

HIJACKING THE BRAIN

New research suggests that the brain's reward system has different mechanisms for craving and pleasure. Craving is driven by the neurotransmitter dopamine. Pleasure is stimulated by other neurotransmitters in "hedonic hot spots." When the craving circuitry overwhelms the pleasure hot spots, addiction occurs, leading people to pursue a behavior or drug despite the consequences.

PATHWAYS TO CRAVING

Desire is triggered when dopamine, which originates near the top of the brain stem, travels through neural pathways to act on the brain. Drugs increase the flow of dopamine.

Ventral tegmental area (VTA)
Dopamine is produced here and flows outward along neurons distributed throughout the brain's reward system.

Brain stem
Basic visceral sensations and reactions to pleasure, such as smiling, originate from this hot spot.

Ventral pallidum
Animal experiments show that damaging this hot spot can turn something that once gave pleasure into a source of disgust.

Dorsal striatum
Neurons here help form habits by identifying enjoyable patterns, such as the anticipation of buying drugs.

Prefrontal cortex
The amino acid glutamate, produced here, interacts with dopamine to spark visualizations that cue cravings.

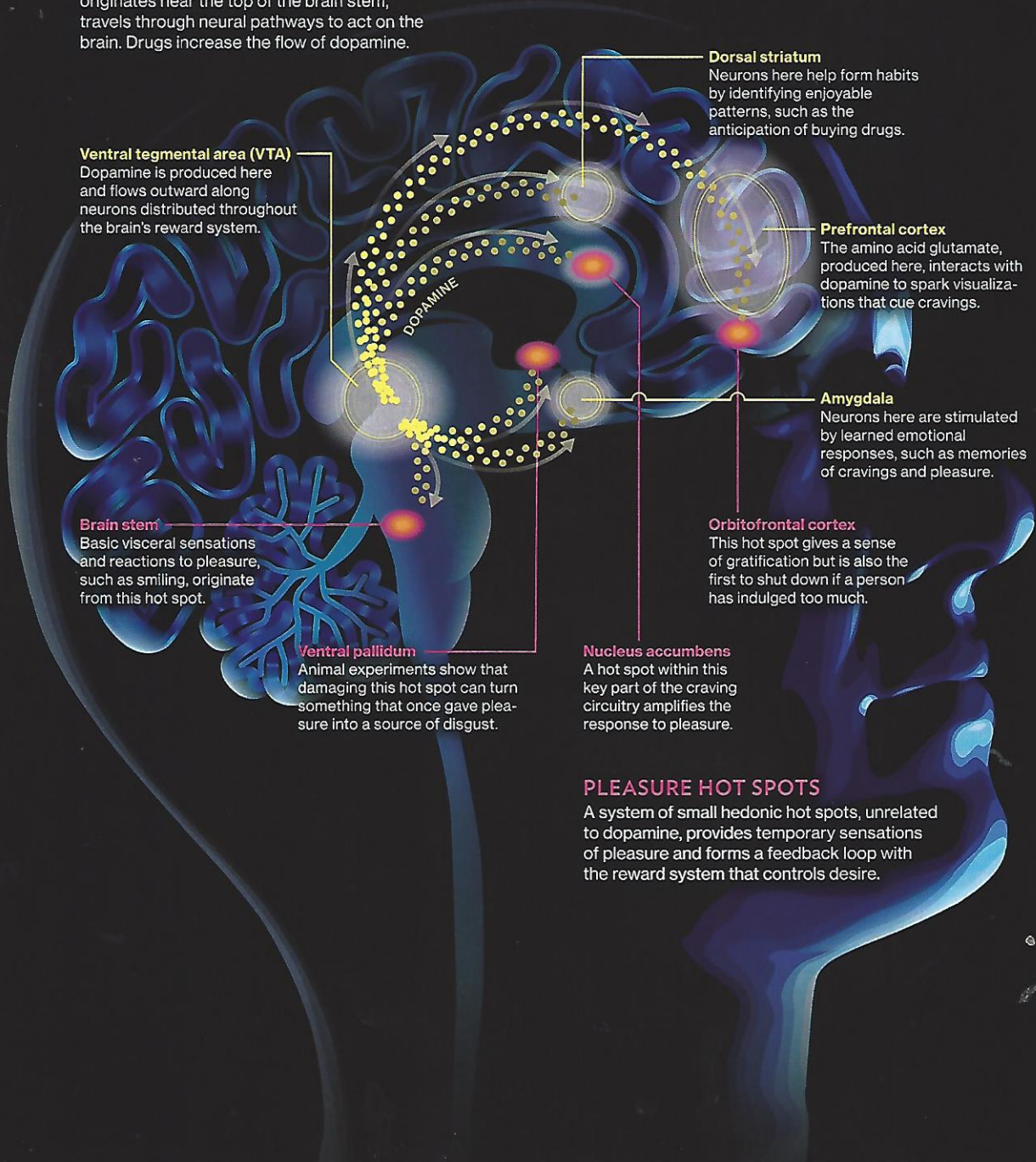
Amygdala
Neurons here are stimulated by learned emotional responses, such as memories of cravings and pleasure.

