The biological approach

Chapter 9

9.1 Introduction

The biological approach is concerned with how our genetic inheritance, evolution of the human species and the nervous system (both central and peripheral) affect how we think, feel and behave. The biological approach, because of the influence of Darwin's theory of evolution and the idea of the 'survival of the fittest', looks at how well a person adapts and adjusts in life. An inability to adapt or adjust to the ups and downs of everyday life may result in a person suffering from psychological disorders such as schizophrenia or depression, or being aggressive towards other people. The biological approach seeks to discover how the genes we inherit from our parents may have a role to play in these and other types of maladaptive behaviours.

The biological approach is also concerned with understanding how our central and peripheral nervous systems, particularly the brain, affect how we think, feel and behave. Questions arise within the biological approach, such as how the brain, a physical organ, can produce the psychological experience of awareness of things around us and consciousness. These are matters that physiological psychologists find difficult to answer.

The biological approach also raises the issue of the relative contribution of nature (genetics, evolution, etc.) and nurture (experiences since birth) to mental abilities such as intelligence, and actual behaviours (such as schizophrenia and aggression). This is commonly called the **nature/nurture debate** or the debate about the relative contribution of heredity and environment (see Chapter 16).

A recent development in biological psychology is called **evolutionary psychology**, which is defined as follows:

> Evolutionary psychology is the study of the evolutionary origin of human behaviour patterns... that may influence everything from sexual attraction, infidelity and jealousy to divorce. (Coon, 2002: 519).

One area that has been extensively researched within the biological/evolutionary approach is that of human mating or sexual preferences. Buss (1994) studied attitudes and behaviours of men and women across 37 different cultures towards sexual behaviour. Buss found, for example, that compared to women, men are more interested in casual sex, prefer a younger partner and get more jealous over sexual infidelity on the part of the woman. By contrast, women prefer older partners, are less upset by sexual infidelity but more upset by a man becoming emotionally involved with another woman. Buss attributes these differences to mating preferences that have evolved in response to the reproductive demands placed on men and women. Generally, women are more involved in nurturing offspring and men in providing for the family, although this traditional pattern has changed dramatically in westernised societies. Evolutionary theory explains the male concern with sexual infidelity by the female partner as being related to concern over the paternity of offspring.

Evolutionary psychology presents and, to some extent, justifies a traditional male and female role in the family. It has to be noted that other explanations of the findings of Buss (1994) are possible – for example, that, generally speaking, the male controls money and resources.

In this chapter we look further into the biological approach in psychology. First we will consider the basic assumptions of the biological approach which we came across in AS psychology (see Chapter 1, pages 5–9 of

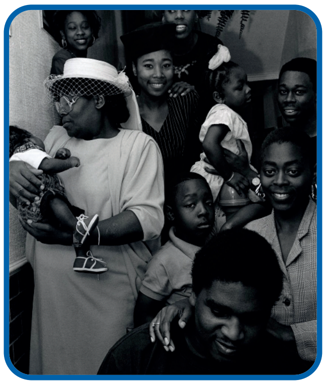

Figure 9.1 *The genes that are passed down from generation to generation play an important part in human behaviour.*

AQA(B) Psychology for AS by Pennington and McLoughlin, 2008). We will then look at the role of the central and autonomic nervous systems in behaviour, and the genetic basis of behaviour. In doing this we will build on Chapter 2, Biopsychology, of *AQA(B) Psychology for AS* by Pennington and McLoughlin. So it would be a good idea to refresh your memory and read that chapter now.

9.2 Assumptions of the biological approach

The biological approach has five main assumptions, as follows:

- Human behaviour is strongly determined by our genes and our genetic inheritance. Non-human animal behaviour is almost totally determined by genes.
- The central nervous system, especially the brain, plays an essential role in thought and behaviour. To explain human thought and behaviour, it is necessary to understand the functions and structure of the brain and the nervous system more generally.
- Chemical processes in the brain are responsible for many different aspects of psychological functioning. An imbalance of certain chemicals in the brain may cause abnormal behaviour and thought – for example, bipolar mood disorder (see Chapter 5).
- Humans and other animals have evolved biologically through Darwinian evolution. This means that animals 'high' on the evolutionary tree, such as monkeys and apes, are similar genetically to humans.
- Evolution has taken place over millions of years, and the 'flight-or-fight-response' is common across the animal kingdom and is important to understanding how humans react in threatening situations.

