Hatching a plan for iguana stew

Smithsonian News Service, S. Weisel

Two green iguana hatchlings emerge from eggs in a dirt-filled plastic container. Below: A hatchling a few hours old, and four inches long, poses on the back of an iguana yearling raised in captivity.

Smithsonian News Service, Eldridge Adams

Hundreds of hatchlings testify to the initial success of a project aimed at both increasing wild iguana populations and at establishing iguana ranches as a food source. Scientists at the Smithsonian Tropical Research Institute in Panama report "the first reliable method" of artificially incubating and hatching eggs of the green or common iguana *Iguana iguana*.

This spring the biologists captured pregnant iguanas, which then laid their eggs in artificial chambers buried in a clearing. Dagmar Werner and Tracy Miller collected more than 700 eggs from the chambers and incubated them under strict temperature control in dirt-filled containers. Almost all the eggs hatched successfully. "Every baby was as beautiful as the one before it," Miller says.

Adult iguanas, which can have a head-body length of 45 centimeters, have long been prized as game animals for cooking in a heavily spiced stew. The eggs, boiled in saltwater, are also considered a delicacy. In many parts of Central and South America, excessive iguana hunting and destruction of tropical forest lands have drastically diminished or destroyed the native iguana populations.

The iguana is one focus of a Smithsonian program aimed at increasing food supplies without destroying tropical forests. Iguanas eat treetop leaves that other animals cannot reach. Their digestive system employs bacterial fermentation to convert this vegetation into protein with an efficiency comparable to that of cattle.

In addition to hatching hundreds of eggs, Werner and Miller last year raised 400 wild-born iguana hatchlings. They found that as many as 60 animals can share a fenced enclosure 12 yards square. In the wild, 90 percent of iguanas die in their first year, primarily prey to birds and carnivorous lizards. In captivity, almost all the hatchlings survived.

Werner is now beginning a small repopulation test in an area of central Panama where the native population had been destroyed. —*J. A. Miller*

A magnetic way to wiggle and grow

Like little swimming compasses, some bacteria can ride the lines of the earth's magnetic field. Each bacterium of this type carries a string of microscopic magnetic particles that somehow help it navigate through muddy water (SN: 4/26/80, p. 267). Now, researchers report that these bacteria seem to have complete control over the formation and deposition of the magnetite (iron oxide) crystals responsible for their ability to track magnetic fields—right down to the precise size, shape and orientation of the crystals within the cells.

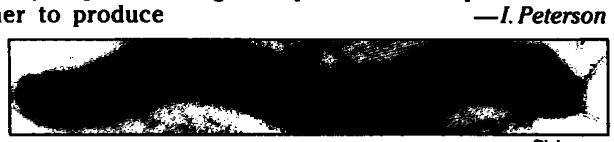
"It was very exciting for us to see that the precipitation process seems to be so exquisitely controlled by the organism," says Richard B. Frankel of the Massachusetts Institute of Technology. Frankel, Stephen Mann of the University of Oxford in England and Richard P. Blakemore of the University of New Hampshire in Durham took a close look at the form, structure and growth of magnetite in the bacterial species *Aquaspirillum magnetotacticum*. Their report appears in the Aug. 2 NATURE.

The bacterium doesn't just put the right materials together to produce single crystals of magnetite, says Frankel. "The particles in this bacterium also have a definite orientation in the chain." The crystal faces that represent the direction in which magnetite is most easily magnetized generally line up parallel to the direction of the entire chain of particles.

The researchers also discovered that in smaller particles at the ends of a chain, amorphous forms of magnetite often appear next to crystalline magnetite within the same particle. The amorphous form may represent the step immediately before the precipitation of magnetite crystals, says Frankel.

To produce the magnetite particles, these cells manage to concentrate iron, originally in solution outside the cell walls, by a factor of as much as 40,000. "It's a terrific iron-accumulating system," says Blakemore, "and virtually nothing is known about it yet."

The precipitation process appears to require molecular oxygen, says Frankel, but only in just the right amount — an oxygen concentration in the surrounding atmosphere of about 1 percent. —*I. Peterson*



Magnetite particle chain in A. magnetotacticum.

Blakemore

Malaria vaccine on its way

Researchers and government officials say they have developed a prototype malaria vaccine that should be ready for world distribution within five years. If successful, this would mark the first human vaccine against a tropical illness, researchers say. Malaria, caused by protozoans and spread by mosquitos, is one of the most common diseases on earth, each year afflicting 220 million people and killing about one million in Africa alone.

"We think we've got the vaccine. We have produced a human malaria antigen. And we can produce it in large quantities. But is it safe? And is it effective?" asks Peter McPherson, administrator of the Agency for International Development (AID), which to date has pumped $35 million into the search for a malaria vaccine. The vaccine has taken a long time in coming, he says, in part because protozoan *Plasmodium* species have such complex life cycles.

But a team led by Ruth Nussenzweig of New York University and partially funded by AID isolated a protein that covers the outer cell surface of all four *Plasmodium* species. This protein, or antigen, can be used in humans to prod the immune system into making antibodies against the slender sporozoite form of *Plasmodium*, she says. This stage of the life cycle is the one spit into people's bloodstreams by feasting mosquitos.

Further, other researchers report in the Aug. 10 SCIENCE isolating the gene that controls production of this protein, and have transferred the gene into bacteria *Escherichia coli*, which in turn mass-produce perfect copies of this protein. This mass production would mean a relatively cheap vaccine, McPherson says. The protein-antigen can also be synthetically produced, and may eventually be administered in combination with smallpox vaccines, Nussenzweig says. —*A. Rowand*