Epigenetics finding completely upends our understanding of drug addiction

I was taught to scoff at Jean-Baptiste Lamarck and his theory that traits acquired through life experience could be passed on to the next generation. The silly traditional example is the mama giraffe stretching her neck to reach food high in trees, resulting in baby giraffes with extra-long necks.

Then biologists discovered we really can inherit traits our parents acquired in life, without any change to the DNA sequence of our genes. It’s all thanks to a process called epigenetics — a form of gene expression that can be inherited but isn’t actually part of the genetic code. This is where it turns out that brain chemicals like dopamine play a role.

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Nearly all addictive drugs, like cocaine and alcohol, increase dopamine levels, and the chemically induced dopamine reward leads to further drug cravings.

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Ultimately, it looks as though dopaminylation — not just typical dopamine functioning in the brain — may control drug-seeking behavior. Long-term cocaine use modifies neural circuits in the brain’s reward pathway, making a steady intake of the drug necessary for the circuits to operate normally.

That requires turning specific genes on and off to make the proteins for those changes, and this is an epigenetic mechanism driven by dopamine acting on [histones, which control DNA expression], not a change in DNA sequence.

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