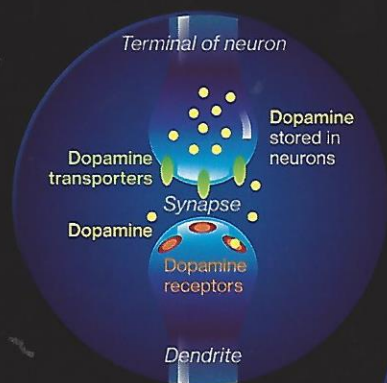
Orbitofrontal cortex
This hot spot gives a sense of gratification but is also the first to shut down if a person has indulged too much.

Nucleus accumbens
A hot spot within this key part of the craving circuitry amplifies the response to pleasure.

PLEASURE HOT SPOTS

A system of small hedonic hot spots, unrelated to dopamine, provides temporary sensations of pleasure and forms a feedback loop with the reward system that controls desire.

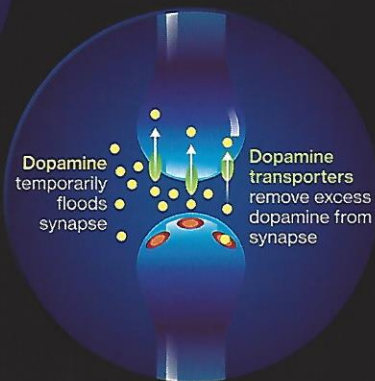




NEURON ACTIVITY

In a normal state

Neurotransmitters carry nerve impulses across synapses between cells to excite or inhibit activity.

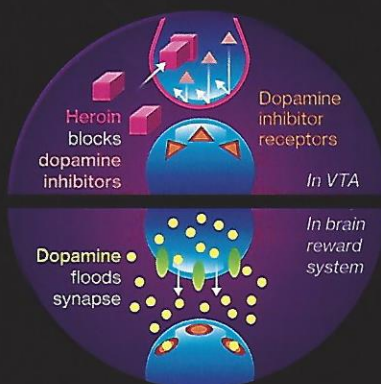


In an excited state

Dopamine temporarily floods a synapse when a pleasurable activity, such as gambling, sex, shopping, or gaming, is anticipated or experienced.

A NATURAL HIGH

Our brains evolved a dopamine-based reward system to encourage behaviors that help us survive, such as eating, procreating, and interacting socially.



On heroin

Synapses flood with dopamine when heroin blocks dopamine inhibitors in the VTA.

A CHEMICAL RUSH

Different drugs interact with the reward system in unique ways to keep synapses artificially flooded with dopamine. That dopamine rush can rewire your brain to want more drugs, leading to addiction.



On methamphetamine

The drug reverses the natural, controlled flow of dopamine into neurons, forcing dopamine to rush into synapses instead.



On cocaine

By interfering with dopamine transport, cocaine prevents removal of excess dopamine from synapses.