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Thin line between desire and dread: Dopamine controls both

July 7 2008

The chemical dopamine induces both desire and dread in adjacent regions of the brain, according to new research at the University of Michigan.

Dopamine is commonly known to motivate animals and people to seek positive rewards. The study breaks new ground by showing dopamine is also involved in negative feelings such as fear. This perhaps explains why dopamine dysfunction is implicated in drug addiction, which involves excessive desire, and in schizophrenia and other phobias involving anxiety and fear.

Kent Berridge, a U-M psychology professor who oversees U-M's Affective Neuroscience & Biopsychology Lab, and his U-M colleagues identified dopamine's dual effect at the nucleus accumbens, a brain region that motivates people and animals to seek out pleasurable rewards such as food, sex or drugs, but is also involved in fear. The research is detailed in the July 9 issue of the Journal of Neuroscience.

They found that inhibiting dopamine's normal function prevented the nucleus accumbens from inducing both rewarding and fearful behaviors, suggesting that dopamine is important in both.

In previous research, Berridge and colleagues showed that a distance of only a few millimeters separate desire and dread functions in the nucleus accumbens. Because dopamine is an important neurotransmitter in this brain structure, the researchers investigated its role in generating these

functions in the current study.

When dopamine was allowed to act normally, injection of a chemical in the front of the nucleus accumbens caused rats to eat nearly three times as much as they normally do. In contrast, injection of the chemical in the back of the nucleus accumbens caused rats to display fearful behavior normally shown in response to a predator.

Berridge speculates that disruption of dopamine neurotransmission in one region of the nucleus accumbens may be a mechanism for pathological excesses of fear in disorders such as schizophrenia. He also suspects disruptions in dopamine neurotransmission in an adjacent region may be a mechanism for excessive reward-seeking in conditions like addiction.

The research was supported by the National Institute of Mental Health and the National Institute on Drug Abuse.

Source: University of Michigan