

Understanding Genetics and Alzheimer's Disease

Alzheimer Society

Research

What is Alzheimer's disease?

Alzheimer's disease is a disease of the brain where abnormal proteins collect in brain cells. Alzheimer's disease causes symptoms of dementia such as memory loss, difficulty performing daily activities, and changes in judgement, reasoning, behaviour, and emotions. These dementia symptoms are irreversible, which means that any loss of abilities cannot come back.

There is currently no cure for Alzheimer's disease. However, there are treatment options and lifestyle choices that may slow it down. Researchers continue to look for ways to prevent or stop Alzheimer's disease and bring back lost abilities and memory.

Early-onset Alzheimer's disease: Symptoms begin before age 60-65.

Late-onset Alzheimer's disease: Symptoms begin after age 60-65.

Alzheimer's disease is not the only form of dementia.

Alzheimer's disease is a common form of dementia; however, there are many other forms of dementia.

Memory loss or dementia symptoms can be due to treatable conditions such as vitamin deficiencies, thyroid disease, sleep disorders, or mental illness. Other irreversible dementias include vascular dementia (due to strokes), Lewy Body disease, frontotemporal dementia, Creutzfeldt-Jakob disease, Parkinson's disease, and Huntington's disease.

These conditions can have similar and overlapping symptoms, and many of them can only be diagnosed with certainty by an autopsy of the brain.

Sometimes people are concerned about a family history of Alzheimer's disease when, in fact, they have a family history of dementia due to different causes.

The Genetics of Alzheimer's disease

Most Alzheimer's disease does not run in families and is described as "sporadic".

- The most common form of Alzheimer's disease is called sporadic Alzheimer's disease; it has no specific family link.
- Sporadic Alzheimer's disease is due to a complex combination of our genes, our environment, and our lifestyle.
- Any of us might develop sporadic Alzheimer's disease in our lifetime, just as any of us might develop heart disease, cancer, diabetes, or other health problems.
- The single greatest risk factor for developing sporadic Alzheimer's disease is aging.
- Most sporadic Alzheimer's disease begins after age 60-65.
- Researchers have found many genes that may increase the chance of developing sporadic Alzheimer's disease. These genes are called *susceptibility genes* because they do not directly cause Alzheimer's disease but they make you more susceptible to developing it in your lifetime.

- The role of specific environmental factors in developing sporadic Alzheimer’s disease is unclear. Some studies show that it may be possible to decrease the likelihood of sporadic Alzheimer’s disease by keeping your mind active, avoiding head injury, reducing vascular disease risk factors, and effectively managing stress and depression.
- Research has not confirmed whether specific vitamins, substances or supplements can prevent or slow down Alzheimer’s disease. Before trying any of these, be sure to discuss the possible risks and benefits with your doctor.
- Sporadic Alzheimer’s disease usually does not run in families. However, people who have a family history of sporadic Alzheimer’s disease have a greater chance of developing the disease than people with no family history of Alzheimer’s disease.

Rare cases of Alzheimer’s disease are inherited or “familial”.

- Families with this rare form of Alzheimer’s disease have very strong family histories of Alzheimer’s disease (many family members over many generations).
- Familial Alzheimer’s disease has the same symptoms as sporadic Alzheimer’s disease and can develop at any age.
- Familial Alzheimer’s disease accounts for less than 1% of all cases of Alzheimer’s disease.
- Familial Alzheimer’s disease is due to changes or alterations in specific genes that can be directly passed on from parent to child.
- Three familial Alzheimer’s disease genes have been discovered so far: the PSEN1, PSEN2, and APP genes. If you have an alteration in any one of these genes, you will almost certainly develop early-onset familial Alzheimer’s disease.
- Alterations in the PSEN1, PSEN2, and APP genes are not known to cause Alzheimer’s disease among persons 65 years and older.
- Researchers are searching for other genes that might cause familial Alzheimer’s disease.
- Familial Alzheimer’s disease runs in families. If a person has familial Alzheimer’s disease, each of his/her children has a 50% chance of inheriting the disease-causing gene and developing Alzheimer’s disease.

