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Dopamine

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Dopamine is a chemical messenger (neurotransmitter) in the brain and a circulating hormone in the blood. While popular culture commonly describes it as the "feel-good" chemical, neuroscientists categorize it differently. Rather than producing the sensation of pleasure, dopamine generates an overwhelming urge to seek out things that provide pleasure or assure survival.

Brain produces dopamine in specialized regions, primarily the ventral tegmental area and the substantia nigra. From there, it travels along four major neural highways, each controlling distinct human functions.

1. Mesolimbic Pathway: Processes motivation, desire, and reinforced behavior. It connects the ventral tegmental area to the nucleus accumbens.
2. Mesocortical Pathway: Regulates focus, attention, working memory, and emotional response by connecting the ventral tegmental area to the prefrontal cortex.
3. Nigrostriatal Pathway: Facilitates smooth, coordinated, and voluntary motor function.
4. Tuberoinfundibular Pathway: Regulates the secretion of prolactin from the pituitary gland.

Dopamine is discovered through a succession of significant advances in biochemistry and neuroscience.

In 1910, George Barger and James Ewens, defined dopamine as a monoamine compound similar to epinephrine. Initially it was thought to be a simple precursor of norepinephrine. They had synthesized dopamine (3,4-dihydroxyphenethylamine) in the laboratory at the Wellcome Physiological Research Laboratories in London.

In the 1930s, Dopamine was recognized as a metabolic intermediate in the pathway converting tyrosine $\rightarrow$ L-DOPA $\rightarrow$ dopamine $\rightarrow$ noradrenaline (norepinephrine).

It was in the mid-1950s that it began to emerge as a substance of significance in its own right, rather than only an intermediary in the synthesis of noradrenaline. Herman Blaschko at Oxford, who worked on monoamine oxidase (MAO) in the early years was one of the first to suggest that dopamine may be physiologically significant. Researchers began establishing the fact, that dopamine was present naturally in mammalian tissues and it might have some physiological functions of its own.

Kathleen Montagu was a researcher who was working in Hans Weil-Malherbe's laboratory at Runwell Hospital near London. She published research paper in August 1957 identifying for the very first time the presence of dopamine (3-hydroxytyramine) in the central nervous system including in animal and human brain tissue.

Dr. Arvid Carlsson was born in Uppsala, Sweden on 25th January 1923, to a middle-class academic family. In November 1957, Arvid Carlsson was working in Lund, Sweden. He also demonstrated that dopamine was a neurotransmitter in the brain. He and his colleagues developed specific assay methods and demonstrated that dopamine acts independently as a vital neurotransmitter regulating movement. Carlsson went on to create a method for evaluating the level of dopamine in brain tissues. He discovered that dopamine levels were notably high in the basal ganglia, an area in brain responsible for movement. He subsequently demonstrated that giving reserpine to the animals resulted in a drop in dopamine levels and a loss of locomotor control. These effects were similar to those seen in Parkinson's disease. He was able to relieve the symptoms by giving the animals L-Dopa (levodopa), a precursor to dopamine.

These findings led to the subsequent work by Hornykiewicz on post-mortem Parkinsonian human brain.



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The discovery of dopamine and the description of an analytical method for measuring it were rapidly followed by reports of significantly decreased dopamine levels in the basal ganglia of people dying of Parkinson's disease. These findings led to the subsequent work by Hornykiewicz on post-mortem Parkinsonian human brain.

The discovery of dopamine's role in Parkinson's disease was one of the most clinically important developments in the history of medicine.

In 2000, Nobel Prize in Physiology or Medicine was awarded jointly to Arvid Carlsson, Paul Greengard, and Eric R. Kandel for their discoveries concerning signal transduction in the nervous system.

Dopamine's history has evolved from being seen as only a biochemical intermediary to being recognized as a key neurotransmitter with critical roles in movement, motivation, cognition, reward, and hormonal regulation.

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Arvid Carlsson

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