

have planted Bt crops in abundance, exposing so many insects to the toxin that entomologists say it's just a matter of time before significant pests evolve resistance.

In an effort to stave off that day, Mario Soberón and Alejandra Bravo of the National Autonomous University of Mexico in Cuernavaca and their colleagues have been tinkering with the toxin genes. The researchers collaborated with Bruce Tabashnik at the University of Arizona in Tucson to study the Cry1A family of the Bt toxins, as they make their fatal attack on the guts of caterpillars.

Enzymes in the insect's midgut snip Cry1A into pieces. The researchers now conclude that when these snippets bind to a protein called cadherin, they lose a molecular fragment. The loss initiates a series of reactions that end with holes in the gut wall.

Tabashnik knew from lab experiments that pink bollworms evolve resistance by developing a balky version of cadherin, which doesn't bind well with the Cry1A pieces. Thus, Bt's attack falters at this step.

To work around that roadblock, the Cuernavaca researchers remodeled Cry1A so that its segments don't need to be clipped, obviating cadherin's role. The new version of Cry1A can indeed kill Tabashnik's formerly resistant bollworms, the researchers report in an upcoming *Science*. —S.M.

NANOTECHNOLOGY

Bucky shrink-wrap

Chemists discovered buckyballs—cage-like molecules of 60 carbon atoms—more than 20 years ago. Members of a family of carbon cages known as fullerenes, buckyballs form spontaneously in a hot gas of vaporized carbon. But the exact mechanics of their formation have remained somewhat hazy.

One theory holds that larger fullerenes form first, then shed atoms as they cool, shrinking to become buckyballs.

Researchers have now filmed giant fullerenes in the act. Jianyu Huang of the Sandia National Laboratories in Albuquerque and his colleagues ran an electric

current through multiwalled carbon nanotubes and filmed the results with atomic resolution using a transmission electron microscope.

The current heated the nanotubes to more than 2,000°C. When the high temperature broke up the innermost layer of a nanotube, fullerenes appeared in its place. At first, the newly formed giant fullerenes, composed of thousands of atoms, were much larger than buckyballs.

But the fullerenes, still trapped inside the heated nanotubes, kept shedding atoms, and they eventually turned into buckyballs.

Huang says that this is the first time that anyone has observed such a “shrink-wrap” mechanism in action. While admitting that other pathways might exist for creating the molecules, he says, “This is one way that carbon-60 can form.” The team describes the results in the Oct. 26 *Physical Review Letters*.

Huang says that refinement of the technique could allow scientists to create fullerenes of specific sizes for applications such as drug delivery and energy storage. —D.C.

BIOMEDICINE

Too little sleep may fatten kids

As childhood obesity reaches epidemic proportions, parents who are concerned about their children's weight might want to encourage an early-to-bed policy. A new study finds that among the primary-school set, losing sleep is linked with gaining pounds.

Earlier studies had correlated weight with sleep patterns but inevitably raised the question of “which came first, the chicken or the egg,” explains Julie C. Lumeng of the University of Michigan in Ann Arbor, who led the new study.

Her team questioned the parents of 785 children from all over the United States about sleep patterns when their kids were in third grade. Three years later, they questioned the parents again.

By sixth grade, 18 percent of the children had become obese. “I expected we'd find that this [sleep link with obesity] was just a bunch of bunk,” says Lumeng, a pediatrician. “But the relationship proved so robust that no matter how we looked at it, we couldn't make it go away.” In her team's analysis, obesity didn't track with children's behavior, gender, or race, nor did it correlate with the strictness or laxity of parental discipline.

Although the average sleep time among all children was 9.5 hours per day throughout the 3 years analyzed, individual sleep times varied widely. In sixth grade, each additional hour above the average sleep time correlated with a 20 percent lower chance of obesity. Sleep patterns were even more strongly linked when the children were in third grade, when every extra hour of sleep was associated with a 40 percent drop in a child's chance of becoming obese by sixth grade. The researchers report their findings in the November *Pediatrics*. —J.R.

EARTH SCIENCE

New climate sensor: Swiss grapes

Using modern weather data and ancient records of grape harvests, researchers have divined summer climate patterns in parts of Switzerland as far back as the late 1400s.

Temperature strongly influences the growth of grapevines and the ripening of their fruit, which makes the plants excellent climate sensors, says This Rutishauser, a climatologist at the University of Bern. He and his colleagues looked for climate clues in grape-harvest data for 15 locations in northern and western Switzerland.

Rutishauser says that grape-harvest data are available back to 1600 for all but a few years, such as 1879 to 1884, when various pests and diseases devastated Swiss vineyards. Gaps in harvest data are more frequent between 1480 and 1600, he notes.

The researchers developed a climate model using data for the years from 1928 through 1979 and then verified it with data gathered from 1980 to 2006. Grape-harvest dates correlated most strongly with average temperatures for the months of April through August, Rutishauser and his colleagues note in the Oct. 28 *Geophysical Research Letters*. On average, each 1°C increase in average temperature for that interval brought the grape harvest forward 12 days.

Switzerland's earliest grape harvest occurred in 2003, when a record-setting heat wave enveloped much of Europe (*SN*: 7/3/04, p. 10). The hottest decade before recent times was the 1580s, which falls near the end of a time known as the Medieval Warm Period in Europe.

The region's latest grape harvest took place in 1816, when global temperatures were much cooler than average because an immense volcanic eruption had occurred the year before. The coolest decade was the 1740s, which falls within an extended cold spell commonly called the Little Ice Age. —S.P.



PINK PERIL The pink bollworm, a major cotton pest, can develop resistance to the Bt pesticide, but researchers now have a new countermeasure.