# Breathe (xenon) deeply to see lungs clearly

Someday, a whiff of the inert gas and general anesthetic xenon may help reveal the inner workings of the lungs and the brain. Researchers seeking to study these organs have figured out how to use xenon to enhance the ability of magnetic resonance imaging (MRI) to visualize tissues.

Typically, MRI depends on the protons in a tissue's water molecules, which give off a signal when subjected to a graded magnetic field. That signal helps the MRI's machine generate a picture.

The technique doesn't work well in places with relatively little water, however, such as cell membranes or the fatlike sections of the brain, says Mitchell S. Albert of the State University of New York at Stony Brook. Also, the lungs' air sacs create a mosaic of gas-liquid boundaries that make MRI difficult, if not impossible, with water protons, says Arnold Wishnia, a biophysical chemist at Stony Brook.

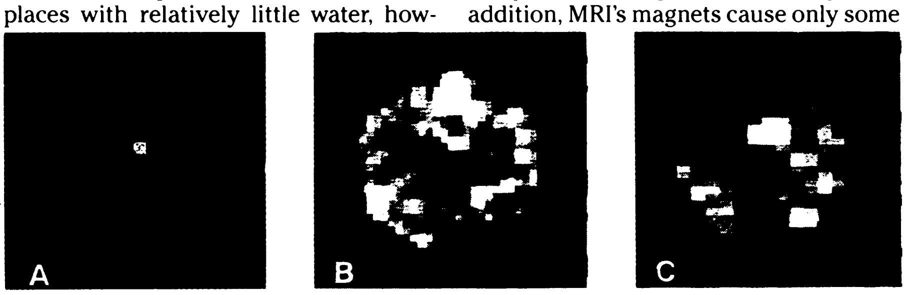
Because xenon doesn't build to very high concentrations in tissues, the team had to learn how to boost the magnetically induced signal from the gas. In addition, MRI's magnets cause only some xenon protons to change their spin state. About an equal number of protons do not change. As a result, the difference between the total number in each state is small, and the resulting signal is weak.

If the researchers first pummel xenon atoms with excited rubidium atoms, they can generate a much stronger signal, Albert, Wishnia, and their colleagues report in the July 21 NATURE.

They excite the rubidium with a laser, then add it to xenon, Albert explains. They can keep the resulting hyperpolarized xenon in this altered state for several hours by keeping it chilled and in a magnetic field. "The enhancement you get is between 10,000 and 100,000 times [normal]," Wishnia says. As a result, images of lungs have incredibly high resolution, even when produced using commercially available MRI machines.

Another technique, high-resolution X-ray computerized tomography, can detect lung damage, but it requires radiation and much more time than the modified MRI, Wishnia says. Once inhaled, xenon loses its polarization within about 35 seconds. Yet because it takes just 0.6 second to "snap" an MRI picture, plenty of time exists for multiple shots, he adds.

"For [imaging] the lung, xenon will absolutely be the method of choice," Wishnia predicts. — *E. Pennisi*




Albert *et al.*/NATURE

*False-color computer images depict lungs removed from a mouse and placed in a tube to undergo a new type of magnetic resonance imaging that uses xenon. Black represents the lowest xenon concentrations; brighter hues indicate higher ones. White depicts the strongest signal. Xenon rushes down the trachea (A), diffuses and fills the lungs until they press up against the tube (B), then outlines the two lungs as they begin to deflate (C).*

# Walking away from a fish-eat-fish world

*Hynerpeton bassetti* lacked the tough body and huge teeth so prevalent among the heavies in Pennsylvania swamps 365 million years ago. But this newly discovered creature did sport an edge over the fierce fish it competed against. *H. bassetti* had lungs and limbs capable of carrying it onto land — making it one of the earliest vertebrates to conquer the continents.

The *H. bassetti* fossil found last year is the oldest known tetrapod — or four-legged vertebrate — in North America and only the second oldest in the world. Despite its pioneering position, however, the animal displayed adaptations to land locomotion even more advanced than those seen in amphibians that came several million years later, says Edward B. Daeschler of the Academy of Natural Sciences of Philadelphia. Daeschler and his coworkers describe the animal in the July 29 SCIENCE.

The researchers have thus far unearthed part of the skull and a well-preserved shoulder, which reveal critical information about the capabilities of *H. bassetti*. "We were very surprised, because we did not expect a tetrapod this early to have this level of specialization," says Neil H. Shubin of the University of Pennsylvania in Philadelphia, who collaborated with Daeschler.

*H. bassetti* had robust shoulder bones with scars that indicate the attachment point of well-developed muscles. The animal could have made strong limb motions both up and down and front to back in a decidedly unfishlike manner, says Daeschler, who hedges on the question of exactly how this animal moved when on dry land. "We haven't said it was a walker, but it was capable of pretty good motion on land," he says.

At the time the creature lived, in the late Devonian period, Pennsylvania lay near the equator on the coast of a broad sea that filled much of ancestral North America. Previous discoveries have turned up early tetrapods in Greenland, Scotland, Russia, Latvia, and Australia. By extending the record to North America, the Pennsylvania find demonstrates that different groups of amphibians were crawling up on land across much of the equatorial world.

"This contributes to us moving away from the naive picture so often caricatured in cartoons of one beach and one fish with its little flag saying 'This is where fishes invaded the land,'" says paleontologist Michael I. Coates of the Museum of Zoology at the University of Cambridge in England.

For decades, researchers have speculated that tetrapods evolved because the harsh climate often dried up lakes and rivers, bestowing an advantage on those that could migrate across land to new water holes. But more recently, some have reasoned that evolution may have favored amphibians because they could escape the competition in the water and exploit new resources on land.

Judging from the giant fish that inhabited the same swamps as *H. bassetti*, Shubin favors the later interpretation. "It's an arms race in these swamps. Everything is getting bigger, developing huge teeth and armor. What this thing seems to be doing is not getting bigger or more armored. It seems to be leaving the fray. It's winning the battle by avoiding it," he says. — *R. Monastersky*

H. bassetti *emerges from the swamps.*

Michael Malicki/ANSP