"Given growing concerns about exposure to UV light, particularly with the thinning ozone layer in the upper atmosphere," Hearst adds, "this enzyme shows us one mechanism by which organisms can protect themselves from UV damage to their DNA."

Ultraviolet radiation disrupts the structure of DNA by causing a chemical reaction that hooks together two distinct bases, forming a so-called pyrimidine dimer. "Pyrimidine dimers kill cells by blocking DNA replication and transcription," says Hearst, and by causing mutations. Photolyase comes to the rescue in a process called photoreactivation. The enzyme binds to damaged DNA, draws energy from light to break apart the offending dimer, then disengages from the double helix.

"The observation of photoreactivation many years ago was one of the first indications to biologists that DNA repair mechanisms exist," says coauthor Johann Deisenhofer, a biochemist at the Howard Hughes Medical Institute at Southwestern Medical Center. "Because this enzyme does not occur in humans, some people may consider it unimportant. Yet it has rather wide distribution in the biosphere, up to marsupials. It appears that placental mammals lost this gene during evolution, though we don't know why that happened."

The enzyme's use of energy from light to drive its repair activities "is quite unusual," Deisenhofer adds. "To my knowledge, there are only two known enzymes that operate this way. The other one is involved in photosynthesis."

While the scientists have no immediate applications in mind for their discovery, Hearst speculates that some biologists may attempt to transfer the gene governing this DNA repair mechanism into organisms lacking the enzyme "to see to what extent the gene protects them from UV damage.

"There's particular interest in protecting plants from ultraviolet exposure," Hearst continues. "DNA repair is such a fundamental aspect of biology that knowing the mechanism by which this repair takes place may give us insights into protection [in humans] against DNA errors and mutations." — *R. Lipkin*

# Spinning nuclei to extreme deformity

The atomic nucleus is typically pictured as a roughly spherical conglomeration of protons and neutrons. But in recent years, researchers have discovered that certain nuclei adopt an elongated, superdeformed shape when they spin rapidly (SN: 7/28/90, p.53).

Now, Demetrios G. Sarantites of Washington University in St. Louis and his collaborators have uncovered evidence that some atomic nuclei can suffer even more extreme changes in shape. In the June 26 PHYSICAL REVIEW LETTERS, the researchers report the first clear indications of hyperdeformation in gadolinium-147 nuclei.

Superdeformed nuclei are usually the products of off-center collisions between two smaller nuclei. The colliding bodies fuse to create a single whirling entity. For nuclei whose mass falls within certain well-defined ranges, rapid spin leads not to fragmentation, but to deformation into a football shape whose length is roughly twice its width.

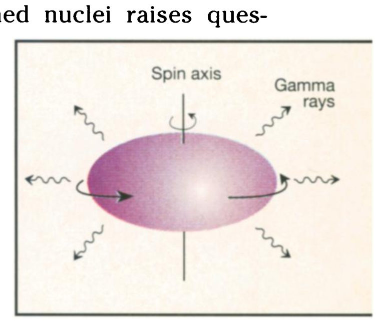
Researchers have observed superdeformation among nuclei of such elements as mercury, thallium, lead, dysprosium, gadolinium, and strontium. At the same time, calculations based on theory have suggested the existence of hyperdeformed nuclear states.

To search for extremely deformed nuclei, Sarantites and his coworkers used a cyclotron at the Lawrence Berkeley (Calif.) National Laboratory to bombard a molybdenum foil with vanadium nuclei. In these high-energy collisions, vanadium-51 and molybdenum-100 nuclei fuse to create heavy, highly excited nuclei, which generally get rid of their excess energy by breaking apart or throwing off protons and neutrons.

However, a small fraction of the rapidly spinning collision products remains intact. Instead of emitting protons, these heavy nuclei radiate gamma rays to get rid their excess spin energy.

By observing the spectrum of gamma rays emitted during the process, the researchers deduced that a spinning gadolinium-147 nucleus has a sausage shape with a length about three times its width. "This is in good agreement with theoretical predictions," the researchers note.

Nonetheless, the existence of these highly deformed nuclei raises questions about the applicability of standard fission theory to nuclei with high spins. — *I. Peterson*




*Spinning superdeformed nucleus.*

# Slowing down the evolution of tough insects

Corn lovers usually have distinct preferences: Some like sweet, white ears, others plump, yellow ones. The corn borer *(Ostrinia nubilalis)* has a preference, too—for taller, more mature plants.

Scientists want to take advantage of the corn borer's choosiness to slow the pace at which the bug is likely to become resistant to a new, genetically engineered variety of corn, Donald N. Alstad and David A. Andow of the University of Minnesota in St. Paul report in the June 30 SCIENCE.

Corn engineered to produce a *Bacillus thuringiensis* protein, which kills most corn borers, may soon become commercially available. However, genetic variation in some of these pests may enable them to survive the protein. These tough bugs will reproduce. So if enough farmers use the transgenic corn, and there's no disadvantage to inheriting the survival gene, eventually most corn borers will tolerate the toxin.

Planting so-called refuge fields—fields of normal varieties—near the transgenic crop helps slow the development of a toxin-tolerant pest population, but refuges suffer a lot of insect damage, studies have demonstrated.

Now, Alstad and Andow have developed a computer model which shows that planting the transgenic crop earlier in the season protects the refuge field and helps to slow resistance. The reason? Corn borers will preferentially lay their eggs in the more mature, transgenic crop. Their offspring's first meal may be their last. If the plants prove powerful enough, they will kill both the borers that have some resistance to the toxin and those that don't.

"You can dramatically delay the evolution of resistance if you kill the heterozygotes"—the insects that carry one gene variation that confers resistance and one that makes them susceptible, says Alstad.

The plan could work for other wandering pests as well, Alstad and Andow note. It might extend the useful life of an engineered plant variety from 4 or 5 years to 15, Alstad speculates.

However, the model "doesn't adequately address" the preference of insects born later in the summer for younger plants, says Eric S. Sachs of Monsanto Co. in St. Louis, which is developing a transgenic variety of corn. Indeed, the model assumes that later bugs show no preference. Also, Sachs notes, cool temperatures may cause spring insects to emerge after the normal plants have matured enough to match the transgenic crop's appeal. — *T. Adler*

Andow

*If given a choice, some corn borers choose the tall corn.*