The biological approach in psychology uses highly scientific methods of research. Techniques such as single-cell recording of neuronal activity and scanning techniques using PET scanners are used to understand the activity of neurons in the central nervous system. The biological approach makes use of the natural occurrence of identical and fraternal twins to help determine the extent to which psychological characteristics, such as personality and intelligence, have a genetic basis. Case studies on people with brain damage are used to help understand the role of different parts of the brain in personality, higher thought processes and intelligence.

The most common methods of investigation used by the biological approach are:

- Laboratory experiments on both humans and other animals. Ethical guidelines strongly determine what can and cannot be done to humans and other animals. Testing animals for drugs and removing a part of the brain to see how behaviour is affected are common techniques.
- Observation of behaviour under strict laboratory conditions is used to investigate, for example, human sleep patterns and aggressive behaviours in animals.
- Studies of identical twins (who share exactly the same genetic make-up) brought up together or reared apart are used to help determine the contribution of genes to psychological characteristics.

Figure 9.2 *Animals are commonly used in laboratory experiments to help understand the function of different parts of the brain.*

9.3 The role of the central and autonomic nervous systems in human behaviour

In Chapter 2 of *AQA(B) for AS Psychology* by Pennington and McLoughlin (2008), we looked at the divisions of the nervous system (see Figure 9.3), localisation of function in the brain and the basic function of the autonomic nervous system. In what follows we will look in a little more detail at the role of each of these parts of the nervous system in human behaviour.

9.3.1 The central nervous system

(a) The cerebral cortex

The cerebral cortex is the most highly developed part of the brain in humans compared to other animals. In evolutionary terms, the cerebral cortex is the most recent structure of the central nervous system and is associated with higher mental functioning. This includes conscious awareness, personality, problem solving and creative thinking (intelligence in its widest sense). Fish and amphibians have no cerebral cortex. Reptiles and birds have only a very basic cerebral cortex. As you go up the evolutionary tree, the amount of cortex in comparison to the total size of the brain increases.

The cortex is divided into four different lobes, as shown in Figure 9.4. These are called the frontal, parietal, occipital and temporal lobes. Each of the lobes has different functions, as follows:

- **Occipital lobe** is primarily to do with the function of vision and is often referred to as the visual cortex.
- **Temporal lobe** is primarily to do with the function of hearing and is often referred to as the auditory cortex.
- **Parietal lobe** processes sensations from the skin and different muscles throughout the body.
- **Frontal lobe** is concerned with higher thought processes such as reasoning and abstract thinking.

