

Alzheimer's Society

Transcript of 'Dementia brain tour'

The narrator is Dr Anne Corbett, Research Communications Officer at Alzheimer's Society, whose brief is to ensure that dementia research is communicated in a clear and accessible way.

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Part 1 - Introduction to the brain

The human brain is incredibly complex. It controls everything our body does, from coordinating our movements and our speech, keeping our heart beating and storing our memories.

Despite all this there is still a lot we don't know about the inner workings of the brain.

Imaging technologies can give us an idea of what is going on inside the brain.

The human brain weighs around 1.5 kilos.

It is fed by a network of blood vessels that deliver oxygen and nutrients to the cells.

The brain can be divided into four main sections, the cerebral hemispheres, the limbic system, the cerebellum and the brain stem

The bulk of the brain is made up of the cerebral hemispheres.

This is made up of the grey matter, the processing centre and the white matter which is like the wiring.

The cerebral hemispheres can be split into four different lobes which each have different functions.

The frontal lobe is responsible for our behaviour.

The parietal lobe helps us with tasks like calculation and spelling and it controls our complex movements.

The temporal lobe is important for language, emotion and memory.

And the occipital lobe is responsible for our vision.

At the centre of the brain is the limbic system.

This area controls a number of functions but importantly it controls learning and memory particularly in the hippocampus.

The cerebellum or little brain controls movement, posture and balance,

The brain stem is thought to be the oldest part of the brain it controls our vital living functions such as breathing, heart beat and blood pressure)

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Part 2: Brain cells

The brain is made up of billions of nerve cells.

Nerve cells are specially designed for their function. They are elongated with many tentacle-like projections called dendrites that make connections with the cells around them.

Dendrites form an intricate network between cells and the white matter. The point where two cells meet is called a synapse.

Messages are passed along and between cells through tiny electrical impulses and chemical messages.

This is the basis for how the brain works. This is how the brain controls our movements, our thoughts, our memories. If something stops the cell from doing its job, this can result in dementia.

Nerve cells are like any other cell in the body. They need oxygen nutrients to stay alive. They also rely on close contact with their neighbouring cells. If a nerve cell is starved on oxygen or nutrients or becomes isolated from its neighbouring cells it will die.

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Part 3: What is dementia?

Dementia affects over 750,000 people in the UK. It is not a disease in its own right and it is not a natural part of ageing. It is an umbrella term that describes a group of symptoms that are caused by many diseases that affect the brain for example, Alzheimer's disease.

Dementia is caused by loss of nerve cells in the brain. Most dementias are progressive which mean they gradually get worse. This is because when a nerve cell dies it usually cannot be replaced. As more and more nerve cells die the brain starts to shrink.

This is known as brain atrophy which can often be seen in the brain scan of a person with dementia.

Common symptoms of dementia include memory loss, impaired cognition and lack of physical coordination. However their symptoms do depend on the area of the brain that is affected.

For example if cells in the temporal lobe start to die then that person might start to experience difficulties with their language.

Or if someone's occipital lobe is affected this can cause problems with vision.

There is currently no cure for dementia and many of the diseases that cause it are terminal.

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Part 4: Alzheimer's disease

Alzheimer's disease affects over 400,000 people in the UK. It is the most common cause of dementia and it is also the best understood.

Alzheimer's most commonly develops in the hippocampus which is why it is often linked to memory loss.

The hallmark of Alzheimer's disease is the development of amyloid plaques and tau tangles in nerve cells.

Amyloid is produced when a much larger protein, the amyloid precursor protein is broken down. This amyloid then accumulates as plaques on the outside of nerve cells.

Many scientists believe amyloid is toxic and causes cells to die.

The second hallmark of Alzheimer's disease is tangles in a protein called tau. Tau is produced by normal healthy nerve cells however during Alzheimer's disease an abnormal version is caused which doesn't function correctly. It causes tangles within the cells and effectively strangles the cells which then die.

