

2.7

Discuss the use of brain-imaging technologies in investigating the relationship between biological factors and behaviour

- Brain-imaging techniques are used in neuroscience to investigate the relationship between behaviour and brain structures, for example after brain damage or to find out which areas of the brain are involved in which cognitive activities (cognitive neuroscience).

- Brain-imaging technology is a promising way to investigate the possible relationship between biological factors and behaviour, but so far scanning can merely register structures and activity in the brain. It is not possible to determine cause-effect relationships at this point.

MRI scan: magnetic resonance imaging

MRI scans can give detailed pictures of internal structures in the body. The body consists, to a large extent, of water molecules. In the MRI scanner a radio frequency transmitter is turned on and it produces an electromagnetic field.

Strengths of MRI	Limitations of MRI
<ul style="list-style-type: none"> MRI scans are particularly useful to show how the blood flows in the brain and can be used to identify problems with blood circulation. They can be used for the early detection of Alzheimers' disease. They are safe to use since no radioactive material is used. 	<ul style="list-style-type: none"> They are very expensive. Movement may affect the pictures. They cannot say anything about cause-effect relationships.

Ashtari et al (2009) used MRI to investigate whether substance abuse (marijuana) can damage the developing brain in adolescents and young adults.

- The researchers scanned the brains of 14 young men with a history of heavy marijuana abuse over a long period. The control group consisted of 14 young men who had not used marijuana.
- The results of the scan indicated that there were brain abnormalities in the frontal, parietal and temporal regions of the brains of the marijuana users. The development of white matter (myelin) was affected and this could explain slow information processing in the brain.
- The researchers concluded that early marijuana use can affect brain development negatively but since the study gave correlational data more research is needed.

fMRI scan: functional magnetic resonance imaging

The fMRI scanner measures changes in blood flow in the active brain. This is associated with use of oxygen and linked to neural activity during information processing. When participants are asked to perform a task, the scientists can observe the part of the brain that corresponds to that function. fMRI scanning is widely used by cognitive neuroscientists and other researchers and its use has increased enormously over the last 10 years.

Strengths of fMRI	Limitations of fMRI
<ul style="list-style-type: none"> It does not use radioactive substances. It can record activity in all regions of the brain. 	<ul style="list-style-type: none"> The focus is mostly on localized functioning in the brain and does not take into account the distributed nature of processing in neural networks. The results are correlational so it is not possible to establish cause-effect relationships.

Harris and Fiske (2006) used fMRI scans to study students' brain processes as a response to being presented with pictures of extreme outgroups. This study in social cognition aimed to find the biological correlates of stereotypes and prejudice.

- The researchers scanned students while they were watching either pictures of different humans or objects. It was predicted that the medial prefrontal cortex would be active when participants looked at humans but not when they looked at objects.

- This was found except when participants looked at pictures of people from extreme outgroups such as the homeless and addicts. Brain regions related to 'disgust' were activated and there was no activity in the prefrontal cortex.
- The researchers concluded that this indicated a dehumanization of the outgroups. These groups were apparently viewed as 'disgusting objects' and not people.

2 Biological level of analysis

General issues in brain imaging to consider in a discussion

- Brain imaging is mainly about mapping brain structures and activity in the brain.
- Another limitation deals with localization of function. It may be possible to identify brain structures that are active during a task but, since most structures are linked to other structures in networks, it is not possible at this point to say definitely where things happen in the brain.

Exam Tip

If you are asked discuss the use of brain-imaging technologies you need to include at least two examples. If you are asked to discuss one, then don't mention more than one since you will receive no credit for mentioning more.

You can address "how and why specific technologies are used" and "strengths/limitations of using them" including research studies to support your argument. Although brain imaging is exciting as it offers a view into the living brain, it is still too soon to conclude anything definite about which areas are involved in what cognitive processes. The human brain is very complex and, at this point, brain imaging is perhaps best used in diagnosis of brain abnormalities.

2.8

With reference to relevant research studies, discuss the extent to which genetic inheritance influences human behaviour

Gene mapping

Attempt to determine the effect of a particular gene on behaviour such as psychological traits (temperament), psychological disorders (e.g. depression or schizophrenia) or various physiological conditions.

Caspi et al. (2003) Longitudinal study on the possible role of the 5-HTT gene in depression after experiences of stressful events

- The 5-HTT gene influences the level of serotonin, which is known to play a role in controlling mood.
- The researchers compared participants with a normal 5-HTT gene and a mutation of the 5-HTT gene with shorter alleles. Both types are quite frequent in humans but the long allele is slightly more frequent (57%).
- The researchers found that participants who carried a mutation of the 5-HTT gene and who had experienced many stressful events were more likely to become depressed after stressful events than those participants who carried the normal 5-HTT gene.
- The 5-HTT gene could indicate a vulnerability to depression after stress and the researchers speculated whether the gene could moderate individual responses to environmental factors.

Evaluation

- Since a large proportion of the population carries the mutation of the 5-HTT gene that makes them susceptible to depression after traumatic events, it can be difficult to conclude that the gene is a major contribution to depression. People who did not carry the mutation also became depressed.
- The study showed a correlation between the presence of a 5-HTT short allele and depression but it is not possible to establish a cause-effect relationship.
- Genes contribute to some extent to behavioural traits and disorders but it is not clear how environmental factors influence genes. Environmental factors were included in the study (stressful events) but there is no evidence against the idea that it could be the stressful events (environmental factors) that made people depressed.
- Much more research is needed before a clear relationship between a gene and a behavioural trait can be established..

You could also use this study in unit 5.5 to discuss etiologies of abnormal behaviour. In this case a possible explanation of depression which could relate to the diathesis-stress model.