Neuroscience

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Junk food turns rats into addicts

Bacon, cheesecake, Ho Hos alter brain's pleasure centers

By Laura Sanders

Junk food elicits addictive behavior in rats similar to that caused by heroin, a new study finds. Pleasure centers in the brains of rats addicted to high-fat, high-calorie diets become less responsive as binging wears on, making the rats consume more and more food, researchers reported October 20. The findings may help explain how changes in the brain could lead people to overeat.

"This is the most complete evidence to date that suggests obesity and drug addiction have common neurobiological underpinnings," said study coauthor Paul Johnson of the Scripps Research Institute's Florida facility in Jupiter.

To see how junk food affects the brain's natural reward system — the network of nerve cells that release feel-good chemicals — Johnson started at the grocery store, loading up on Ho Hos, sausage, pound cake, bacon and cheesecake. He fed rats either a standard diet of high-nutrient, low-calorie chow or unlimited amounts of the palatable junk food. Rats that ate the junk food soon developed compulsive eating habits and became obese. "They're taking in twice the amount of calories as the control rats," said Johnson's coauthor Paul Kenny, also of Scripps Florida.

Lab rats had to eat more and more junk food over time to get a pleasure high.

Johnson and Kenny used electrical stimulations to activate pleasure centers in the rats' brains, regions responsible for drug addiction. Rats controlled the amount of feel-good stimulation by running on a wheel — the more they ran, the more stimulation they got. Rats fed junk food ran more, indicating that they needed more stimulation to feel good.

After five days on the junk food diet, rats showed "profound reductions" in the sensitivity of their brains' pleasure centers, suggesting that the animals quickly became habituated to the food, Kenny said. As a result, the rats ate more to get the same amount of pleasure — just as heroin addicts require more and more drug to feel good. "They lose control," Kenny said. "This is the hallmark of addiction."

Reward pathway deficits persisted for weeks after the rats stopped eating the junk food.

Scientists are interested in determining the long-term effect of altering the brain's reward system. "We might not see it when we look at the animal," said obesity expert Ralph DiLeone of Yale University School of Medicine. "They might be a normal weight, but how they respond to food in the future may be permanently altered."

Exercise helps brain rebound

Running protects neurons in monkeys from damage

By Laura Sanders

A toned, buff bod isn't the only thing a workout is good for. Exercise protects special brain cells in monkeys and improves motor function, a new study finds. The data, presented October 18, add to a growing body of evidence that shows exercise is good for the brain, too.

"This is sort of a quiet revolution that's been occurring in neuroscience, to realize that physical activity at a certain level impacts the brain in a really profound way," said brain aging expert Carl Cotman of the University of California, Irvine.

In the new study, researchers led by Judy Cameron of the University of Pittsburgh trained six adult female rhesus monkeys to run on treadmills built for humans. Over three months, monkeys ran, jogged or sat on a treadmill for five hours each week. Monkeys that ran reached heart rates of about 80 percent of maximum, comparable to a human training program for cardiovascular fitness. The jogging monkeys' heart rates reached about 60 percent of maximum.

After this training, researchers hit the right side of the monkeys' brains with MPTP, a neurotoxin that selectively kills neurons that produce the signaling chemical dopamine. These neurons and their dopamine regulate movement.

Sedentary monkeys showed a decrease in dopamine neurons after the neurotoxin was applied. But in the brains of monkeys that had run for three months, the neurotoxin had almost no effect. Jogging also had a protective effect, though it was slightly weaker than running's effect, Cameron said. "This is really good news. It means that any little bit more activity you can do is positive for your brain."

When the researchers continued the experiment for another six weeks, the results held. Brain scans revealed that "the animals that were exercising had virtually no loss of dopamine in those neurons," Cameron said.

In separate experiments, the researchers found that monkeys that didn't exercise were unable to perform some movements that the runners could.

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