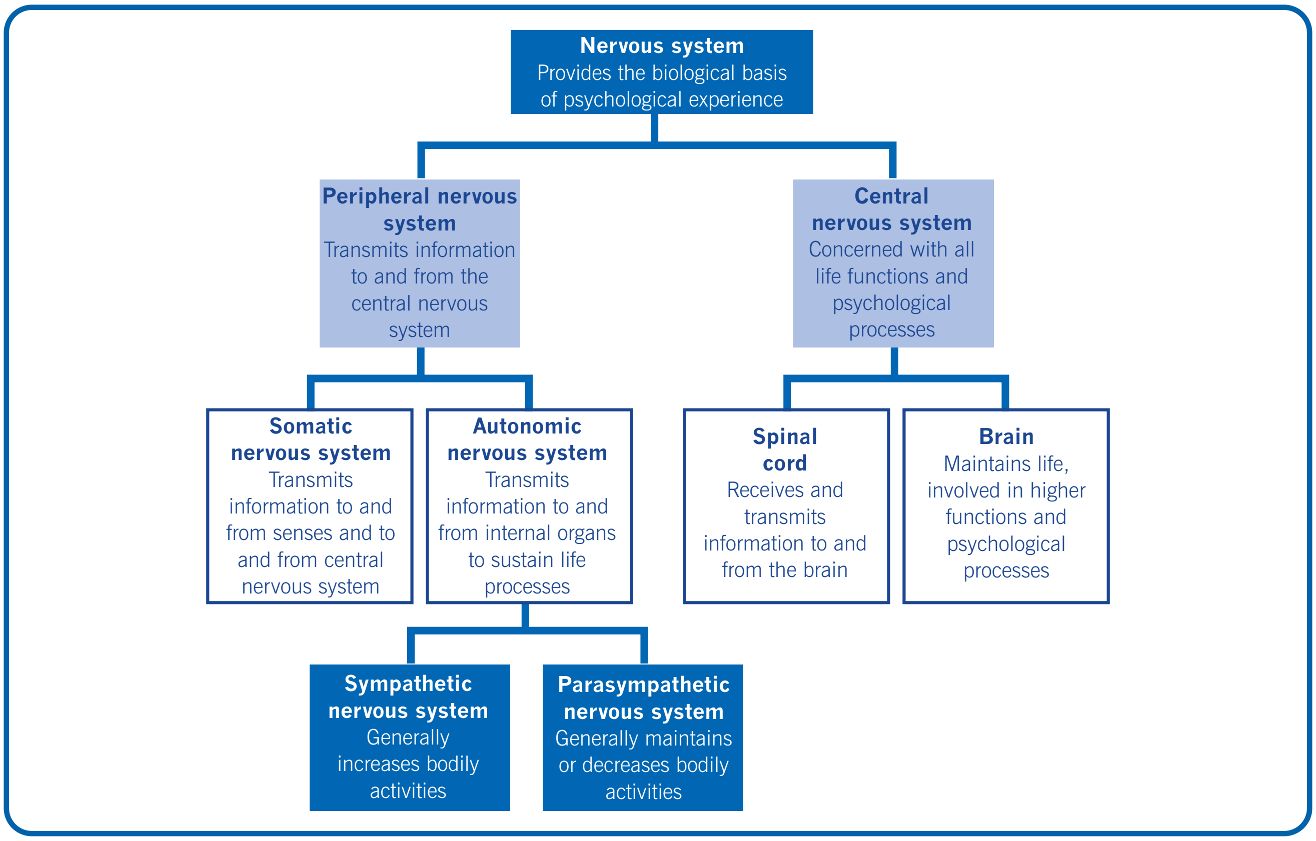

Figure 9.3 *Divisions of the nervous system, with an indication of the basic functions of each division.*

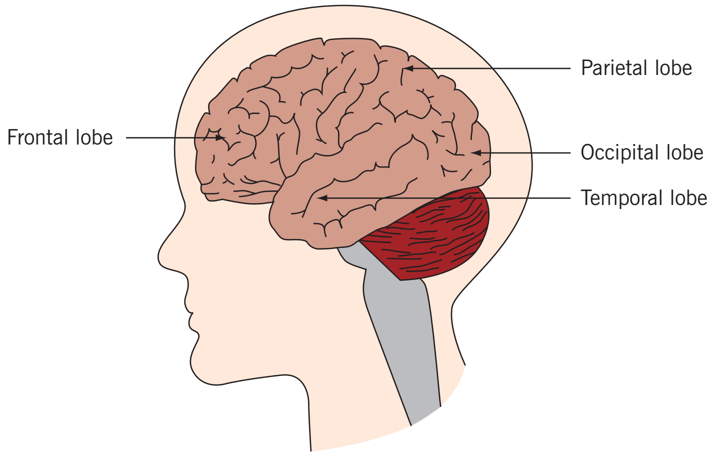

Figure 9.4 *The four main lobes of the cerebral cortex: frontal, parietal, occipital and temporal lobes of the brain.*

Each of these lobes has specific parts which are specialised for different functions, as identified above. Each of these lobes of the cortex can be divided into two areas, as follows:

1 **Primary areas.** These process incoming sensory information from our different senses. The occipital or visual cortex receives information from our eyes, and the temporal or auditory cortex receives information from our ears. The primary areas in each lobe also control motor functions to do with the senses. For example, the muscles of each eye are controlled by the visual cortex. The basic organisation of the primary areas in humans is very similar to that of other animals, such as the rat. This indicates that these areas are old in evolutionary terms.

2 **Association areas.** These areas are involved in complex mental processes and complex behaviours. The association areas are involved in perception, memory, language, creative thinking and planned behaviour. The association areas make use of information from the different senses for higher mental functions and complex behaviour. The higher up the evolutionary tree, the greater the proportion of association areas in the cerebral cortex. This is shown in Figure 9.5.

