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**Dementia: The Ageing  
Brain and the Role of  
Participatory Arts**  
Key Stage 4 Psychology  
Resource 2

2019



# Resource Two

## Overview



Topic	Dementia on the Brain: What happens when the brain does not function as it should? Part 1: Alzheimer's Disease
GCSE Modules	Biopsychology, memory, cognition and development.
Objectives	By the end of this resource, you should be able to: <ul style="list-style-type: none"><li>✓ Define dementia and Alzheimer's disease</li><li>✓ Explain the development of plaques and tangles in Alzheimer's disease</li><li>✓ Describe the structural and chemical changes in the brain of someone with Alzheimer's</li><li>✓ Understand the symptoms that may accompany Alzheimer's</li></ul>
Instructions	<ol style="list-style-type: none"><li>1. Read the data source</li><li>2. Complete the activities</li><li>3. Explore the further reading</li></ol>
Context	In the previous Resource, you covered some basic information about the structures and functions of the human brain, in addition to the normal functioning of neurons and neurotransmitters. With this in mind, we are now going to move on to consider what happens when the brain does not function as it is intended to, resulting in dementia. But what exactly is dementia?

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## Data Source



### Section A

#### Defining Dementia



Unlike popular assumption, dementia is not a disease itself. Rather, it is a broad term that describes the set of symptoms that people display when they are affected by a degenerating condition affecting the brain. The symptoms associated with dementia tend to include memory loss, decreased language processing, difficulties with problem-solving, as well as changes to mood and behaviour. However, there are so many different forms of dementia that affect the brain differently. 'Dementia' is just a broad umbrella term which represents multiple diseases. Thanks to enhanced brain imaging techniques and brain scan equipment, we are now able to investigate the brains of living patients, to get a better understanding of potential brain tissue loss and decreased activity. Let's consider each of the different types of dementia now and how they affect the brain differently. In this resource, we will consider Alzheimer's disease in greater depth, while the latter Resource 3 will consider other forms of dementia. The following material has been informed by the Alzheimer's Society website and Professor June Andrew's book 'Dementia: The One-Stop Guide'. Both will be included in your further reading section if you would like to get some additional information and reading completed after this resource.

### Section B

#### Alzheimer's Disease

Alzheimer's is the most well-known and most common form of dementia. According to Alzheimer's Society, around 520,000 people in the United Kingdom are affected by dementia – that's approximately over half of all dementia cases. It is named after the doctor who first described the disease, Alois Alzheimer. When the brain tissue of someone with Alzheimer's disease is examined under a microscope, large abnormal clumps of tissue can be seen. Although still not fully

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## Data Source

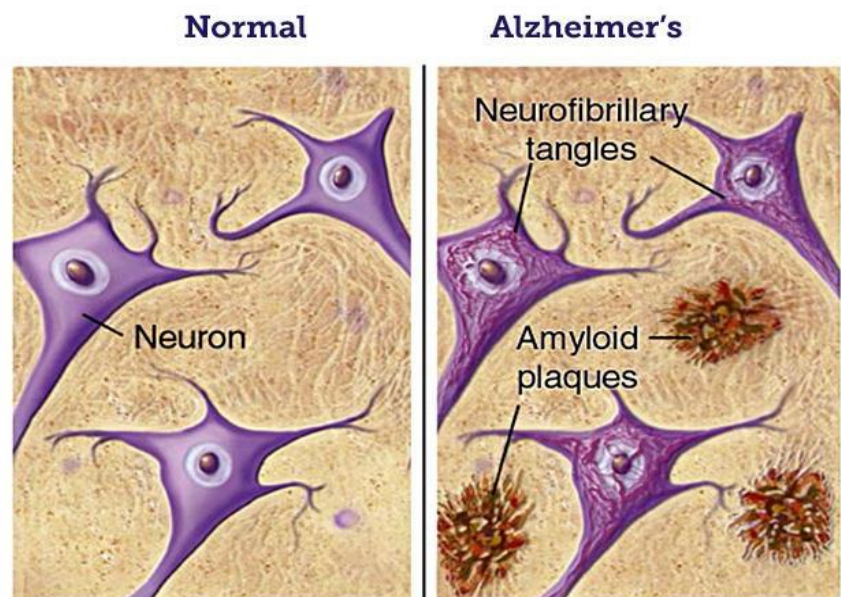


understood why this happens, the prime suspects for these clumps are proteins in the brain referred to as 'plaques' and 'tangles'. These plaques and tangles disrupt the normal workings of the brain's neural network. As explained in Resource 1, there are billions of neurons and nerve connections in the human brain that are constantly in communication with one another. However, when a person starts to develop Alzheimer's disease, these connections between cells begin to deteriorate and neurons start to die, resulting in large parts of brain tissue slowly being lost.

