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Answer:

**Neurotransmitters:**

A **Neurotransmitter** is a chemical substance which is released at the end of a nerve fibre by the arrival of a nerve impulse and, by diffusing across the synapse or junction, affects the transfer of the impulse to another nerve fibre, a muscle fibre, or some other structure.

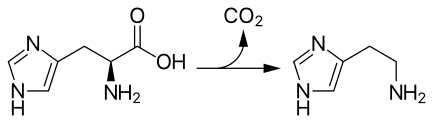
**Neurotransmitters include**:

* Dopamine,
* Histamine,

**Synthesis of Histamine:**

**Histamine** is an organic [nitrogenous](https://en.wikipedia.org/wiki/Nitrogen) compound involved in local [immune responses](https://en.wikipedia.org/wiki/Immune_system), as well as regulating physiological function in the gut and acting as a [neurotransmitter](https://en.wikipedia.org/wiki/Neurotransmitter) for the brain, spinal cord, and uterus. Histamine is involved in the [inflammatory response](https://en.wikipedia.org/wiki/Inflammatory_response) and has a central role as a mediator of [itching](https://en.wikipedia.org/wiki/Itching)

Histamine is derived from the [decarboxylation](https://en.wikipedia.org/wiki/Decarboxylation) of the [amino acid](https://en.wikipedia.org/wiki/Amino_acid) [histidine](https://en.wikipedia.org/wiki/Histidine), a reaction [catalyzed](https://en.wikipedia.org/wiki/Catalyst) by the [enzyme](https://en.wikipedia.org/wiki/Enzyme) [L-histidine decarboxylase](https://en.wikipedia.org/wiki/L-histidine_decarboxylase). It is a [hydrophilic](https://en.wikipedia.org/wiki/Hydrophilic) [vasoactive](https://en.wikipedia.org/wiki/Vasoactive) [amine](https://en.wikipedia.org/wiki/Amine).

[](https://en.wikipedia.org/wiki/File:Histidine_decarboxylase.svg)

Conversion of [histidine](https://en.wikipedia.org/wiki/Histidine) to histamine by [histidine decarboxylase](https://en.wikipedia.org/wiki/Histidine_decarboxylase)

Once formed, histamine is either stored or rapidly inactivated by its primary [degradative enzymes](https://en.wikipedia.org/wiki/Degradative_enzyme), [histamine-N-methyltransferase](https://en.wikipedia.org/wiki/Histamine-N-methyltransferase) or [diamine oxidase](https://en.wikipedia.org/wiki/Diamine_oxidase). In the central nervous system, histamine released into the [synapses](https://en.wikipedia.org/wiki/Synapse) is primarily broken down by [histamine-N-methyltransferase](https://en.wikipedia.org/wiki/Histamine-N-methyltransferase), while in other tissues both enzymes may play a role. Several other enzymes, including [MAO-B](https://en.wikipedia.org/wiki/MAO-B) and [ALDH2](https://en.wikipedia.org/wiki/ALDH2), further process the immediate metabolites of histamine for excretion or recycling.

Bacteria also are capable of producing histamine using histidine decarboxylase enzymes unrelated to those found in animals. A non-infectious form of foodborne disease, [scombroid poisoning](https://en.wikipedia.org/wiki/Scombroid_poisoning), is due to histamine production by bacteria in spoiled food, particularly fish. Fermented foods and beverages naturally contain small quantities of histamine due to a similar conversion performed by fermenting bacteria or yeasts. [Sake](https://en.wikipedia.org/wiki/Sake) contains histamine in the 20–40 mg/L range; [wines](https://en.wikipedia.org/wiki/Wine) contain it in the 2–10 mg/L range.

**Synthesis of Dopamine:**

**Dopamine** (**DA**, a contraction of **3,4-dihydroxyphenethylamine**) is an [organic chemical](https://en.wikipedia.org/wiki/Organic_compound) of the [catecholamine](https://en.wikipedia.org/wiki/Catecholamine) and [phenethylamine](https://en.wikipedia.org/wiki/Phenethylamine) families. It functions both as a [hormone](https://en.wikipedia.org/wiki/Hormone) and a [neurotransmitter](https://en.wikipedia.org/wiki/Neurotransmitter), and plays several important roles in the brain and body. It is an [amine](https://en.wikipedia.org/wiki/Amine) synthesized by removing a [carboxyl group](https://en.wikipedia.org/wiki/Carboxyl_group) from a molecule of its [precursor chemical](https://en.wikipedia.org/wiki/Precursor_(chemistry)) [L-DOPA](https://en.wikipedia.org/wiki/L-DOPA), which is [synthesized](https://en.wikipedia.org/wiki/Biosynthesis) in the brain and kidneys. Dopamine is also synthesized in plants and most animals. In the brain, dopamine functions as a [neurotransmitter](https://en.wikipedia.org/wiki/Neurotransmitter)—a chemical released by [neurons](https://en.wikipedia.org/wiki/Neuron) (nerve cells) to send signals to other nerve cells.