Damage to the visual and auditory cortex will usually result in a person being blind or deaf. If there is damage to the parietal lobe, the person will be clumsy and unco-ordinated in their movements. Significant damage to the whole cerebral cortex would reduce complex human behaviour to nothing more than primitive reflexes, similar to creatures at the bottom of the evolutionary tree.

The frontal lobes of the cortex are the parts of the brain that set humans apart from other animals. The frontal lobes can be divided into three main areas:

Motor cortex: This controls fine movement of the hands, feet, tongue and face. The motor cortex is responsible for voluntary behaviour – for example, lifting your arm or walking.

Sensory cortex: This receives sensory information from the nerve endings in different parts of the body.

Prefrontal cortex: This receives information from all the senses and different parts of the body. It is involved in the highest mental functions and complex, planned behaviours.

Both the motor cortex and the sensory cortex are organised to reflect the density of neurons in different parts of the body. For example, the lips and fingertips are highly sensitive parts of the body and each of these areas of the body has a high density of neurons. In the two cortexes, the lips and fingertips have a great deal of space devoted to them. By contrast, the upper legs, trunk and upper arms of the body have relatively low density of neurons and have only a little space devoted to them in the motor and sensory cortexes.

Damage to the frontal lobes can cause a range of different deficits. These include memory loss, loss of fine

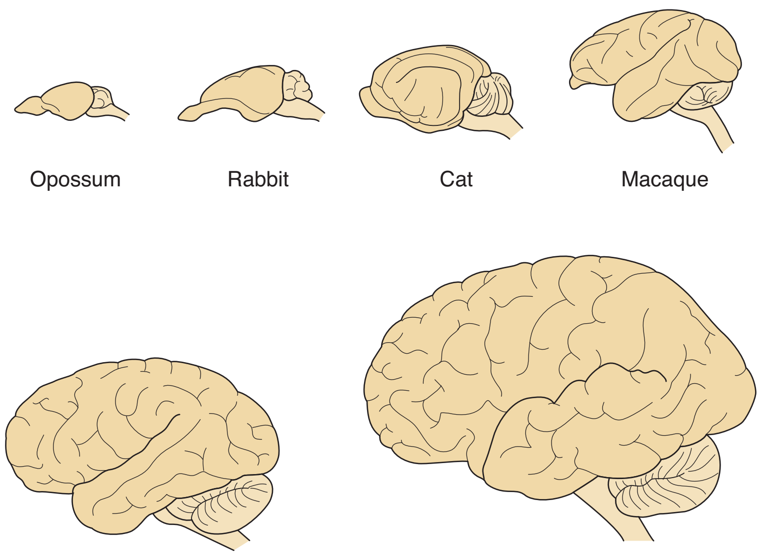

Figure 9.5 *The amount of association areas in the cortex increases the higher up the evolutionary tree of the animal. Humans have the greatest amount of association areas of all animals in their cerebral cortex.*

movement, personality change, inability to focus attention and inability to coordinate complex sequences of behaviour – for example, working at a computer.

(b) Limbic system

The limbic system is deep in the brain and is a set of structures that are around the top of the brainstem. The limbic system in humans is involved in emotions, motivation, learning and memory. It has also been identified as being involved in eating and sexual behaviour. This makes the limbic system fundamental to what we feel, think and do. The limbic system is made up of three main structures, called the septal area, amygdala and hippocampus.

The **amygdala** is involved in emotions, especially the attachment of emotional importance to events. For example, the amygdala is responsible for causing someone to cry when they see a picture or part of a film that has deep emotional significance for them. The amygdala is also involved in making us feel afraid or fearful. It is also involved in recognising that someone else is fearful or afraid. Morris *et al.* (1996) put people in a PET scanner and showed them pictures of fearful, happy and neutral faces of other people. They found from the PET scan that the amygdala showed high levels of neural activity when fearful faces were shown to the person. This may have an evolutionary explanation: recognition of fear in others may help to identify a dangerous situation early. The person can then respond appropriately by flight or fight. The advantage of being able to do this is that the person does not need to be in the dangerous situation themselves.

