

What to know about acetylcholine



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Acetylcholine is a chemical messenger, or neurotransmitter, that plays an important role in brain and muscle function. Imbalances in acetylcholine are linked with chronic conditions, such as Alzheimer's disease and Parkinson's disease.

In this article, we explain what acetylcholine is and look at how it is linked with various health conditions, including Alzheimer's disease, [myasthenia gravis](#), and Parkinson's disease. We also discuss treatments for acetylcholine-related conditions.

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What is Acetylcholine and why does it matter?



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Acetylcholine was the [first neurotransmitter discovered](#) ✓.

Imbalances in levels of acetylcholine play a role in some neurological conditions. People who have [Alzheimer's disease](#) and [Parkinson's disease](#) tend to have low levels of acetylcholine.

There is no proven way to maintain ideal levels of acetylcholine and prevent neurological diseases. However, researchers are developing advanced treatments to help people with these health conditions live longer, healthier lives.

How does acetylcholine work?

Acetylcholine [develops](#) in the body's nerve terminals from a molecule called acetyl coenzyme A (acetyl CoA), which is made from glucose

(sugar), and choline, in a reaction triggered by the enzyme choline acetyltransferase (CAT)

In the body, acetylcholine [affects](#) both the peripheral and central nervous systems. It produces varied reactions in the body depending on where it is released.

For example, when acetylcholine is activated in the motor neurons, it initiates the transmission of signals that create muscle movement. It even affects the muscles involved in contracting for urinating. In addition, it is responsible for things like dilating the eyes and triggering the release of sweat and saliva.

In contrast, when acetylcholine is released into the brain, it impacts arousal, attention, focus, memory, and motivation.

What does a lack of acetylcholine do?

When a person doesn't have enough acetylcholine (also called acetylcholine deficiency), this can cause a [variety of symptoms](#) such as:

- red and inflamed skin
- dry mouth and inability to sweat
- vision problems
- agitation
- delirium
- fever
- difficulty urinating

What happens when there's too much acetylcholine in the body?

Too much acetylcholine can lead to what is known as a cholinergic crisis.

This can happen from external causes such as from taking high-dose acetylcholinesterase (ACE) inhibitors, or from exposure to something like nerve gas, pesticides, or insecticides.

Symptoms include:

- blurred vision
- Nausea and vomiting
- diarrhea
- slow heart rate
- difficulty breathing
- excessive sweat and saliva
- more frequent and urgent urination
- paralysis

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Acetylcholine and disease

Researchers believe acetylcholine is [closely associated](#) [🔗] with a number of brain diseases. These include:

Alzheimer's disease

Alzheimer's disease is the most common cause of [dementia](#) among older adults, according to the [National Institute on Aging](#) ✓.

Its symptoms include severe memory loss and problems with the ability to think that interfere with daily life. There is no cure for Alzheimer's disease.

Experts do not know what causes Alzheimer's disease. However, they know that many people with the condition [have lower levels of acetylcholine](#) ✓. Alzheimer's disease damages cells that produce and use acetylcholine.

Certain medications can increase levels of acetylcholine. They do this by blocking the action of enzymes that break down the neurotransmitter.

The primary enzyme in this group is called acetylcholinesterase (AChE), and drugs that make these enzymes less active are called AChE inhibitors or cholinesterase inhibitors.

AChE inhibitors can help with symptoms related to thought processes such as language, judgment, and memory.

AChE inhibitors [include](#):

- donepezil ([Aricept](#))
- galantamine (Razadyne)
- rivastigmine (Exelon)

AChE inhibitors may also help treat other health conditions. Some tumors appear to have an unusual level of AChE in them, [according to some research](#). Scientists may find that AChE inhibitors can help treat certain types of [cancer](#).

Myasthenia gravis

Myasthenia gravis is an autoimmune condition that causes muscle weakness, especially after a person is active.

Myasthenia gravis causes the immune system to block or destroy acetylcholine receptors. Then, the muscles do not receive the neurotransmitter and cannot function normally. Specifically, without acetylcholine, muscles cannot contract.

Symptoms of myasthenia gravis can range from mild to severe. They may include:

- weakness in the arms, legs, hands, fingers, or neck
- drooping of one or both eyelids
- blurred or [double vision](#)
- trouble swallowing
- shortness of breath
- difficulty speaking

Many people with myasthenia gravis can lead regular lives. A variety of treatments can control symptoms.

