshold related to it?

We've been led to believe that the mouse is a good model organism for studying pain, but mice without *SCN9A* don't live at all. It could also be that *SCN9A* is responsible for some of the variation in pain threshold seen among humans.

If this gene leads to a drug therapy, could we exist in a pain-free world?

I'm not sure you'd want to. You'd damage yourself without knowing it. We've been thinking about the potential for reckless abuse of such an analgesic — for example, among competitive athletes who take drugs to avoid pain. ■

MAKING THE PAPER

Jin Meng

How a fossil helped to redraw the mammalian family tree.

Distant relatives of today's flying squirrels probably existed at least 135 million years ago; much earlier than anyone had suspected. That is the conclusion of a team of researchers led by Jin Meng, who have found the fossilized remains of a new species of mammal (see page 889). The fossil indicates that early in their evolution, mammals, as a group, had very different ways of getting around — some on land, some in water and some gliding from tree to tree.

Like many fossil finds, the discovery of these remains was largely a result of good luck. "You never get exactly what you are looking for, so you have to look at everything," says Meng, who is a curator of palaeontology at the American Museum of Natural History in New York.

That's exactly what Meng was doing in March when he visited the Institute of Vertebrate Paleontology and Paleoanthropology in Beijing, China. Meng completed his graduate studies at the institute in 1980s and, after moving to the United States, has continued to visit and collaborate with his colleagues there. He was inspecting specimens of mammalian fossils his colleagues had collected a few months earlier in the eastern part of Inner Mongolia.

The team noticed a squashed skeleton preserved in a split slab sitting on a desk. "It had not caught anyone's attention until then," recalls Meng. His colleagues had initially thought it might be a triconodont, a common Mesozoic mammal. But the team noticed that the fossil's teeth were unusual. Triconodont teeth have pointed cusps in a straight line, but the specimen's teeth had sharper cusps that curved backwards.

This led Meng and his colleagues to think they might be looking a new species. Their suspicions were confirmed when they examined the fossil under a microscope. They could see the outline of a membrane of skin covered in hair, a membrane that was adapted for flight. "It was a big surprise," says Meng.

The scientists spent the next six months working day and night to characterize their find. "It is a very competitive area, so we had to work as fast as we could. But we also had to be very thorough," says Meng.

The biggest challenge for the researchers was to work out where the new mammal fitted in the evolutionary tree. They added the animal's measurements and properties to a database containing 435 characteristics for each of 58 different mammalian species, including both Mesozoic and current mammals, looking for similarities. They discovered that their specimen has little in common with any other mammal. This suggests that it belongs to its own mammalian order, says Meng, an order that became extinct a long time ago. In the process the group also concluded that the animal probably ate insects and was active at night.

The finding will raise questions about the early evolution of mammals, says Meng. In particular, why did gliding behaviour evolve so early in mammalian life? It might also explain the origin of some mysterious teeth fossils that scientists have identified over the years. These can now be re-examined to see if they belonged to an ancient glider. Meng, meanwhile, plans to continue his visits to China two or three times a year, and hopes to stumble across another find. "We will keep looking in the same area," he says. "I don't know what will show up next." ■

KEY COLLABORATION

One of the mysteries about Mars is why its northern hemisphere consists largely of lowlands with few craters but its southern hemisphere is made up of heavily cratered highlands. On page 905, an international team confirms the existence of ancient craters below the smooth northern plains, which suggests the buried crust is close in age to the exposed crust in the southern hemisphere.

The data were collected by the Mars Advanced Radar for Subsurface and Ionospheric Sounding (MARSIS) instrument onboard the European Space Agency's Mars Express spacecraft.

MARSIS was developed by the Italian Space Agency and NASA. It was built by aerospace firm Alenia Spazio guided by the University of Rome 'La Sapienza' in partnership with the Jet Propulsion Laboratory in Pasadena, California, and the University of Iowa.

MARSIS sends low-frequency radar signals from space that bounce off features buried below the planet's surface. The joint programme helped make the most of limited resources, says Tom Watters, a senior scientist at the Smithsonian Institution's National Air and Space Museum in Washington DC. "It's a great way for the United States and Europe to partner on space exploration," he says. "Budgets are always an issue and costs for these missions are always on the increase." ■