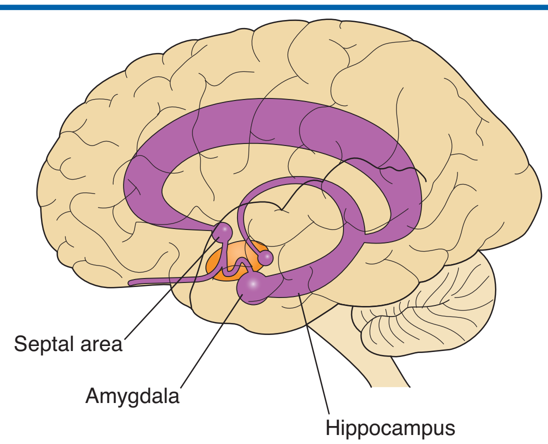

Figure 9.6 *The limbic system of the brain, consisting of the septal area, amygdala and hippocampus.*

The **hippocampus** is involved in memory. In particular, it seems that it is specifically involved in recent

Figure 9.7 *Identifying fear in another person may help with survival.*

memories. People who have suffered damage to the hippocampus lose recent memories, whilst older memories are retained. The hippocampus has two main roles to do with memory:

- a temporary store for information immediately following an experience or event
- feeding recent memories to the prefrontal cortex for retention in long-term memory.

The **septal area** is important for motivation and the experience of pleasure. Milner (1991) showed that rats with electrodes implanted in the septal area would cross an electrified grid to get stimulation of the septal area through the electrodes – that is, the rats would put up with a lot of pain to get the septal area stimulated.

In terms of human behaviour, the limbic system seems to be involved in many of the defining features of what we regard as being human. These are to do with higher-level memories, the attachment of emotion to memories and feelings of pleasure and sexual satisfaction.

9.3.2 The autonomic nervous system

The autonomic nervous system is responsible for sending information to and receiving information from organs responsible for vital bodily functions such as the basic life processes of breathing and digestion. It would help if you refreshed your knowledge of the autonomic nervous system by reading Chapter 2, pages 53–5, of *AQA(B) Psychology for AS* by Pennington and McLoughlin (2008).

The autonomic nervous system is made up of two parts:

- The **sympathetic nervous system**: This prepares the person to deal with danger and threats in the external world. It does this by preparing the body for the flight- or fight-response to threat. In doing this the parasympathetic nervous system stops digestion, directs more blood to muscles, increases heart rate, dilates the pupils and causes the hairs on the body to stand on end.
- The **parasympathetic nervous system** supports normal and routine body functions. It does this by conserving energy expenditure, regulating heart rate, controlling blood sugar levels and secreting saliva. When danger has passed, the parasympathetic nervous system takes control and brings body functions back to normal.

The sympathetic and parasympathetic systems are often regarded as working in opposition to each other. However, a better way to see the interaction of the two systems is as balancing the bodily functions of the person so that the person is responding appropriately to what is going on in their immediate environment.

(a) The autonomic nervous system and stress

Stress can be seen as both a psychological and a biological response by the individual to difficult and demanding external pressures in life. External pressures or dangerous situations trigger a flight-or fight response from the sympathetic nervous system. The sympathetic nervous system also triggers the release of noradrenalin and adrenalin from glands in the body. This helps with the flight-or fight response by making more energy available to the person.

Stress is to do with the perception the person has of a situation and how able they deal successfully with the situation. The life events recognised as being most stressful for a person are death of spouse, divorce and loss of employment (Holmes and Rahe, 1967). Selye (1976) identified three stages in the physiology of stress that he called the **general adaptation syndrome**. He conducted a range of experiments on rats where they were exposed to different stressful situations – for example, fatigue and extreme cold. He found that the body responds to stress in three stages if the stressful situation is maintained.

1 **Alarm stage.** This is the body's initial response to the stress which has been described above, in relation to an external threat or dangerous situation. The sympathetic nervous system prepares the body for flight or fight. Blood pressure rises, heart rate increases,

