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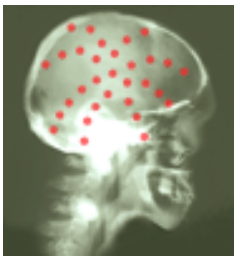
Why Waiting Is So Hard

Brain damage makes impatient rats

By Adam Marcus
HealthScoutNews Reporter



SOURCES: Interviews with Rudolf Cardinal, researcher, University of Cambridge, England; Ann Kelley, Ph.D., professor of psychiatry and neuroscience, University of Wisconsin, Madison, and Edmund Fantino, Ph.D., professor of psychology, University of California, San Diego; May 24, 2001 *Science Express*

THURSDAY, May 24 (HealthScoutNews) -- Remember the story about the grasshopper who fiddled away his summer days while the ants busily stocked their cupboards for the coming winter?

That example of deferred gratification may not be merely a matter of imprudence. Though Aesop doubtless didn't know it, new research suggests that the grasshopper's folly in his fable might have reflected a brain defect that scrambled his impulse control.

English scientists studying reward-seeking behaviors in rats say the inability to defer gratification may result from glitches in a brain area called the nucleus accumbens. This region appears to be a sort of neurochemical scold that, when working properly, allows the animals to appreciate the cliché that good things come to those who wait.

Failure to check urges can lead to a number of human behavioral problems, including attention-deficit disorder, hyperactivity, addiction and obesity, says Ann Kelley, a neuroscientist at the University of Wisconsin at Madison who studies the accumbens. "It's part of the brain that is intimately involved in reinforcement and reward and guiding organisms" to make good choices, says Kelley.

Although what makes a choice "good" is largely subjective -- if the grasshopper wants to waste time and hurts no one but himself, who cares? -- "you can't go off eating and mating all the time, because those impulses are not good for you all the time," Kelley says.

In the latest work, which appears in the May 24 issue of *Science* online, Rudolf N. Cardinal and colleagues at the University of Cambridge in England studied reward-seeking behavior in groups of lab rats with chemically-induced injuries to various brain areas.

Cardinal's group rigged a series of levers on delays that released increasing amounts of food pellets with increasing lag times. The quickest response issued a pellet immediately, while the longest released a veritable rat feast after a full minute's wait.

Normally, rats quickly learn to forgo small food rewards in favor of larger deferred meals. But animals with damage to the nucleus accumbens core stubbornly refused to go for the bigger prizes, preferring instead to repeatedly push levers that released smaller snacks even when they

apparently knew they could get more by waiting.

"The rats with the lesions were still choosing a lever, but they made very impulsive choices when doing so," says Cardinal, a medical and doctoral student at Cambridge. "It's not simply that they were less hungry." To insure that the impulsive strategy didn't lead to more food over time, all rats had to wait about a minute and a half before getting a new choice of levers to push.

Injuries to two areas that lead into the accumbens, the anterior cingulate cortex and the medial prefrontal cortex, didn't seem to affect the animals' ability to defer gratification.

Cardinal says the key to the finding may be dopamine, a brain signaling molecule associated with appetites. Indeed, each of the three structures the researchers studied have intense dopamine activity.

"It has been demonstrated that humans with ADHD (Attention Deficit Hyperactivity Disorder) do have abnormal functioning in all three of these areas," and that Ritalin seems to help the condition by restoring the right balance between dopamine and another messenger chemical, serotonin, Cardinal says.

So how much can a study of rats, levers and snacks tell us about human nature? Quite a lot, says Kelley. "We have to assume that the rodent model is a good model for the mammalian brain, but it's remarkable how similar the organ is," she says.

But Edmund Fantino, a psychologist at the University of California at San Diego, says that when it comes to patience, lower-order animals like rats or birds "are really challenged."

"We are far, far superior in that respect to pigeons and rats," says Fantino, who did some of the earliest work on impulse control, in pigeons. "Humans have a rich array of behavioral strategies that we employ that make it more likely that we'll behave more optimally."

Therefore, he says, knocking out a single brain area like the nucleus accumbens core isn't likely to erase a person's ability to leave the last piece of chocolate cake for tomorrow.

What To Do

For more on ADHD, visit the National Institute of Mental

Health, or the National Attention Deficit Disorder Association.

Try this site for more Aesop's fables.

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