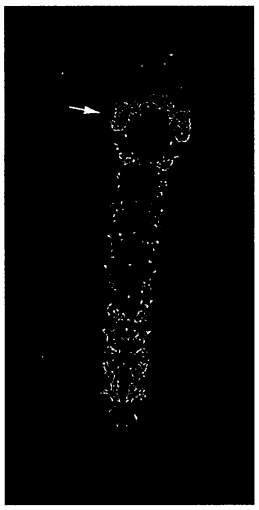

Changeling. An *Anopheles gambiae* larva carrying the GFP gene.

that could help edge that dream closer to reality. Some researchers hailed the new studies as milestones, but skeptics warned that the strategy may never work in practice.

Genetically engineering mosquitoes in any way—let alone making them resistant to infectious diseases—has been tricky. That changed a few years ago when researchers discovered a series of so-called transposons—short, movable stretches of DNA that can help insert new genes into a genome—that worked well in mosquitoes (*Science*, 20 October 2000, p. 440). Now, the field is making "massive strides forward," says molecular entomologist Paul Eggleston of Keele University in the United Kingdom. Last year, for instance, a team at the European Molecular Biology Laboratory in Heidelberg, Germany, reported that it had genetically modified *Anopheles stephensi*, a species that transmits malaria in India. In a proof of principle, the team inserted a gene that encodes green fluorescent protein (GFP) and demonstrated that the gene functioned in its new environment.

Now a team led by Marcelo Jacobs-Lorena of Case Western Reserve University in Cleveland, Ohio, has spliced into the same mosquito species a gene that confers resistance to *Plasmodium*, the parasite that causes malaria. The gene encodes a peptide, called SM1, that appears to block receptors in the mosquito's gut and salivary glands that *Plasmodium* needs to replicate inside the mosquito. In two experiments, mosquitoes carrying the gene lost their ability to infect mice with malaria; in a third study, they became much less effective vectors, Jacobs-Lorena reported.

Also at the meeting, Mark Benedict of the U.S. Centers for Disease Control and Prevention in Atlanta announced that his team has found a way to create transgenic *A. gambiae*, the most common malaria vector in Africa and a much bigger killer than *A. stephensi*. Again, the team slipped the GFP gene into *A. gambiae*. Jacobs-Lorena calls the work "a real landmark," because so many previous attempts to genetically alter *A. gambiae* had failed. Now, it's probably a matter of months before researchers produce a malaria-resistant version of *A. gambiae*, for instance by equipping it with SM1, says Eggleston.

But Harvard medical entomologist Andrew Spielman cautions that huge scientific and practical obstacles remain to be overcome before transgenic mosquitoes can be deployed in the field. These range from finding a way to ensure that they replace existing populations to dealing with ethical problems regarding the protection of inhabitants of a test site. Because of these hurdles, it's "extremely unlikely" that this line of research will ever make good on its promises, Spielman asserts. Eggleston concedes that the field faces many problems. But even if the altered mosquitoes are never released, he says, they will teach researchers a great deal about how malaria parasites interact with their host.

–MARTIN ENSERINK

PALEONTOLOGY

Unhatched Eggs Help Dinos Get a Head

Rugged as they look, fossilized dinosaur skulls are frustratingly hard to find. Exposure, scavengers, and flash floods ensured that few of the information-laden artifacts survived their day. Miraculously, though, the most delicate skulls of all—those of dinosaur embryos—sometimes come to light. In the past 13 years, paleontologists have identified embryonic remains of five kinds of dinosaurs, but only one, a duck-billed dinosaur, had an intact skull. Intact embryos of the long-necked, lumbering sauropods remained unknown—until now.

Heads up. The first complete skulls from embryonic sauropods were discovered in eggs from this site in Argentina.

On page 2444, three paleontologists describe the first articulated skulls—not much bigger than a postage stamp—of titanosaurs, a group of sauropods known only from incomplete skeletons and very few skulls. "This is a really exciting find," says Jeffrey Wilson of the University of Michigan's Museum of Paleontology in Ann Arbor. The embryos come from a site in Patagonia, called Auca Mahuevo, whose rocks are packed with thousands of dinosaur eggs between 71 million and 89 million years old. In 1998, Luis Chiappe of the Natural History Museum of Los Angeles County, Rodolfo Coria of the Carmen Funes Museum in Plaza Huincul, Argentina, and others described cantaloupe-sized eggs containing fragmentary bones—and the chisellike teeth of titanosaurs. Working with Leonardo Salgado of the Museum of Geology and Paleontology in Neuquen, Argentina, the team has now found six more embryos, some with intact skulls.

The 4-centimeter-long skulls may help show which skeletal features of titanosaurs developed in tandem and which are independent. That's important, because scientists determine evolutionary relationships by comparing such features, or characters, and spurious connections can lead them astray. The embryonic titanosaur skulls confirm earlier suspicions that two key sauropod traits—the orientation of the braincase and the position of the nostrils—are independent, Chiappe and his colleagues say. Further study could tease apart even more characters to help paleontologists sort out the sauropod family tree.

The embryos may also shed light on early sauropod evolution, about which relatively little is known. Although development doesn't necessarily replay evolutionary history, says paleontologist Eric Buffetaut of France's basic research agency CNRS, embryonic features may be reminiscent of more primitive sauropods. "If you can use embryos as proxy to reconstruct this early evolution, that's really original," he says. Buffetaut hopes the discovery of sauropod embryos will encourage other paleontologists to examine eggs in their collections.

–ERIK STOKSTAD

CLINICAL RESEARCH

India Acts on Flawed Cancer Drug Trials

THIRUVANANTHAPURAM, INDIA—Reacting to numerous regulatory violations in the testing of an anticancer drug, the Indian government has suspended all human trials for 6 months at the Regional Cancer Center (RCC) here in the southern state of Kerala. It has also closed a loophole allowing the unregulated importation of experimental drugs by requiring organizations to obtain approval before the testing or marketing of any drug.

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