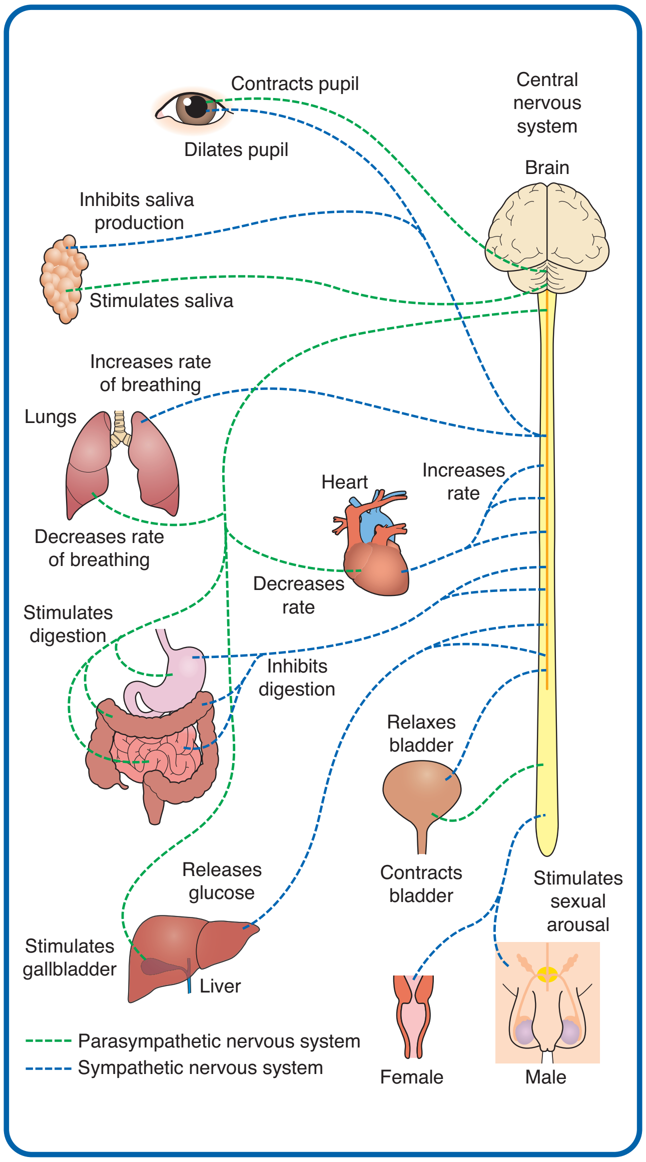

Figure 9.8 *The actions of the sympathetic and parasympathetic nervous systems.*

breathing gets faster, blood sugar levels rise. This high state of readiness of the body uses up a lot of energy and if continued for a long time would be dangerous for the person – for example, prolonged high blood pressure may have a negative effect on the heart.

2 **Resistance stage.** The alarm stage cannot continue for too long and the parasympathetic nervous system kicks in and returns some bodily functions to normal. However, the external stress has not gone away. The body still has high levels of adrenalin, high heart rate and so on, but the body is adapting to being like this over a prolonged period. The body is now susceptible to illness such as influenza and colds.

3 **Fatigue stage.** If the resistance stage lasts for a long period, the body becomes exhausted from being in a permanent state of alertness. The body defences are weakened and the person becomes vulnerable to serious illness such as a heart attack.

For the parasympathetic nervous system to return bodily function to normal, the perceived threat or stressor needs to be removed or the perception of the situation being stressful changed for the person. Only then can the person escape from general adaptation syndrome.

For more on the physiological and psychological aspects of stress, see Chapter 6 of this book.

(b) The autonomic nervous system and emotion

There are three important theories of emotion. These are the James-Lange theory, the Cannon-Bard theory, and Schachter and Singer's (1962) cognitive theory. Each of these is based on the experience of the individual of the action of the sympathetic nervous system. Here we will consider just the Schachter and Singer theory.

The Schachter and Singer theory proposes a two-factor theory of emotion. Here specific bodily sensations, caused by the action of the sympathetic nervous system, result from external situations that cause a general level of physiological arousal. The body sensations are, typically, increased heart rate, flushing, tremor and rapid breathing. These sensations have to be interpreted according to social and environmental factors and the general context in which the sensations occur. This allows the person to identify what emotion is being experienced – for example, fear or happiness. This is shown in Figure 9.9.

The Schachter and Singer theory implies that it is the context that determines the specific emotion and not bodily sensations. In effect, all emotions have similar bodily sensations.

9.4 The genetic basis of behaviour

The key concepts needed for an understanding of how genetics may influence behaviour are as follows:

- genetics and heredity
- genes and chromosomes
- genotype and phenotype.