AChE inhibitors [may also help relieve symptoms of myasthenia gravis](#) . However, these are different medications than the ones used to treat dementia. The medication of choice is usually pyridostigmine (Mestinon, Regonol).

When these drugs slow the breakdown of acetylcholine, they improve neuromuscular connection and muscle strength.

In addition, doctors [may also prescribe](#)  immunosuppressants such as rituximab (Rituxan).

Parkinson's disease

An imbalance in levels of acetylcholine may have an effect on people with Parkinson's disease, too.

The body needs a balance of acetylcholine and dopamine, another chemical messenger, to control movements well.

Parkinson's disease is a neurodegenerative condition that causes involuntary movements, tremors, and difficulties with thinking and mood.

The exact causes of Parkinson's disease are unknown. However, experts have discovered that people with the condition often have a decrease in dopamine that allows acetylcholine to take over. When this occurs, muscles become too "excited," which leads to symptoms such as jerking movements and tremors.

For this reason, some medications for Parkinson's disease [block the action of acetylcholine](#) . This allows dopamine levels to rebalance, which can help relieve some symptoms.

These medications are called anticholinergics. They can also help ease dyskinesias, which are excessive movements that can be side effects of other Parkinson's medications.

Anticholinergics are not for everyone. Side effects may include confusion, memory loss, hallucinations, and blurry vision.

Experts also believe that many nonmotor symptoms of Parkinson's disease, such as memory problems, are related to reduced levels of acetylcholine.

Toxins, pesticides, and acetylcholine

Exposure to organophosphate (OP) pesticides or certain nerve agents used in warfare can cause levels of acetylcholine in the body

to rise very high.

The [Centers for Disease Control and Prevention \(CDC\)](#) say that these chemicals lead to a buildup of acetylcholine in the nervous system, causing symptoms of:

- wheezing
- sweating
- weakness
- [headaches](#)
- fainting
- [diarrhea](#) and vomiting
- mental changes
- muscle twitching
- convulsions
- paralysis
- respiratory arrest

A person can be exposed to these chemicals through the skin, through breathing, or through ingestion. In the United States, [about 8,000 people a year](#)  are exposed to OPs.

Exposure is most likely to occur through contact with pesticides on crops — including apples, grapes, spinach, cucumbers, and potatoes — or through contact with household products such as ant and roach killers.

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Botox and acetylcholine

Botulinum toxin ([Botox](#)) is the most popular nonsurgical cosmetic treatment in the U.S., according to the [American Society of Plastic Surgeons](#).

It primarily works by [interfering with acetylcholine](#) ✓ in the targeted muscle. Injecting Botox into certain facial muscles, for example, can create a temporary reduction in wrinkles because Botox prevents the muscles from contracting. This causes the skin on top of the muscle to appear smoother.

Botox [can also treat](#) ✓ a variety of muscle-related conditions, as well as things like migraine headaches and excessive sweating, for example.

There is some evidence suggesting it might also help with [bladder issues](#) ✓ such as overactive bladder or [bowel issues](#) ✓ such as gastroparesis, but more research is necessary to confirm this.

Frequently asked questions

How can I increase my acetylcholine naturally?

There is no proven way to increase acetylcholine levels. However, some evidence suggests that consuming choline might help. People must get enough choline from their diets to produce adequate levels of acetylcholine.

Foods that contain choline include meat, fish, eggs, beans, and cruciferous vegetables. The [Office of Dietary Supplements](#) ✓ states

that while some animal studies have shown that higher intakes of choline could lead to better cognitive function, other studies have found this unhelpful.

Most people do not get enough choline from their diets. The recommended amount of choline is [425 milligrams \(mg\)](#) per day for females assigned at birth (FAAV) and 550 mg for males assigned at birth (MAAB).

A person can take choline supplements, but high doses can cause side effects such as vomiting, a fishy [body odor](#), and [liver damage](#).

How does acetylcholine affect human behavior?

Acetylcholine [affects](#) things like the sleep-wake cycle, as well as the ability to focus or remember. Problems with acetylcholine can cause various issues in these areas.

Research also shows that an imbalance in acetylcholine can also [negatively affect mood](#), potentially triggering symptoms of anxiety or depression.

Summary

Acetylcholine is an important and abundant neurotransmitter in the body. When there is too much or too little, a person may experience neurological problems, such as those that characterize Alzheimer's disease or Parkinson's disease.

Eating a healthful diet can help a person get adequate choline, which the body uses to create acetylcholine. Ask a doctor before taking choline supplements, due to their potentially serious side effects.

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