Key Stage 4
Drug discovery

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.

AD mainly affects people over 65, although younger people can develop it.

What causes it?

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.

The amyloid plaques and tau tangles injure neurones (nerve cells) in the brain, leading to a decrease in chemical messengers (neurotransmitters) that are involved in sending impulses between neurones.

Can we cure AD?

Currently there are no drugs to treat the underlying causes of Alzheimer’s disease. However, at the ARUK Oxford Drug Discovery Institute (ARUK ODDI), scientists are collaborating with other laboratories to find new ways to tackle the disease.

Firstly, the ODDI biologists build biological models of AD in the lab, and create ways to test specific properties of the model. The ODDI chemists design and make experimental drugs, which the biologists add to their biological model and run the test. There are many rounds of designing, making and testing, and many molecules fall by the wayside. Slowly they are able to craft and refine the small molecules until a few have the desired effect. Having shown that the approach is likely to succeed, they then hand the small molecules to pharmaceutical companies, who continue refinement and testing to turn the small molecules into a drug. Only the single best small molecule will undergo safety testing and, if it passes, undergo clinical trials with patients.

Your task

A laboratory has come up with a possible treatment for AD.

You should:

- Complete the storyboard to explain what causes AD and how the new drug could help treat it.
- Decide if the drug should undergo further testing.

http://www.oxfordsparks.ox.ac.uk/content/discovering-life-changing-dementia-treatments
1. Complete the storyboard to show what happens in the brain of a person with AD

<table>
<thead>
<tr>
<th>Antibodies</th>
<th>neurone</th>
<th>microglia</th>
<th>beta-amyloid protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta-amyloid clumps together to form plaques. The plaques build up outside of neurones</td>
<td>Plaques interact with neurones, cause toxicity, and prevent them communicating with each other properly</td>
<td>Microglia use phagocytosis to break down protein tangles</td>
<td>Microglia become activated and release chemicals that cause inflammation, which damages neurones further</td>
</tr>
</tbody>
</table>

2. Explain how these changes cause the symptoms of AD.

3. The drug is a monoclonal antibody which binds to the antigens on the beta-amyloid protein. Suggest an idea about how it prevents AD developing.

http://www.oxfordsparks.ox.ac.uk/content/discovering-life-changing-dementia-treatments