Medical Xpress

Nurture impacts nature: Experiences leave genetic mark on brain, behavior

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New human and animal research released today demonstrates how experiences impact genes that influence behavior and health. Today's studies, presented at Neuroscience 2013, the annual meeting of the Society for Neuroscience and the world's largest source of emerging news about brain science and health, provide new insights into how experience might produce long-term brain changes in behaviors like drug addiction and memory formation.

The studies focus on an area of research called epigenetics, in which the environment and experiences can turn genes "on" or "off," while keeping underlying DNA intact. These changes affect normal brain processes, such as development or memory, and abnormal brain processes, such as depression, drug dependence, and other psychiatric disease—and can pass down to subsequent generations.

Today's new findings show that:

- Long-term heroin abusers show differences in small chemical modifications of their DNA and the histone proteins attached to it, compared to non-abusers. These differences could account for some of the changes in DNA/histone structures that develop during addiction, suggesting a potential biological difference driving long-term abuse versus overdose (Yasmin Hurd, abstract 257.2, see attached summary).
- Male rats exposed to cocaine may pass epigenetic changes on to their male offspring, thereby altering the next generation's

response to the drug. Researchers found that male offspring in particular responded much less to the drug's influence (Matheiu Wimmer, PhD, abstract 449.19, see attached summary).
- Drug addiction can remodel mouse DNA and chromosomal material in predictable ways, leaving "signatures," or signs of the remodeling, over time. A better understanding of these signatures could be used to diagnose drug addiction in humans (Eric Nestler, PhD, abstract 59.02, see attached summary).

Other recent findings discussed show that:

- Researchers have identified a potentially new genetic mechanism, called piRNA, underlying long-term memory. Molecules of piRNA were previously thought to be restricted to egg and sperm cells (Eric Kandel, MD, see attached summary).
- Epigenetic DNA remodeling is important for forming memories. Blocking this process causes memory deficits and stunts brain cell structure, suggesting a mechanism for some types of intellectual disability (Marcelo Wood, PhD, see attached summary).

"DNA may shape who we are, but we also shape our own DNA," said press conference moderator Schahram Akbarian, of the Icahn School of Medicine at Mount Sinai, an expert in epigenetics. "These findings show how experiences like learning or drug exposure change the way genes are expressed, and could be incredibly important in developing treatments for addiction and for understanding processes like memory."

Provided by Society for Neuroscience

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