Figure 1

Normal and Alzheimer's Neurons

### Normal vs. Alzheimer's Diseased Brain



Beta-amyloid protein plaques: scientific research has shown that beta-amyloid plaques form when the proteins on the surfaces of neurons are broken down differently. A large protein called APP (amyloid precursor protein) is normally sectioned by enzymes on the surfaces of neurons, resulting in the freeing of amyloid-beta protein fragments, which are

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then broken down and cleared in the body. When someone has Alzheimer's disease, these amyloid-beta proteins are no longer sufficiently regulated or cleared by the body, resulting in an imbalance of amyloid-beta proteins which clump together and form large plaques which increase in size, becoming insoluble. These clumped amyloid-beta fragments are toxic in the brain and disrupt the normal functioning of neurons.

Neurofibrillary tau protein tangles: unlike plaques which form outside of neurons, Alzheimer's disease tangles form in the interior of neurons. As explained earlier, signals in the brain pass from the main body of one neuron, through the synapse or synaptic gap, and into the adjacent neuron. Before the signals pass through the synapse, they travel down a long tube known as a microtubule. Microtubules are maintained and taken care of by normal tau protein – look upon it as the glue for the skeleton of microtubules, attaching itself along the circuit to help keep it in working order. However, in Alzheimer's disease the tau protein detaches from the microtubules, resulting in the breaking down of the circuits and the microtubules fall apart. Similar to amyloid-beta protein, fragments of freed tau protein clump together and form tangles which are located inside the neuron. Without the long microtubular circuits, signals cannot be sent from one neuron to another; hence, the neuronal transport system is lost, and the neuron subsequently dies. When we refer to 'neurodegeneration' in dementia, tau protein has a large part to play in this.

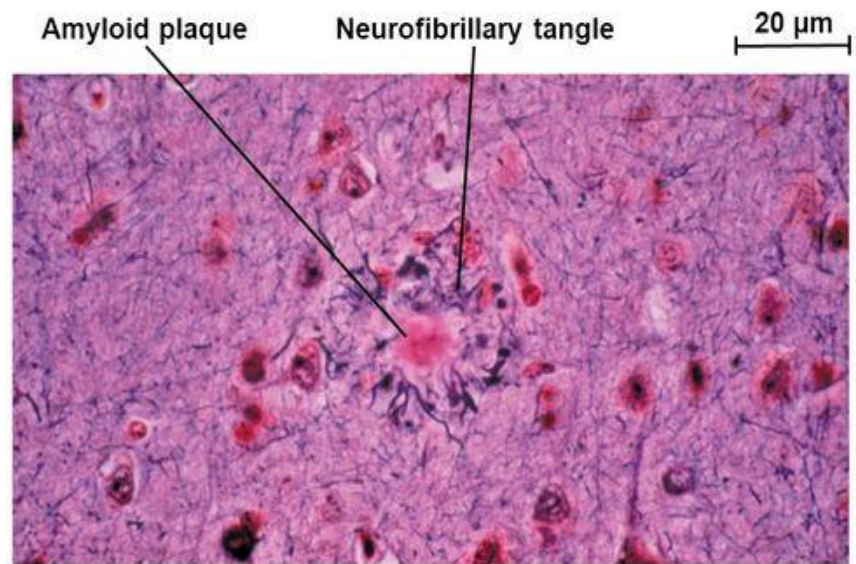
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Figure 2 *Microscopic signs of Alzheimer's disease*

Plaques and Tangles



In addition to some structures being damaged by Alzheimer's disease, there is often less of some of the brain's 'chemical messengers' or neurotransmitters that are important for functioning well. All in all, Alzheimer's disease is a progressive condition, which means that damage to the brain will continue to worsen over time, resulting in shrinkage to the size of the brain and worsening symptoms.

### Section B

Alzheimer's Disease,  
Smaller Structures of the  
Brain and Subsequent  
Symptoms



People often assume that Alzheimer's disease – or dementia in general – is just about memory loss, but there are many other symptoms characterised by the condition. The following sub-sections are taken from Alzheimer's Society 'Dementia Symptoms and Areas of the Brain':

'In Alzheimer's disease, among the areas often damaged first are the hippocampus and its connected structures. This makes it much harder for someone to form new memories or learn new information. A person with Alzheimer's may struggle

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## Data Source



to remember what they did earlier that day, or what they have just said, meaning they may repeat themselves in conversation. The hippocampus is needed for retrieval of memories but retrieving those from longer ago may depend on it less. This is why someone in the earlier stages of Alzheimer's (with a damaged hippocampus but an intact cortex) may remember a childhood holiday but struggle to remember what they ate for breakfast that morning.'

'In Alzheimer's disease the amygdala is generally affected later than the hippocampus. So a person with Alzheimer's will often recall emotional aspects of something even if they don't recall the factual content. They may therefore respond more according to how they feel about a place or person than in a more logical way.'

'Damage to the visual system in the temporal lobes makes recognising familiar faces and objects harder. The person may seem to forget who a familiar person is. However, because the pathways for vision and hearing are separate, they may still know who that person is once they hear them speak.'

