This pattern is similar to that of animals storing fat to prepare for the winter.

In 1972, studies of rodents and other animals by Ergo chief scientist Albert Meier, then a zoologist at Louisiana State University, showed that timed, daily injections of prolactin could "reset" the hormonal rhythm so it peaked close to when corticosterone peaked. The result: Insulin resistance was attenuated, and the animals became thinner regardless of the true season (*General and Comparative Endocrinology*, supplement 3, 499).

If a way could be found to alter patterns of prolactin secretion in humans, the researchers thought, a treatment for obesity and diabetes might be conceivable. Meier and Ergo Research Director Anthony Cincotta began investigating a drug called bromocriptine. The chemical is known to mimic the activity of the neurotransmitter dopamine, a prolactin inhibitor, in the cells of the pituitary gland. In preliminary experiments on humans, Ergo researchers reported at the ADA meeting in June, morning administration of bromocriptine—a form of which the company has patented under the name Ergoset—reduced prolactin levels during the daytime and led to weight loss, less body fat, and alleviation of diabetic symptoms.

Phase III clinical trials are under way at 19 medical centers around the United States. While they are attracting interest from endocrinologists, many remain skeptical. Richardson, for example, points out that the theory behind this therapy leaves many questions unanswered. One is whether bromocriptine's effects on the liver, muscle tissue, and the sympathetic nervous system, rather than its influence on prolactin, are partly responsible for changes in insulin resistance.

The outcome of the Ergoset trials will help decide the issue, says Joseph Avruch, chief of the diabetes unit at Massachusetts General Hospital in Boston. "One can quibble about the appropriateness of their model systems and whether they've got the mechanism on the nose, but at the end of the day, the question is will it work or won't it?" Avruch says. "Until I see persuasive evidence of efficacy, my enthusiasm is fairly reserved."

–Wade Roush

ASTROPHYSICS

Casting a Wide Net for Cosmic Rays

The skies offer no mystery more perplexing than the one posed by a handful of cosmic rays that crash into Earth's atmosphere with energies millions of times higher than any terrestrial particle accelerator can achieve. No one knows what mechanism could boost a particle to such energies—as high as 10^{20} electron volts (eV)—or where these celestial accelerators could be, because the particles can't be traced to any recognizable source. It's what James Cronin of the University of Chicago calls "one of those wonderful scientific puzzles." And as current detectors can pick up the signatures of these rare particles at the rate of only one every couple of years, it's likely to remain a puzzle—unless Cronin and 100 or so other cosmic-ray specialists in an informal international collaboration have their way.

The group has come up with a dramatic proposal to boost the detection rate and perhaps dispel the mystery: create two Delaware-sized detector arrays, one in the Northern Hemisphere and one in the Southern. Each would consist of thousands of swimming-pool-sized water tanks designed to capture the rare flashes of light from energetic particles. Together, according to a report soon to be issued by the Pierre Auger collaboration (named for the French scientist who discovered high-energy cosmic rays), the detectors should detect 50 to 100 cosmic rays each year at 10^{20} eV or more. Although funding—a total of $100 million—has yet to be found, the scheme is already "catching the imagination of many," says co-leader Alan Watson of the University of Leeds, U.K.

Such extraordinary measures are justified, say cosmic-ray researchers, because the highest energy cosmic rays seem to be in a class apart from their more common lower energy cousins. When any cosmic ray—a charged particle such as an electron or atomic nucleus—slams into the upper atmosphere, it triggers an "air shower" of gamma rays and secondary particles like muons and electrons. Clues to the energy and direction of the original particle come from optical detectors, which can pick up the fluorescence sparked by the shower, and from other instruments that capture the secondary particles and photons directly. And in most cases, a scenario proposed by the physicist Enrico Fermi, in which cosmic rays gain energy by bouncing off magnetic fields in interstellar space, can explain the origin of the original cosmic ray.

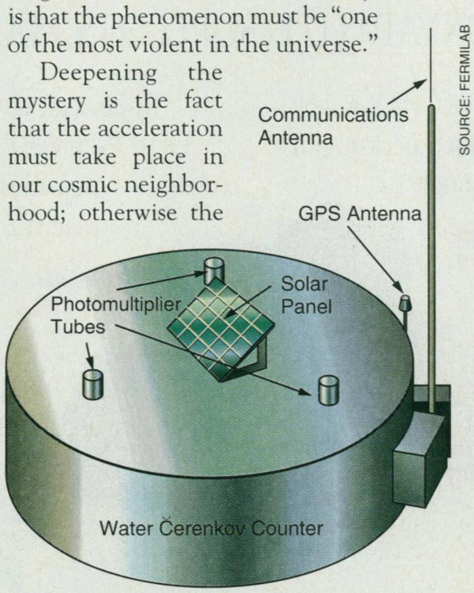
But the occasional spectacular air shower implies an energy above 10^{18} eV for the original particle—an energy that would take the age of the universe, at a minimum, to achieve by the Fermi mechanism. Theorists can't agree about what acceleration mechanism could be stepping in at these energies; the only thing that seems certain, says Murat Boratav, an Auger collaborator at the University of Paris, is that the phenomenon must be "one of the most violent in the universe."

Deepening the mystery is the fact that the acceleration must take place in our cosmic neighborhood; otherwise the particles would be sharply slowed by colliding with photons of the microwave background radiation that permeates space. Yet when observers trace the few reliable trajectories backward into space, they find that "nothing's out there," says Paul Mantsch, a collaborator at the Fermi National Accelerator Laboratory outside Chicago, which has served as a gathering point for the Auger design team. The only hope for solving these puzzles, the team realized, is to detect many more signatures of these cosmic rays to determine, for example, whether their sources cluster in space or are spread out and what the primary particles themselves might be.

After evaluating various detecting schemes, the team settled on arrays of water detectors. Each tank would be lined with photomultiplier tubes to detect the flashes of so-called Čerenkov light from air-shower particles, and wireless links would relay the data to a central computer. The spacing of the detector grid—1500 meters—would be fine enough for a single large air shower to register on five to 10 tanks at once, but coarse enough for two arrays covering 3000 to 5000 square kilometers to be practical. In order to survey the whole sky, one would be built in the western United States, Spain, or the former Soviet Union and the other in Australia, South Africa, or Argentina.

Whether the Auger detectors will actually be built should start to become clear, says Chicago's Cronin, when the team meets in November in Paris, where the report will be presented formally. Members will then begin working through U.S. universities to secure collaborative funding from many countries. If funding sources start to appear soon after, construction could begin by the fall of 1997 and be completed 4 years later. "I'm pretty optimistic," Cronin says. But he admits that if the participating countries don't commit substantial funding next year, "the whole thing could turn to worms."

–James Glanz



Catcher for a ray. A 4-meter-wide water tank would capture secondary particles from the highest energy cosmic rays.