Does dyslexia apply across languages?

Introduction
This activity introduces the suggested links between dyslexia and the functioning of different brain regions. It points out the cultural nature of the diagnosis, both across languages and across time.

Suggested answers to questions

1. Talk about what you understand by the term ‘dyslexia’ and how it affects people.
   Almost all students will have known someone with dyslexia. There may well be someone in the class with such a diagnosis. Allow them to lead the discussion. Dyslexia has many definitions but all include the idea of specific difficulty in reading, despite normal abilities in other areas and adequate teaching. It is now generally believed to relate to the ability to translate printed symbols into the sounds needed to build up words or to the ability to break words down into sounds.

2. Suggest the sequence of brain functions that have to take place in order to make sense of a printed text.
   - Visual recognition of letter shape
   - Association between shape and sound
   - Building up sounds into a word
   - Recalling the meaning of the word

3. How do the brain regions involved in reading illustrate the ideas of:
   a. ‘localisation’
      Localisation: Different parts of the brain carry out different functions. The brain uses the visual cortex in the occipital region then Wernicke’s area to interpret the meaning.
   b. ‘lateralisation’
      The two halves of the brain do not carry out identical functions. Reading is processed by the left side of the brain.

4. What is the essential difference between Chinese and Japanese writing and that used in English?
   - English relies on letters that represent sounds – phonemics.
   - Chinese and Japanese kanji represent objects and concepts – visual

Science explanations

 Kb Within the cortex different regions process signals from different parts of the body and process specific types of input. Several brain regions will be actively involved in any thought process.

 Lb There are controlled processes by which the information coded in a gene is converted into the chemicals in the cell. This is gene expression. Expression of any particular gene is controlled by other genes called gene regulators. Gene regulators switch a gene on or off in response to specific input from the internal or external environment.

 Ld Many factors influence which particular genes are expressed at any point in time. These include: stages in development, where in the body the cell is, epigenetic inheritance, the action of other genes, and direct influences from the internal and external environment.
5 From the information provided, what is the evidence that dyslexia may have a genetic component? Does it suggest that dyslexia is brought about only by genetics? Explain your answer.

There are fewer neurones in the key regions (e.g. in the parietal region for English speakers). The case study of A.S. demonstrates that there is likely to be some sort of genetic contribution to his dyslexia since he can read very well using Japanese kanji but struggles to read English, his first language. If he was having difficulty in both languages it could be inferred that other factors were impeding his education and intellectual development.

It is not clear whether A.S.’s dyslexia is brought about only by his genes, since he may have suffered damage to key areas of his brain through viral infection or physical trauma during his development. Equally since his experience is very unusual, we do not have sufficiently large enough samples sizes to draw any comprehensive conclusions.

Genetics is not destiny. Even if an individual has a genetic sequence associated with poor reading ability, it does not necessarily mean that they will be a poor reader. The genetic variations act only as risk factors in a complex interplay with the environment.

6 Reading is not a ‘natural’ skill and is therefore does not have a localised brain region. However, the ability to read does seem to rely on making use of two or more regions of the brain.

a Describe what you understand by the phrase ‘dyslexia is not a natural skill’.

Humans have evolved over millions of years. Reading has been common amongst humans for a hundred years in the UK. The ability to read would not have been acted on by natural selection.

b Describe another aspect of our lives that is not a ‘natural skill’ but nevertheless, draws on specific natural skills.

Driving a car relies on visual attention, perception, memory, motor coordination and other natural skills, but of course, is not a natural skill itself.

7 In most Western countries reading has only been widespread for about one hundred years - so it could be argued that when reading was not an important part of people’s lives, dyslexia did not exist as a ‘condition’. This
is why some people say that dyslexia is an example of 'medicalisation' of what was once normal.

a Explain what is meant by 'medicalisation'.

Medicalisation is a term given to the tendency to identify and name a medical condition for a variation in skill or behaviour that was previously considered as normal. It is often associated with the creation of a treatment and actively supported by the pharmaceutical industry. The rapid increase in the number of defined psychiatric disorders, including ADHD, provides examples.

b Discuss whether you think the emergence of dyslexia is an example of 'medicalisation'.

