

How the brain knows when eating must stop

At some point during a meal, the brain instructs the hand to put down the fork: The diner has had enough. The brain sends this message before all the food has left the stomach and entered the bloodstream. In probing what signals satiety, psychologists have identified a novel method by which the brain evaluates the contents of the gut.

The vagus nerve, which carries two-way communication between the gut and the brain, transmits distinctly different patterns of electric signals in response to carbohydrates and to protein in the gut, finds Gary J. Schwartz of Johns Hopkins Medical Institutions in Baltimore. These signals largely reflect gut wall contractions—mechanical motions that mix and grind up food, he reported at last week's Society for Neuroscience meeting in Washington, D.C.

There's another component of the vagus nerve's reaction to protein. Schwartz suspects that hormonelike peptides produced by the gut in response to food are responsible for amplifying the signals triggered by the motions of the stomach and small intestine.

Most scientists had assumed that nerves sample gut contents through receptors that, like taste buds on the tongue, directly discriminate specific classes of chemicals being eaten, Schwartz notes. His data from anesthetized rats now indicate that this gut-level "tasting" may rely instead on indirect cues from nonspecific features of the digestive system, such as gut wall

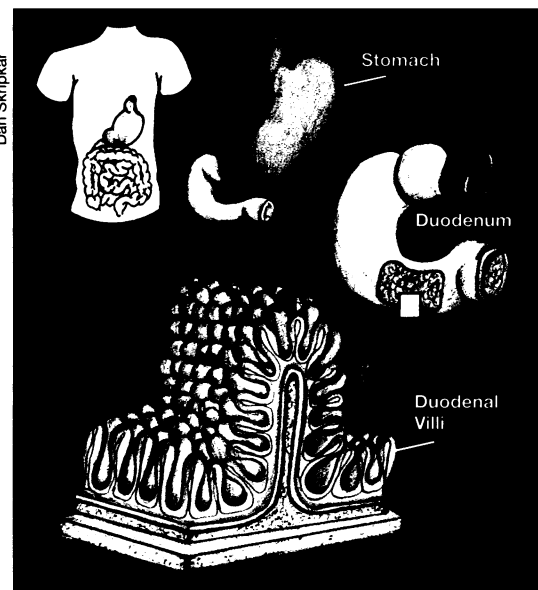
motility. Because other stimuli can also elicit both these motions and peptide production, the brain apparently decodes what's eaten—and how much—from the distinctive pattern of the vagus nerve's response to each nutrient, together with other information the brain receives from the gut.

Most nutrient absorption occurs in the stomach and duodenum—the upper segment of the small intestine. As Schwartz and his team infused glucose, a sugar, or peptone, a protein, directly into the duodenum, they recorded both gut wall movements and the corresponding signals to the brain.

In terms of the intensity and timing of contractions, and the corresponding intensity and duration of the vagus nerve's electric firing, "2 calories of the protein produced about a 30 to 40 percent larger [and longer] response than did 2 calories of glucose," Schwartz found.

He suspects that part of the effect may be mediated by the mast cells of the immune system. Present throughout the gut, these cells "are almost the perfect, ubiquitous transducer," he explains. "They can change a mechanical, thermal, or chemical stimulus into a neural signal." Moreover, he notes, vagus nerve fibers winding throughout the fingerlike villi lining the duodenum "are in a perfect position to taste what's happening to those mast cells."

"These are wonderfully coherent, novel, and interesting results," says Gerard P.



Gut environment where nerves from the brain indirectly monitor food.

Smith of Cornell Medical Center in White Plains, N.Y. While "we knew the gut talks to the brain over these [vagus nerve] fibers, what no one before has shown us is how the fibers respond to nutrients by changing their neural firing."

Adds Jaak Panksepp of Bowling Green (Ohio) State University, this information may prove "very important in learning what terminates a meal." However, he notes that over a day or so, the body adjusts its calorie consumption based on past meals and current needs. Therefore, Schwartz's new findings, he says, may have small consequences for how animals adjust their 24-hour caloric intake.

—J. Raloff

Risky sex breeds neglected epidemic

The United States has a secret, and the Institute of Medicine (IOM) wants to rouse the nation to do something about it. In a report called "The Hidden Epidemic," IOM says that the United States has failed to respond adequately to sexually transmitted diseases (STDs), even though it has the highest rates of infection in the developed world.

Twelve million people in the United States, one-fourth of them adolescents, get STDs each year, according to the report. Several studies show that U.S. rates of infection are 50 to 100 times those of other developed nations, IOM states. For example, 150 of every 100,000 people in the United States have gonorrhea, compared to 3 per 100,000 in Sweden and 18.6 per 100,000 in Canada.

Thousands of people die annually of complications because the United States lacks an "effective national system" for curbing the epidemic, IOM contends.

Only a concerted effort to screen people for STDs, treat them, and educate others about the risks of infection will

stem the tide of disease, Helene Gayle of the federal Centers for Disease Control and Prevention in Atlanta said last week at the American Public Health Association's annual meeting in New York.

The IOM study found that all levels of government spent just \$1 to prevent STDs for every \$43 spent on drugs, tests, doctors' fees, and hospitalization. In all, these diseases cost the nation \$17 billion a year.

Thirty-two percent of men and women in a 1995 government study could not name any STD other than AIDS. There are more than a dozen such diseases, including gonorrhea, syphilis, herpes, and viral hepatitis. Bacterial STDs can be cured with antibiotics, although some antibiotic-resistant strains are spreading. Without treatment, STDs can cause sterility, pelvic inflammatory disease, and cancer.

Several new sexually transmitted microbes have emerged in the last 2 decades. Two of them, HIV I and II, cause AIDS. Others are human papillomavirus (HPV), a cause of cervical can-

cer; HTLV-I, which can cause a rare cancer or a paralytic illness; mycoplasma, which causes urethritis; mobiluncus, which causes vaginosis; and human herpes virus 8, which causes Kaposi's sarcoma and lymphoma.

Although relatively new, HPV afflicts 24 million women in the United States. Studies have linked the virus to 80 percent of all cases of invasive cervical cancer, a malignancy that strikes 16,000 women and claims 4,900 lives each year.

Chlamydia, the nation's most common bacterial STD, is transmitted 4 million times annually, according to IOM. Yet 80 percent of the women infected—and 40 percent of the men—experience no initial symptoms and may unknowingly infect someone else. Because so many cases escape detection, 1 million infected women annually progress to pelvic inflammatory disease.

The IOM report asserts that a moralistic approach to STDs—viewing them as symbols of sinful behavior—deters people from seeking information and treatment, "directly hindering" control efforts in the United States. —S. Sternberg