Key Stage 4
The Genetics of Alzheimer’s

Student worksheet

What is Alzheimer’s Disease?

Alzheimer’s disease (AD) is named after the doctor who first described it (Alois Alzheimer). It is a type of dementia, and symptoms include difficulties with thinking, memory, problem-solving or language.

Different types

AD mainly affects people over 65, although younger people can develop it. Around 5% of people with AD are under 65. This is called early-onset Alzheimer’s. It usually affects people in their 40s, 50s and early 60s.

Changes in the brain

The root cause of AD is poorly understood, and may be a combination of aging, genetic susceptibility, and overall body health. These factors can contribute to toxic proteins building up in the brain. One of the proteins involved is called beta-amyloid, which forms plaques around brain cells. Another protein called tau forms tangles within brain cells. These lead to a decrease in chemical messengers (neurotransmitters) that are involved in sending impulses between nerve cells. Over time, nerve and brain cells die and areas of the brain shrink. The first areas usually affected are responsible for memories.

What causes it?

It is still unknown what triggers Alzheimer’s disease, but several factors, such as old age and poor cardiovascular health are known to increase the risk of developing it.

Your task

Is genetics a risk factor for AD? You work this out by studying case studies of AD in two families.

You should:

- Study the family trees of each family. These show who in the family developed AD.
- Compare the patterns of inheritance in each family. How likely is it that AD is inherited in each case?
- Read the information on the genetics of AD and write advice to each person, answering their questions.

https://www.oxfordsparks.ox.ac.uk/content/discovering-life-changing-dementia-treatments
My name is Camille Robertson. I’m 66 years old. My Grandfather developed Alzheimer’s disease in his late 70s and my sister Anne now has it as well. She is 74.

I want to know what the chances are that I, my children and grandchild will have AD.
I’m Matt Chalmers and I’m 26. I’m worried that I’ll develop Alzheimer’s disease when I get older. My Mum has the disease, and she started showing symptoms when she was 45.

I want to know what my chance of developing AD is.
Two types

Alzheimer’s disease can be early-onset or late-onset. The early-onset form is much less common than the late-onset form, accounting for less than 5% of all cases of AD.

The symptoms of the early-onset form appear before age 65, while the late-onset form appears after age 65.

Late-onset

The late-onset form does not clearly run in families, although in some families there may be more than one person who has developed it.

Scientists think that a gene called APOE is a risk factor for the disease, in particular an allele called e4. People who inherit one copy of the APOE e4 allele have an increased chance of developing the disease; those who inherit two copies of the allele are at even greater risk.

Early-onset

The early-onset form of Alzheimer disease is inherited in an autosomal dominant pattern, which means one copy of a faulty gene in each cell is sufficient to cause the disease. In most cases, an affected person inherits the faulty gene from one affected parent.

Genetic testing can be used to see if a person has a faulty gene, and so will develop AD. It is a big decision to have a genetic test, and can affect other family members, not just the person having the test, so genetic counselling is always offered first so these issues can be discussed.