Study links acid reflux, esophageal cancer

The human esophagus gets its share of irritation. Stomach acid bubbling up into this tube often inflames it, resulting in the misnamed but familiar problem of heartburn. An acid-blocking pill or antacid usually seems to take care of the difficulty.

Researchers, however, have asked whether such chronic inflammation can lead to more serious trouble. Prolonged irritation has been shown to disrupt cell growth. For example, steady inflammation of the liver from hepatitis has been linked to liver cancer. New data suggest a similar risk for the esophagus.

Heartburn, or acid reflux, is more common in patients diagnosed with a cancer called adenocarcinoma of the esophagus than it is in healthy people, Swedish researchers report in the March 18 NEW ENGLAND JOURNAL OF MEDICINE. While the study doesn't prove that acid reflux causes cancer, chronic irritation presents "one potential mechanism" for it, says study coauthor Jesper Lagergren, a gastrointestinal surgeon and epidemiologist at the Karolinska Institute in Stockholm.

Esophageal adenocarcinoma is quite rare. Seeking a link with heartburn, Lagergren and his colleagues compared 820 healthy people with 189 patients who had recently been diagnosed with this cancer. The participants had an average age of almost 70.

The researchers found that 60 percent of the cancer patients had had acid reflux at least once a week for 5 years or more, compared with only 16 percent of the control group. While 3 percent of the controls reported acid reflux more than 3 times a week, 22 percent of the cancer patients did. Likewise, 3 percent of the controls reported reflux going back more than 20 years, compared with 21 percent of the cancer patients.

"This is one of those studies that confirms what everyone believes," says David Y. Graham, a gastroenterologist at Baylor College of Medicine and the Veterans Affairs Medical Center, both in Houston.

Researchers haven't ascertained how the cancer develops. The link connecting heartburn and cancer may be a syndrome called Barrett's esophagus, a precancerous condition in which the lining of the lower esophagus is replaced by cells that resemble stomach-lining cells, says Graham.

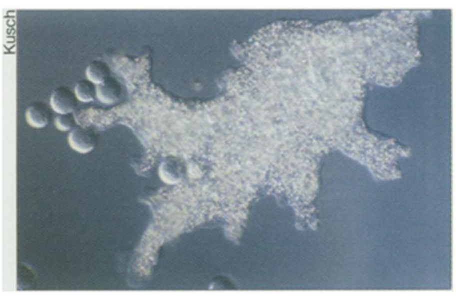
Previous studies indicated that about 10 percent of heartburn sufferers have Barrett's esophagus. Although only about 1 percent of people with Barrett's esophagus develop esophageal cancer in any given year, it's still considered a risk factor. Most people with esophageal adenocarcinoma have had Barrett's esophagus.

In the Swedish study, 62 percent of the patients with esophageal adenocarcinoma had signs of Barrett's. The actual correlation may be much higher because by the time cancer is diagnosed, tumors may have overtaken and obscured the Barrett's lesions, says Henry P. Parkman of Temple University School of Medicine in Philadelphia.

The new study indicates that people seeking treatment for chronic heartburn might benefit from being tested for Barrett's esophagus, Parkman adds, so that those who have the condition could be screened for adenocarcinoma. *—N. Seppa*

Amoeba betrayed by anticannibal defense

Although substantially smaller than *Tyrannosaurus rex, Amoeba proteus* terrorizes the cell-eat-cell jungle of a drop of pond water. That dangerous predator, however, shows one weakness in its hunting performance. Some of its prey detect a chemical that the amoeba releases and thrash backwards out of range. In a rare insight into predation, scientists may have figured out why the hunter keeps giving itself away.


Kusch

Amoeba proteus *gulps beads, about 30 micrometers in diameter, in a test of what might be an anticannibal defense.*

The amoeba's one-celled snacks, members of the genus *Euplotes*, are just a few of the many organisms that mount a defense on demand—such as fleeing or growing spines or thickening a shell after picking up a chemical cue. These so-called inducible defenses raise a difficult question. What evolutionary benefit could possibly accrue to the predator?

For amoebas, the answer lies in a vital function of the telltale chemical, proposes Jürgen Kusch of the University of Kaiserslautern in Germany. In the March ECOLOGY, he presents data indicating that the peptide, called A-factor, prevents cannibalism by clone mates.

Some theorists have speculated that evolution would have removed tattle-tale chemicals unless some great benefit to the predator constrained that tendency. Researcher Drew Harvell of Cornell University, coeditor of *The Ecology and Evolution of Inducible Defenses* (1999, Princeton), comments, "This is the first experimental study that I know of that suggests a real constraint."

Kusch tested his idea by feeding beads to amoebas. They readily engulfed plain beads or ones coated with albumin. However, amoebas ate few beads treated with A-factor and rejected them entirely when concentrations of the peptide became too high.

It could be a self-recognition cue, Kusch says. Amoebas multiply by splitting—no one has observed sex—so clone mates with the same A-factor accumulate.

"It makes no sense to multiply and afterwards to eat each other," Kusch says. "It's a waste of time and of energy."

Harvell says she wants to see more evidence before accepting self-recognition as A-factor's main function.

Kusch's proposal is "really an interesting idea," says Stanley Dodson of the University of Wisconsin-Madison. He notes that some theorists have taken a different tack, suggesting that predators benefit from revealing themselves and thus avoiding wiping out their food supply in a single feast. "That's never been demonstrated," he says. *—S. Milius*

Pumping electrons: Look Ma! No heat!

Heat buildup has always plagued electric circuits. As electronic components continue to shrink, even small amounts of heat become troublesome. Now, scientists have developed a way of pumping electrons through tiny circuits that may eliminate the dissipation of energy as damaging heat.

"This is a new means of making charge move," says Charles M. Marcus of Stanford University, who led the research. To make their pump, he and his team have used an existing method of making a device known as a quantum dot (SN: 4/11/98, p. 236). The dot confines electrons to a region within a thin layer of a semiconductor or metal.

To move electrons through their pump, the scientists manipulate the wave properties of electrons within the dot. By exploiting those properties, the researchers control current completely via the principles of quantum mechanics—the physics of the smallest bits of matter.

"I think this experiment is very significant," comments Qian Niu of the University of Texas at Austin. "It is really the first experiment that demonstrates that you can use a pure quantum effect to pump electrons." He and David J. Thouless of the University of Washington in Seattle formulated theories in the 1980s and early 1990s that indicated the feasibility of such quantum pumping.

In previous experiments, scientists have created electron pumps from quan-