'As the damage spreads to the frontal lobes, someone with Alzheimer's may struggle with decision-making, planning or organising (e.g. family finances). A more complex task with a sequence of steps, such as following a new recipe, might also become much harder.'

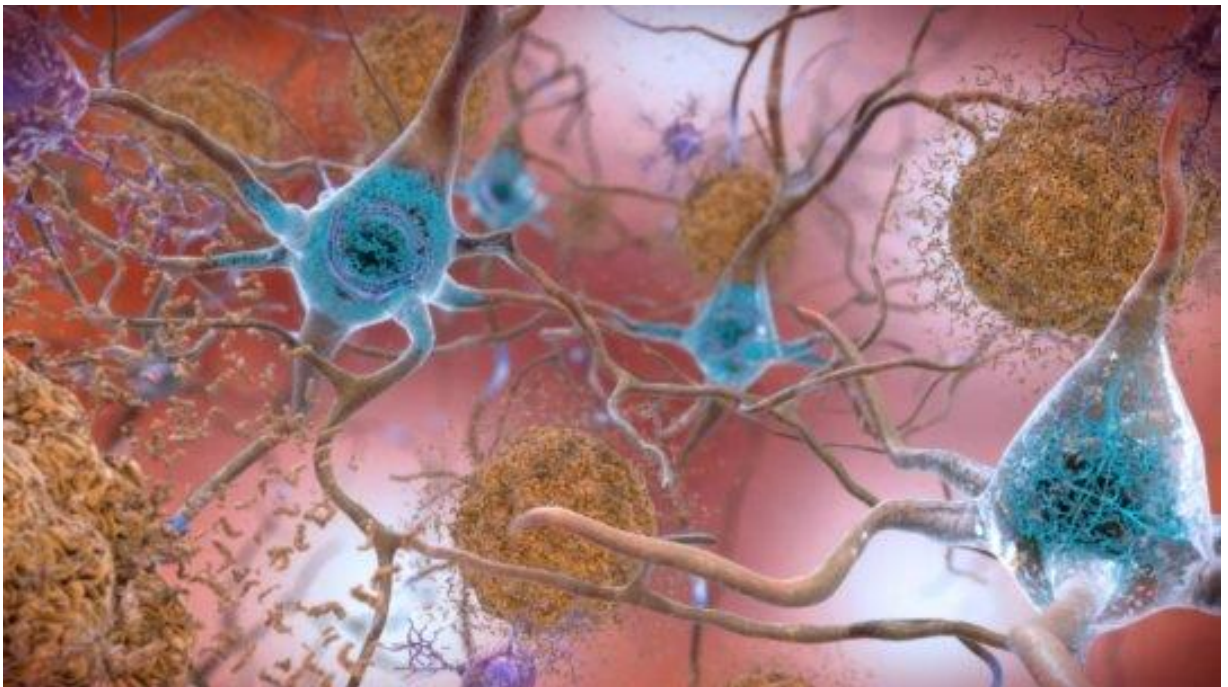
'In contrast to these losses, many abilities are retained, particularly those acquired long ago. Learned skills such as dancing or playing the piano rely on procedural memories, and so are mostly stored deep within the brain. In Alzheimer's disease, these skills are often retained the longest.'

# Resource Two Activities



## Activities

1. Define dementia.
2. Define what Alzheimer's disease is and what it is caused by.
3. In Alzheimer's disease, which brain structure is generally affected first: the amygdala or the hippocampus? And what does this mean for someone living with dementia?
4. Below is an artwork published in Science Daily illustrating plaques and tangles in the brain of someone with Alzheimer's disease. Can you identify the plaques and tangles in the below image? Include the names of each type of protein that is responsible for each forming.





# Resource Two

## Activities



### Activities

5. In the form of a short essay, explain how plaques and tangles are formed in the brain of someone with Alzheimer's disease.



6. Based on material offered by Alzheimer's Society, identify some of the structures of the brain that will be damaged by Alzheimer's disease and how the damage will affect the behaviour of someone with the condition.

7. From what you have read above about the damage of the brain during Alzheimer's disease, suggest why you think music and creative activities are useful for people with Alzheimer's? Don't worry if you don't know the exact answer to this question – just propose some ideas based on the information you have been given so far. Your answer should be a short paragraph.

# Resource Two Further Reading



## Explore



## Read

Follow up with the data sources that informed the above resource:

'Symptoms of Alzheimer's disease' web article by Alzheimer's Society.

<https://www.alzheimers.org.uk/about-dementia/types-dementia/alzheimers-disease-symptoms#content-start>

Read Professor June Andrew's book 'Dementia: The One-Stop Guide'.

Andrews, J (2015). Dementia: The One-Stop Guide. London: Profile Books LTD.

## Watch

'Plagues and Tangles' video on YouTube with animation:

[Plagues and Tangles](#)

## Do

Research the most recent research into pharmaceutical products for Alzheimer's disease and find out how they aim to improve, prevent or reverse dementia symptoms. Write up what you find in a short PowerPoint slide.



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