Is there genetic testing for Alzheimer’s disease?

For most of us, there is no genetic test that can definitely tell us whether we will develop Alzheimer’s disease or not.

Genetic testing for sporadic Alzheimer’s disease is not recommended.

Researchers have identified more than 30 different susceptibility genes for sporadic Alzheimer’s disease. However, a susceptibility gene called the APOE4 gene is believed to have the greatest impact on a person’s chances of developing sporadic Alzheimer’s disease.

Some people who are concerned about developing sporadic Alzheimer’s disease might be interested in finding out if they carry an APOE4 gene. Advisory committees around the world have recommended against this type of genetic testing. This is because individuals who have an APOE4 gene might never develop Alzheimer’s disease and individuals with no APOE4 genes can still develop Alzheimer’s disease.

Direct-to-consumer genetic testing: Some internet companies provide APOE4 genetic testing. Experts caution against using these services. If you are considering any kind of genetic testing, make sure you talk to your doctor or a genetic counsellor beforehand.

Genetic testing for familial Alzheimer's disease is available in some cases.

Genetic testing is only an option for families that have early-onset familial Alzheimer's disease.

If you are interested in genetic testing for early-onset familial Alzheimer's disease, the first step of this process should be a detailed review of your family history by a genetic counsellor or physician to make sure that your family fits the pattern of early-onset familial Alzheimer's disease (several family members with Alzheimer's disease beginning before the age of 60-65). These families are rare.

If your family fits the early-onset familial Alzheimer's disease pattern, a sample of DNA (genetic material) would need to be taken from a family member who has been diagnosed with early-onset Alzheimer's disease. This DNA sample would then be tested for alterations in the three known early-onset familial Alzheimer's disease genes.

If this family member is found to have an alteration in one of the three early-onset familial Alzheimer's disease genes, other relatives can choose to have genetic testing to find out if they carry the same alteration, even if they have no symptoms of Alzheimer's disease. This is called presymptomatic or predictive genetic testing. This testing can only be done after meeting with a genetic counsellor to review all the risks and benefits.

Testing of the three known early-onset familial Alzheimer's disease genes can be done at Canadian research laboratories or commercial laboratories in the United States. (Commercial testing is costly and may not be covered by your provincial healthcare plan.)

Help is available

If you are thinking about genetic testing for Alzheimer's disease it is important to get help from a health care professional like your doctor or a certified genetic counsellor. They will help you find out whether genetic testing is relevant for you based on your family history. If it is relevant, they will also help make sure you understand the testing process and all the things you should think about before getting tested.

For more information about genetic testing, please contact your local Alzheimer Society, your family doctor, or the Canadian Association of Genetic Counsellors (www.cagc-accg.ca).

This document is for information only; it is not intended to replace the advice of a health care professional.

There is a lot to think about before having a genetic test for familial Alzheimer's disease, including:

- **Motivations:** Why do you want the test? Will it change life decisions such as financial planning or having children?
- **Informed consent:** Do you fully understand what the test will and will not tell you? Do you fully understand the possible benefits and risks of having the test?
- **Confidentiality:** Will your test results be kept private? Who will you share them with?
- **Risks:** Will the test results affect family relationships? Your mental or emotional wellbeing? Insurance or employment applications?

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Alzheimer Society

Alzheimer Society of Canada

20 Eglinton Avenue West, 16th Floor, Toronto, Ontario, M4R 1K8

Tel: 416-488-8772 • 1-800-616-8816 • Fax: 416-322-6656

E-mail: info@alzheimer.ca • Website: www.alzheimer.ca

Facebook : www.facebook.com/AlzheimerSociety • Twitter : www.twitter.com/AlzSociety

