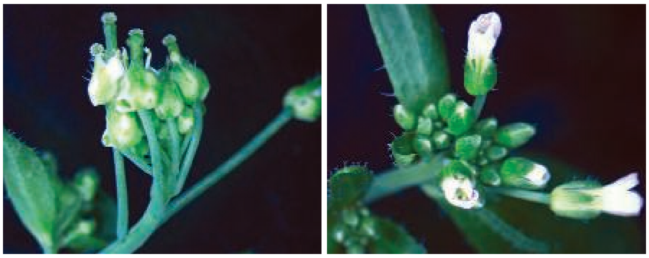
GENETICS

Talking About a Revolution: Hidden RNA May Fix Mutant Genes

When it comes to plants and animals, biologists think of DNA as the sole storehouse of genetic information. But a surprising new study of the mustard plant *Arabidopsis thaliana* challenges that notion. In the 24 March issue of *Nature*, Susan Lolle and Robert Pruitt of Purdue University in West Lafayette, Indiana, and their colleagues report that in this weed, gene inheritance can somehow skip generations: Plants sometimes end up with their grandparents' good copy of a gene instead of the mutant ones belonging to their parents. The researchers put forth the radical proposal that plants contain an inheritable cache of RNA that can briefly reverse evolution, undoing mutations and restoring a gene to its former glory.

"[The paper] suggests the existence of a unique genetic memory system that can be invoked at will," says Vincent Colot of the Plant Genomics Research Unit at Genopole in Evry, France. If confirmed and extended to animals, the new findings could profoundly affect biomedicine as well as population genetics. For example, geneticists trying to assess disease risk would have to take into consideration the makeup of this RNA memory, notes Emma Whitelaw of the University of Sydney, Australia.



Mutation in reverse. RNA may undo a mutation that causes *A. thaliana* flower parts to fuse (*left*) such that offspring flowers just fine (*right*).

Pruitt and Lolle first discovered that genes could go back in time about 3 years ago while studying one in *A. thaliana* called *HOTHEAD*. In plants with both copies of *HOTHEAD* mutated, the floral parts are all stuck together into a little ball.

Typically, when such a mutant plant self-fertilizes, its progeny inherit two copies of the gene responsible for the abnormal trait. Thus, when this *Arabidopsis* strain reproduced that way, there should have been two mutant *HOTHEAD* genes passed on, and all the progeny should have had balls instead of flowers. Instead, Lolle and Pruit found that 1% to 10% of the offspring produced normal flowers, indicating that at least one copy of the mutant gene had reverted to its nonmutated form in those plants. "It's something that Mendelian genetics has not prepared us for," says Pruitt.

They tested whether the progenies' wild-type version of *HOTHEAD* had been derived from mutated ones by fertilizing a wild-type *Arabidopsis* strain with pollen from the original mutant strain. Most of the time, the offspring had the expected genetic makeup—one mutated *HOTHEAD* and one wild-type allele—and normal flowering. But 8 out of 164 embryos examined had two wild-type alleles, says Pruitt.

To ensure that wild-type seeds hadn't inadvertently gotten mixed up in their experiments, they checked the DNA of plant embryos removed directly from the *HOTHEAD* ▶

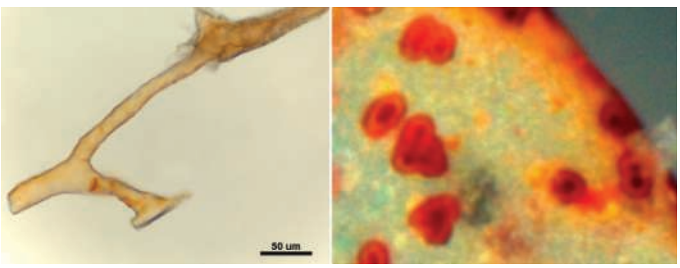
PALEONTOLOGY

Tyrannosaurus rex Soft Tissue Raises Tantalizing Prospects

It's not *Jurassic Park*–style cloning, but a remarkable find has given paleontologists their most lifelike look yet inside *Tyrannosaurus rex*—and, just possibly, a pinch of the long-gone beast itself.

On page 1952, a team led by Mary Schweitzer of North Carolina State University in Raleigh describes dinosaur blood vessels—still flexible and elastic after 68 million years—and apparently intact cells. "If we have tissues that are not fossilized, then we can potentially extract DNA," says Lawrence Witmer, a paleontologist at Ohio University College of Osteopathic Medicine in Athens. "It's very exciting." But don't fire up the sequencing machines just yet. Experts, and the team itself, say they won't be convinced that the original material has survived unaltered until further test results come in.

The skeleton was excavated in 2003 from the Hell Creek Formation of Montana by co-author Jack Horner's crew at the Museum of the Rockies in Bozeman, Montana. Back in the lab, Schweitzer and her technician demineralized the fragments by soaking them in a weak acid. As the fossil dissolved, transparent vessels were left behind. "It was totally shocking," Schweitzer says. "I didn't believe it until we'd done it 17 times." Branching vessels also appeared in fragments from a hadrosaur and another *Tyrannosaurus* skeleton. Many of the vessels contain red and brown structures that resemble cells. And inside these are smaller objects similar in size to the nuclei of the blood cells in modern birds. The team also found osteocytes, cells that deposit bone minerals, preserved with slender filipodia still intact.



A stretch? Dissolved *T. rex* bone yielded flexible, branching vessels (*left*), some of which contain cell-like structures (*right*).

If the cells consist of original material, paleontologists might be able to extract new information about dinosaurs. For instance, they could use the same sort of protein antibody testing that helps biologists determine evolutionary relationships of living organisms. "There's a reasonable chance that there may be intact proteins," says David Martill of the University of Portsmouth, United Kingdom. Perhaps, he says, even DNA might be extracted.

Hendrik Poinar of McMaster University in Hamilton, Ontario, cautions that looks can deceive: Nucleated protozoan cells have been found in 225-million-year-old amber, but geochemical tests revealed that the nuclei had been replaced with resin compounds. Even the resilience of the vessels may be deceptive. Flexible fossils of colonial marine organisms called graptolites have been recovered from 440-million-year-old rocks, but the original material—likely collagen—had not survived.

Schweitzer is seeking funding for sophisticated tests that would use techniques such as mass spectroscopy and high performance liquid chromatography to check for dino tissue. As for DNA, which is less abundant and more fragile than proteins, Poinar says it's theoretically possible that some may have survived, if conditions stayed just right (preferably dry and subzero) for 68 million years. "Wouldn't it be cool?" he muses, but adds "the likelihood is probably next to none."

–ERIK STOKSTAD

CREDITS (TOP TO BOTTOM): S. J. LOLLE *ET AL.*, *NATURE* **434**, 505 (2005); M. H. SCHWEITZER