Current treatments for Alzheimer's disease are designed to improve communication between cells. However these treatments can only slow the

progression of the symptoms of the disease. Scientists hope in the future drugs will target amyloid and tau and hopefully stop the disease altogether.

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Part 5: Posterior cortical atrophy

Posterior cortical atrophy or PCA is a specific type of Alzheimer's disease that affects the back of the brain, the occipital lobe. This is the type of Alzheimer's that the author Terry Pratchett has been diagnosed with.

The symptoms of PCA are very specific. Since this part of the brain is responsible for visual processing people with PCA lose the ability to recognise colours and shapes, to recognise faces, they lose the ability to read.

Often the classic symptoms of Alzheimer's disease such as memory loss don't develop till much later on in PCA. This means that PCA is often misdiagnosed or only picked up at the later stages.

It is likely that PCA is actually more common than we think as it is often dismissed as problems with eyesight associated with old age.

Alzheimer's Society funds research into the cause, cure, care and prevention of dementia, including PCA. One of our current research projects is looking into whether a brain scanning technology could be developed to help diagnose PCA.

Part 6: Vascular dementia

Vascular dementia is the second most common type of dementia although it can also occur in combination with Alzheimer's disease in a condition called mixed dementia.

Vascular dementia is associated with problems in the blood supply to the brain. Interruption of the blood supply for example through a blockage or a leak can cause a stroke. A stroke can cause significant damage to the area of the brain that is starved of its blood supply.

Sometimes a single stroke can be enough to cause the symptoms of dementia. In other cases a person may experience a series of smaller strokes over many years that gradually causes damage.

Vascular dementia can also be caused by small vessel disease which is due to damage to the tiny blood vessels deep inside the brain.

Prevention of vascular dementia is closely linked to maintaining a healthy blood supply. People with higher blood pressure are at a much higher risk of dementia.

The risk can be reduced by stopping smoking, maintaining a healthy weight and regular exercise.

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Part 7: Dementia with lewy bodies

Dementia with lewy bodies affects about 4% of people with dementia. It is closely related to Alzheimer's disease and also to Parkinson's disease.

Lewy bodies are tiny spherical deposits of protein that develop inside nerve cells.

They prevent the cells from communicating properly by disrupting the tiny chemical messages between cells. As yet we have no idea why Lewy bodies form.

Lewy body dementia can affect many different parts of the brain leading to many different types of symptoms.

This type of dementia shares many symptoms with Alzheimer's disease however people with lewy body dementia often experience hallucinations or problems with paying attention.

They can frequently experience problems with their movement as well in a similar way to people with Parkinson's disease.

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Part 8: Fronto-temporal dementia

Fronto-temporal dementia covers a range of conditions that affect the frontal and temporal lobes.

People with damage to their frontal lobes will often experience changes in their behaviour for example becoming more disinhibited whereas people with damage to their temporal lobe will often struggle with language.

People who experience damage to both of these areas might experience a mixture of these symptoms. This is a fairly rare form of dementia and it often affects younger people.

Unlike other forms of dementia there maybe a strong family link with fronto-temporal dementia. Scientists have identified some genes that are linked to fronto-temporal dementia but our understanding of them is still limited.

One of the diseases that causes fronto-temporal dementia is Pick's disease. Proteins accumulate inside nerve cells causing dementia. As yet we have no idea why certain parts of the brain are far more vulnerable to this disease than others.

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Part 9: Rarer causes of dementia

There are a number of rarer diseases and conditions that cause dementia. People with Down's syndrome are particularly at risk of developing dementia, and they are more likely to develop Alzheimer's disease early in life.

This is because the gene that has been linked to Alzheimer's disease is found on chromosome 21. People with Down's syndrome have an extra copy of this chromosome and therefore an extra copy of the Alzheimer's gene.

Dementia can also be caused by HIV, Huntingdon's disease, Prion diseases like CJD and also excessive alcohol consumption. The biology of these dementias is still poorly understood and in most cases treatments are very limited.

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