Reading is an essential part of functioning in a modern society in a way that it was not in past times. Thus the normal variation which might have been irrelevant is now seen as, and in fact is, a disability in our culture. The condition has become seen as a medical condition because of the culture.

8 Use all of the answers you have generated to produce present to the rest of the class your response to the question: Is dyslexia a result of nature or nurture?

Points that might be made are:

There is a genetic basis

Diagnosis depends on the culture, including which language you speak and how important reading skills are.
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Introduction
This activity uses dyslexia as an example of some Nature Nurture issues. You will consider possible explanations of dyslexia and discuss what we can learn about why normal differences become ‘medicalised’.

Reading
The human brain is dominated by the cerebral hemispheres (also known as the cerebrum). Each hemisphere is then divided into four structural lobes, Frontal, Parietal, Temporal and Occipital; see textbook Figure 3.6 page 70. You will learn more about these different regions of the brain in Topic 3.

When we look at a brain, it appears that both halves are very similar. They may look similar but different functions take place in different regions. Two of the regions associated with speech, Broca’s (speech production) and Wernicke’s areas (speech comprehension) are respectively located in the frontal lobe and bordering the temporal and parietal lobes – but in the left hemispheres only; see textbook Figure 3.11 on page 73.

Dedicating a small area of the brain to a function is called ‘localisation’. The dominance of one hemisphere over another is known as ‘lateralisation’.

1 Talk about what you understand by the term ‘dyslexia’ and how it affects people.

2 Suggest the sequence of brain functions that have to take place in order to make sense of a printed text.
Some people who have dyslexia have been shown to have reduced brain activity in the region of the brain between Wernicke’s and Broca’s areas – known as the insula - when compared with people who do not have reading difficulties.

However, there is some evidence to suggest that dyslexia may be different for people in different cultures. English-speakers and Chinese-speakers appear to use different parts of the brain to convert written ‘words’ into sounds. Chinese relies on complex images representing entire words, while English word depiction is more about rules than pattern recognition and memory. Chinese people with dyslexia have been shown to have fewer neurones in an area of the brain important for identifying images and shapes. Those dyslexic in English have fewer neurones in the left parietal region, which has a major role in converting letters into sound.

Japanese writing, known as kanji has its origins in Chinese pictorial representation. In 1996 Wydell and Butterworth published a case study about a 17-year old boy, known as A.S., who had English-speaking parents and spoke English as his first language. A.S. had been to Japanese school from the age of six. By the age of 13 he was classified as being dyslexic in English, but not in Japanese. He could read university texts written in Japanese from a young age, but was behind his classmates in reading English – despite it being the language he spoke at home.

Questions
Working in small groups, discuss the following questions:

3 How do the brain regions involved in reading illustrate the ideas of
   a ‘localisation’ and
   b ‘lateralisation’?

4 What is the essential difference between Chinese or Japanese writing and that used in English?

5 From the information provided, what is the evidence that dyslexia may have a genetic component? Does it suggest that dyslexia is brought about only by genetics? Explain your answer

6 Reading is not a ‘natural’ skill and therefore the brain does not have a localised region for reading. However, the ability to read does seem to rely on making use of two or more regions of the brain.
   a Describe what you understand by the phrase ‘reading is not a natural skill’.
**b** Describe another aspect of our lives that is not a 'natural skill' but nevertheless, draws on specific natural skills.

7 In most Western countries reading has only been widespread for about one hundred years - so it could be argued that when reading was not an important part of people's lives, dyslexia did not exist as a 'condition'. This is why some people say that dyslexia is an example of 'medicalisation' of what was once normal.

a Explain what is meant by 'medicalisation'.

b Discuss whether you think the emergence of dyslexia is an example of 'medicalisation'.

8 Use all of the answers you have generated to present to the rest of the class your response to the question: *Is dyslexia a result of nature or nurture?*