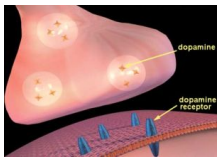
15 January 2007 By: Stefan Anitei, Science Editor



How Does Prenatal Cocaine Intake Damage the Neuronal Structure?

An anomaly in dopamine receptors

In the '80s there was a hysteria amongst physicians about the effects of cocaine intake on newborns. Cocaine received while in the mother's womb provoked cognitive impairments: attention deficits, learning disabilities and emotional problems. A recent study made by Dr. Gregg Stanwood and Dr. Pat Levitt at the Vanderbilt Kennedy Center for Research on Human Development tries to find the cell mechanisms that induce the long-term behavioral and neurological problems associated with prenatal exposure to cocaine. Even if till now not detected in children, lab experiments in rabbits revealed a long lasting displacement of dopamine receptors in certain brain cells, which alters their ability to function normally. "Incredibly high levels of cocaine -- usually coupled with the abuse of other drugs -- can lead to premature labor, preterm birth and low birth weight," said Stanwood, research assistant professor of Pharmacology. "But in women who have abused relatively low recreational doses of cocaine, it is actually very hard to distinguish those children at birth from children born to anyone else," he said. "However, as those children age, they do develop deficits in their cognitive and emotional development." These children usually suffer by attention and arousal problems, like children with attention deficit hyperactivity disorder (ADHD), with one difference: medication for the latter proves ineffective for cocaine affected ones. Because cocaine abusers usually take other drugs, too, it is difficult to study the effects of prenatal cocaine exposure on the developing brain in humans and lab animals offer better clues. Previously, the same team found that cocaine intake in rabbits during the beginning of pregnancy provoked shifts in brain circuits that use the neurotransmitter dopamine. These offspring also presented attention problems as well as insensitivity to stimulants like amphetamine. "In collaboration with Dr. Eitan Friedman of the City University of New York, we had previously shown a decrease in signaling of a particular receptor protein, the dopamine D1 receptor," Stanwood said. "We know that this receptor is involved in regulating the formation of cortical circuitry. It's also involved in the behavioral effects of amphetamines and cocaine." "The current study was an attempt to look at the mechanism of this decrease in D1 receptor signaling," he said. In the new study, the researchers found that prenatal cocaine did not affect the number of D1 receptors in brain cells, but their location within the cell. D1 receptors are situated at the cell surface (image), but neurons affected prenatally by cocaine had the receptors predominantly sequestered inside the cells. "The fascinating thing is that this effect appears permanent," said Stanwood. The modified D1 receptors trigger the changes in neuronal architecture and behavior previously observed. "What remains to be determined is whether D1 receptor localization is affected in humans exposed to cocaine prenatally", said Stanwood. "Neither we nor anyone else has yet identified whether this mechanism occurs in the human population, so that is a critical next step."