

# Acetylcholine

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**Acetylcholine (ACh)** is an ester of acetic acid and choline. It acts as a **neurotransmitter** in the peripheral and central nervous system. In the periphery, it transmits the signal on the neuromuscular plates and is a mediator of the parasympathetic autonomic system.

Centrally, it acts as a neurotransmitter and neuromodulator. Here it has a role in maintaining consciousness, attention and the formation of memory.<sup>[1]</sup> ACh acts on two types of receptors - on the one hand, on ionotropic nicotinic receptors and, on the other hand, on metabotropic muscarinic receptors.<sup>[2]</sup>

## Chemical properties, synthesis

ACh is synthesized in **cholinergic neurons** by the enzyme choline acetyltransferase. This enzyme binds the acetic acid residue to choline via an ester bond. Acetyl-CoA and choline serve as substrates.

Choline is synthesized through the sequential methylation of ethanolamine, which is formed by decarboxylation of serine. **S-adenosylmethionine** (*active methionine*, *SAM*) serves as a donor of methyl groups. The resulting acetylcholine has the properties of a strongly polar quaternary ammonium compound - regardless of pH, it has a positive charge, so it does not penetrate into cells or, for example, through the blood-brain barrier.

Degradation of ACh takes place hydrolytically, extracellularly on the membrane of the synaptic cleft with the help of the enzyme acetylcholine esterase - inactive metabolites choline and acetate are formed

## Function

### Neuromuscular plate

Acetylcholine acts on the neuromuscular plate, which is a special type of chemical synapse between a motoneuron and a skeletal muscle motor unit. After being washed into the synaptic cleft, it binds to nicotinic receptors (nAChR). There is a change in the membrane potential of the muscle fiber and an intracellular washout of  $\text{Ca}^{2+}$  ions from the sarcoplasmic reticulum, which are essential for muscle contraction. For more details, see the article Neuromuscular disc.

### Autonomic nervous system

### Central nervous system

### Pharmacology

## Links

### Related Articles

- Anticholinergics
- Neurotransmitter

### Resources

1. Tiwari, Prashant; Dwivedi, Shubhangi; Singh, Mukesh Pratap; Mishra, Rahul; Chandy, Anish (2017-05-15). "Basic and modern concepts on cholinergic receptor: A review". *Asian Pacific Journal of Tropical Disease*. 3 (5): 413–420.
2. KLAUS-HEINRICH, Koolman. *Barevný atlas biochemie - Překlad 4. vydání*. - edition. Grada Publishing a.s., 2012. 498 pp. pp. 364. ISBN 9788024729770.