Behavior

Taking hopelessness to heart

Nagging despair and emotional distress markedly boost a person's chances of developing heart disease and dying from its consequences, according to a new study.

Hopelessness and sadness that linger for years, yet fall short of "severe depression," can undermine heart function, the researchers assert. At mild to moderate levels, depression — like high blood pressure — may wreak cardiovascular havoc if left uncontrolled, they hold.

Led by Robert Anda of the Centers for Disease Control and Prevention in Atlanta, the investigators studied 2,832 adults ranging in age from 45 to 77. The participants, who were tracked for an average of about 12 years, entered the study free of heart disease and other chronic illnesses. Initial examinations included questions about feelings of depression, discouragement, and hopelessness experienced in the previous month. Research has shown that responses to these questions remain consistent over time.

About 11 percent of the volunteers noted symptoms of at least mild depression. In addition, 11 percent cited moderate hopelessness and 3 percent reported severe hopelessness.

All three of these groups suffered a significantly greater death rate from heart disease over the follow-up period compared with those reporting no depression or hopelessness. The researchers statistically controlled for sex, age, cigarette and alcohol use, blood pressure, and other factors linked to heart ailments. Deaths from heart disease were four times more prevalent among participants who reported severe hopelessness than among those who reported no hopelessness. Cases of nonfatal heart disease also emerged more often in depressed adults. Among depressed and hopeless people, cigarette smoking boosted even further the risk of contracting and dying from heart disease, the researchers note in the July EPIDEMIOLOGY. Other scientists have found that a potentially fatal blood-vessel disease progressed more rapidly in mildly to moderately depressed men who smoked cigarettes than in nondepressed smokers (SN: 3/28/92, p.196).

The physiological effects of prolonged depression and hopelessness may contribute to heart disease by promoting blood clots and thickening of artery walls, Anda speculates.

Monkeys disclose the face of emotion

Smiles, frowns, and other emotional expressions attain greater intensity on the left side of the face, at least among right-handed adults. Scientists argue that the brain's right hemisphere, which controls many muscles on the left side of the face and largely regulates emotional displays, produces these slightly lopsided looks (SN: 3/11/89, p.149).

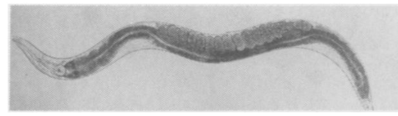
Evidence now suggests that rhesus monkeys display the same left-sided bias in facial expressions. This finding, combined with previous data suggesting that the left hemisphere regulates language in humans and vocal signals in monkeys, indicates that division of communication functions between the left and right brain is similar in all primates, asserts Marc D. Hauser, an anthropologist at Harvard University.

In a frame-by-frame analysis of videotaped fear grimaces made by 19 free-ranging rhesus monkeys, Hauser found that a large majority of the animals moved the left side of the mouth first and retracted the lips further on the left side while grimacing. Mouth and ear movements used as threats showed the same left-sided emphasis, as did grimaces during copulation, Hauser reports in the July 23 SCIENCE.

Of 43 human adults who viewed two composite images of a monkey's fear grimace — in which each side of the face was paired with its mirror image — next to the creature's genuine fear grimace, 41 rated the left-side composite as most expressive of fear, Hauser notes.

Biology

Worming through the nervous system



Horvitz/MIT

C. elegans: *Simply elegant.*

For neuroscientists, the worm-like nematode *Caenorhabditis elegans* could not be better named. Its elegance lies in its relative simplicity. A mere 302 nerve cells make up its nervous system. Of those, 26 produce a chemical messenger called GABA and all but one of those 26 help the nematode move, keep its head steady, or defecate, says Steven L. McIntire, a neurobiologist at the University of California, San Francisco.

In the past, scientists thought GABA calmed nerve cells and kept them from relaying signals. But in *C. elegans* at least, GABA sometimes excites nerve cells, McIntire and his coauthors report in the July 22 NATURE.

Working with Howard Hughes Medical Institute researcher H. Robert Horvitz and his colleagues at the Massachusetts Institute of Technology, McIntire analyzed the individual functions of these GABA-producing nerve cells by observing how destroying single cells with a laser affected the animal's behavior.

To move, the nematode sends a wave of contraction down its body; GABA allows the top muscles to stay relaxed while the bottom ones shorten, and vice versa. But to defecate, the animal uses GABA to cause muscle contraction, says Horvitz.

In addition, Horvitz's team linked problems affecting GABA nerve cells to specific genetic defects in mutant nematodes. They did this by comparing the behavior of each mutant with that of nematodes undergoing the laser treatment and then conducting biochemical analyses of GABA and its effects in the mutant animals, Horvitz says. One defective gene causes a loss of coordination because it affects the development of the 19 GABA-producing nerve cells that control how the nematode wiggles. Another affects an enzyme that helps make GABA. Two more interfere with how cells release GABA to relay messages to other cells. Yet another seems to influence how muscles respond to GABA.

"It's really the first comprehensive look at one neurotransmitter in an entire nervous system," Horvitz says.

New twist in the way a protein turns

Each protein — a molecule critical to life — consists of a long chain of amino acids folded and twisted to give it a functional shape. In the past, researchers thought these chains could bend in only four ways. Now they know of at least one more.

Biochemists discovered the new kind of folding while examining pectate lyase C, a 353-amino-acid bacterial enzyme that causes potatoes, tomatoes, apples, and tropical plants to rot. Crystallographic studies conducted by Marilyn D. Yoder, Frances Jurnak, and Noel T. Keen at the University of California, Riverside, revealed that the amino acids spiral around to form a molecular corkscrew called a parallel beta helix.

Linda Bobbitt/UC Riverside

Simplified drawing of enzyme's unusual fold.

This newly identified spiral is more compressed and its loops wider than those in an alpha helix, the twist in a typical protein, notes Fred E. Cohen of the University of California, San Francisco. It requires about 22 amino acids per turn, compared with the alpha helix's 3.6 amino acids per turn. Other loops extending from this spiral provide platforms for the enzyme's chemical activities, the Riverside team reports in the June 4 SCIENCE.