Dopamine is [synthesized](https://en.wikipedia.org/wiki/Biosynthesis) in a restricted set of cell types, mainly neurons and cells in the [medulla](https://en.wikipedia.org/wiki/Adrenal_medulla) of the [adrenal glands](https://en.wikipedia.org/wiki/Adrenal_gland). The primary and minor [metabolic pathways](https://en.wikipedia.org/wiki/Metabolic_pathway) respectively are:

Primary: L-Phenylalanine → L-Tyrosine → L-DOPA → Dopamine

Minor: L-Phenylalanine → L-Tyrosine → *p*-Tyramine → Dopamine

Minor: L-Phenylalanine → [*m*-Tyrosine](https://en.wikipedia.org/wiki/L-m-tyrosine) → [*m*-Tyramine](https://en.wikipedia.org/wiki/Meta-tyramine) → Dopamine

The direct precursor of dopamine, [L-DOPA](https://en.wikipedia.org/wiki/L-DOPA), can be synthesized indirectly from the [essential amino acid](https://en.wikipedia.org/wiki/Essential_amino_acid) [phenylalanine](https://en.wikipedia.org/wiki/Phenylalanine) or directly from the non-essential amino acid [tyrosine](https://en.wikipedia.org/wiki/Tyrosine). These [amino acids](https://en.wikipedia.org/wiki/Amino_acid) are found in nearly every protein and so are readily available in food, with tyrosine being the most common. Although dopamine is also found in many types of food, it is incapable of crossing the [blood–brain barrier](https://en.wikipedia.org/wiki/Blood%E2%80%93brain_barrier) that surrounds and protects the brain. It must therefore be synthesized inside the brain to perform its [neuronal activity](https://en.wikipedia.org/wiki/Neurotransmission).

L-Phenylalanine is converted into L-tyrosine by the [enzyme](https://en.wikipedia.org/wiki/Enzyme) [phenylalanine hydroxylase](https://en.wikipedia.org/wiki/Phenylalanine_hydroxylase), with [molecular oxygen](https://en.wikipedia.org/wiki/Allotropes_of_oxygen#Dioxygen) (O2) and [tetrahydrobiopterin](https://en.wikipedia.org/wiki/Tetrahydrobiopterin) as [cofactors](https://en.wikipedia.org/wiki/Cofactor_(biochemistry)). L-Tyrosine is converted into L-DOPA by the enzyme [tyrosine hydroxylase](https://en.wikipedia.org/wiki/Tyrosine_hydroxylase), with tetrahydrobiopterin, O2, and iron (Fe2+) as cofactors. L-DOPA is converted into dopamine by the enzyme [aromatic L-amino acid decarboxylase](https://en.wikipedia.org/wiki/Aromatic_L-amino_acid_decarboxylase) (also known as DOPA decarboxylase), with [pyridoxal phosphate](https://en.wikipedia.org/wiki/Pyridoxal_phosphate) as the cofactor.

Dopamine itself is used as precursor in the synthesis of the neurotransmitters norepinephrine and epinephrine. Dopamine is converted into norepinephrine by the enzyme [dopamine β-hydroxylase](https://en.wikipedia.org/wiki/Dopamine_beta_hydroxylase), with O2 and [L-ascorbic acid](https://en.wikipedia.org/wiki/Ascorbic_acid) as cofactors. Norepinephrine is converted into epinephrine by the enzyme [phenylethanolamine *N*-methyltransferase](https://en.wikipedia.org/wiki/Phenylethanolamine_N-methyltransferase) with [*S*-adenosyl-L-methionine](https://en.wikipedia.org/wiki/S-Adenosyl_methionine) as the cofactor.

Some of the cofactors also require their own synthesis. Deficiency in any required amino acid or cofactor can impair the synthesis of dopamine, norepinephrine, and epinephrine.

