At a glance

Alzheimer’s Disease (AD) is the most common cause of dementia. It is a disease that affects the brain, causing the abnormal build-up of proteins, which damage neurones in the brain.

This activity extends students’ understanding of the nervous and immune systems and monoclonal antibodies. It asks them to apply their knowledge to an unfamiliar situation – the mechanism of a new drug for AD.

Learning Outcomes

- Students write economic, social and ethical arguments
- Students draw diagrams to explain what causes AD
- Students apply knowledge to suggest ideas about how a drug works

Each student will need

- Copy of student worksheet page 1
- Copy of student worksheet page 2
- A post-it note or mini whiteboard and pen

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

1. Starter activity
   - Ask the students if they know what dementia is, what the symptoms are. They may have experienced a family member with the disease, so sensitivity is called for here. Discuss the fact that dementia is a collection of symptoms caused by diseases that affect the brain. It is important to point out that it is not an inevitable part of ageing, it caused by disease so could be prevented or treated, but currently there is no cure.
   - Introduce Alzheimer’s disease as one form of dementia. You may wish to play the class a small part of the video that shows a person with AD (see weblinks below). Ask the class to list the symptoms of AD.

2. Main activity: Should we fund AD research?
   - Ask the class: Should we put more money into funding AD research to try and find new treatments? Play devil’s advocate and give three arguments against funding: One economic – it is very expensive; one social – the money could be used to research treatments for other diseases that affect young people; one ethical – animals are used to test the drugs. You may need to explain to the class what each type of argument means.
   - Give each student a post-it note or use mini whiteboards and ask them to write down an argument about why we should fund the research to try and persuade you. They should state if it is an economic, social or ethical argument.
   - Ask students to share their arguments and then take a vote as a class to show if they think the funding should go ahead (hopefully they will vote yes!).
   - Play the animation 'Discovering Life-Changing Dementia Treatments', which outlines the causes of AD and the work going on in Oxford to help discover new treatments.

3. Main activity: How does a new drug work?
   - Give each student a copy of page 1 of the student worksheet and ask them to read through it. This outlines the work being done at Oxford.
   - Discuss the importance of testing new drugs.
   - Give each student a copy of page 2. They complete a storyboard to describe what happens in the brain of someone with AD. They can use the information in the animation, which you may wish to play again, pausing at the useful parts.
   - Ask the students to complete parts 2 and 3 on the worksheet.
   - Note: The precise mechanism that the drug (called Aducanumab) exerts its effects are unknown. Students can use their knowledge about monoclonal antibodies and the immune system to suggest possible ideas. These could be: it prevents the protein forming clumps, it blocks the toxic effects of the protein, it binds to microglial cells to assist with phagocytosis (and this reduces the production of the inflammation response). If your class have not covered monoclonal antibodies, you might want to remove this question, or replace with information.

4. Plenary
   - Ask the class to vote on if they think this drug should undergo further testing. Ask a few students to explain why they think this.
• Reveal that the drug has undergone, and is currently undergoing clinical trials on patients with AD but as yet the results have, unfortunately, not proven that it is the cure we have been looking for. The good news is that new drugs are being developed and tested. Another anti-amyloid antibody is being developed by Biogen. It showed some promising results from Phase I trials, and Biogen is continuing to invest in Phase III trials, which suggests that they have some confidence in it. We won’t know the result of these until 2022.

• Discuss with the students why trials of monoclonal antibody therapeutics on AD patients have failed to show efficacy. One of the major reasons is thought to be the use of full-blown AD patients as trial participants, and we now think that we have to get people in earlier stages of the disease in order to make a difference (at later stages the neuroinflammation is a run-away effect that can’t be stopped by removing amyloid). This brings us to the lack of a good predictive test for AD, we can’t take a person with mild cognitive impairment and say for certain that they are going to develop AD or a different disease (e.g. Dementia with Lewy Bodies, Frontotemporal dementia, vascular dementia).

Weblinks

Oxford Sparks animation:

https://www.youtube.com/watch?v=b9PhQ9yMu8Y

Kids meet a woman with dementia. She talks about her symptoms.

https://www.alzheimers.org.uk/

The website for Alzheimer’s society, which contains information about the disease.