Souping up and other tricks produce satiety

The body's natural sensors aren't very good at recognizing how many calories a person has just eaten. The fallibility of this satiety feedback system makes it easy to overindulge in calorie-rich foods, such as those high in fat. It may also allow the body to feel satisfied after eating less than its normal complement of calories, a pair of studies now finds.

The new research, reported this week at the Experimental Biology '99 meeting in Washington, D.C., hints at how cooks might discourage overeating by making each calorie more filling.

In the more provocative of their two new studies, Barbara J. Rolls and Elizabeth A. Bell of Pennsylvania State University in State College found that water can play different roles in satiety, depending on how it is consumed.

On three separate occasions, they fed a 270-calorie appetizer of chicken-rice casserole to 24 lean young women and then measured how much lunch each ate afterward. When the women started with the casserole alone or along with a 10-ounce glass of water, they went on to eat another 300 calories of food, on average. However, when 10 oz. of water was added to the casserole—transforming it into a soup—each woman consumed just another 200 calories.

Though the women ate about 27 percent fewer calories after the soup-based starter, "it didn't leave them feeling hungrier later in the day," Rolls notes. Each ate the same calories at dinner as she had in the other phases of the trial.

What makes this differential effect especially striking, Rolls points out, is that when the women drank the water, they were instructed to down it along with the casserole. "They took a sip, then a bite, then a drink, then a bite. We wanted it to enter the stomach and be dispersed with [the casserole's] nutrients the same way as with the soup."

These data reinforce the idea that food and drink affect hunger and satiety systems "through entirely different mechanisms. And when the water is in soup, it's no longer processed as a drink but as a food," Rolls told SCIENCE NEWS.

In a second, 5-week-long study, Rolls and Bell recruited 34 women to eat all their meals in the researchers' laboratory for 4 days each week. In the first week, the women could dine on their choice of a wide range of foods. From then on, part of every meal—equivalent to about half the calories that each woman had eaten per meal during the first week—was compulsory. After finishing the mandatory foods, however, the women could eat all they wanted of other entrees and side dishes.

In this trial, the energy density—calories per given weight of food—of the compulsory foods varied from week to week. During 2 weeks, the compulsory items were low in fat, but for one of those weeks they were energy-dense. Another week included high-fat, energy-dense compulsory items.

In general, the women responded to portion size rather than energy density of food. They ate the same size portions each day, regardless of whether the compulsory portion had been low in calories or high. As a result, they took in far fewer calories during weeks in which the mandatory food was low in energy density.

"The American population continues to get more overweight with every national survey," observes Susan B. Roberts of Tufts University who works at the Agriculture Department's Human Nutrition Research Center on Aging in Boston. Currently, she notes, more than half of U.S. adults are overweight.

Since so many low-fat foods are actually very high in calories, she says, "it's legitimate to begin switching our focus from dietary fat to caloric density." However, "to make these calculations you practically have to be a professional," she adds. She and Rolls both say food labels should begin listing caloric-density measurements. *—J. Raloff*

Farmer ants have bacterial farmhands

A graduate student who once mused about funny-looking patches on ants has discovered that the insects have a microscopic partner species overlooked despite about a century of study.

Researchers have long known that the tribe of New World ants literally farms gardens of spongy fungus to feed themselves. Now it turns out that the ants get help from a mutualistic relationship with *Streptomyces* bacteria, report Cameron R. Currie of the University of Toronto and his colleagues.

Whitish patches of bacteria on the ants secrete antibiotics that target a major pest in their gardens, the researchers say in the April 22 NATURE. This weed fungus, *Escovopsis,* can reduce an ant garden to brown ooze in just a few days.

More than 2,000 research papers have focused on the weed biology of ants and the food fungi they cultivate, Currie says (SN: 11/21/98, p. 334). Yet previous studies completely missed the bacteria and noted the weed fungus only as a rarity, not the widespread menace that it has proved to be.

The new work "totally changes this textbook relationship from two to four players," Currie points out. He says he wouldn't be surprised if other classic mutualisms turn out to include overlooked microbes.

Other scientists had noticed the bits of pale crust on the ants but dismissed them as an ant secretion. When Currie took a fresh look, he realized the patches were alive. The research team identified them as *Streptomyces*, the same genus that has yielded many antibiotic drugs. Extracts from the patches did nothing to most fungi tested but slammed *Escovopsis.*

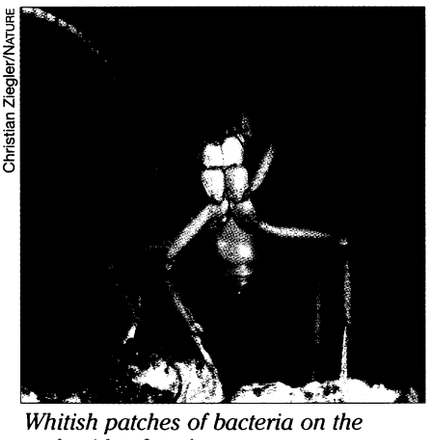
The *Streptomyces* bacteria turned up on all 22 species of fungus growers that Currie checked. This survey covered 8 of the fungal-farming 12 genera, from just-the-basics farmers to leaf cutters that snip up foliage to feed their fungi.

All 74 young ant queens that Currie examined carried bacterial helpers as they set off to start their own fungus farms in new nests. Males, which don't farm, did not sport bacteria.

The *Escovopsis* fungus seems to prey only on ant gardens, Currie says, and he found it in many of the colonies he examined. "It's an ancient coevolutionary arms race," he says. Countering the weed is an alliance of ants, their food fungus, and bacterial helpers.

Ted Schultz of the Smithsonian Institution in Washington, D.C., welcomes the new work as "a spectacular paper" raising many new questions about the bacteria and the weed. "It opens up a whole lot of neat ecology," Schultz says.

Ulrich G. Mueller of the University of Maryland in College Park comments, "What's interesting from an evolutionary perspective is that once again the ants hit on something before we did." Ants beat humans in developing agriculture by some 50 million years. Now, he says, it looks as if the same ants came in ahead on bacterial antibiotics by millions of years. *—S. Milius*



Christian Ziegler/NATURE

Whitish patches of bacteria on the underside of an Acromyrmex *ant secrete a natural weed killer.*