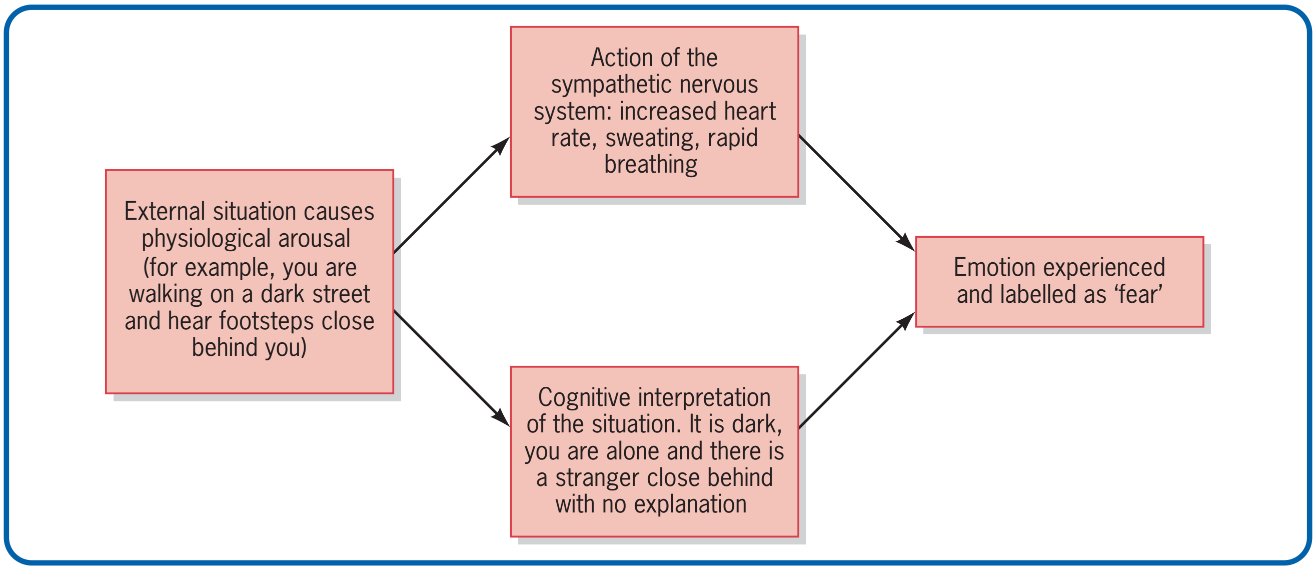

Figure 9.9 *The Schachter and Singer cognitive theory of emotion.*

Researchers rely on the use of the naturally occurring phenomenon of monozygotic and dizygotic twins to investigate heritability of behaviour and psychological characteristics. Of special interest is when identical twins are reared apart and how similar they are with respect to, for example, intelligence, personality and concordance for schizophrenia. Adoption studies are also used to help determine the extent to which characteristics and behaviours are most similar to natural or adopted parents. It would be useful to read Chapter 2, pages 57–67, of *AQA(B) Psychology for AS* by Pennington and McLoughlin (2008) at this point.

In what follows we will look at different areas of psychology and the extent to which behaviour may be genetically determined.

9.4.1 Anxiety, obesity and homosexuality

Anxiety

Anxiety disorders such as panic attacks, phobias and obsessive-compulsive disorder are thought to have a genetic basis (Kendler *et al*., 1992). Some people are thought to have a genetic predisposition for developing an anxiety disorder. However, this will not usually happen unless there are trigger events in the environment. The chemical that has been identified as genetically determined is the neurotransmitter norepinephrine. A high level of neural activity in the amygdala is also associated with anxiety (Shin *et al*., 1997). It is generally accepted that stressful life events are an essential component for triggering an anxiety attack. However, some people may be prone to developing an anxiety disorder as a result of their genetic make-up. A biological basis to anxiety does not seem to have a single-gene explanation, but a contribution from a number of genes (Plomin *et al*., 1997) – see the study described on the next page.

A study has shown that there may be a biological link between smoking when a teenager and an increased risk of developing an anxiety disorder as an adult (Johnson *et al*., 2000).

The reason that this research is mentioned here is that it is thought there is a biological mechanism linking smoking and anxiety. It has been suggested that high levels of nicotine from smoking may sensitise certain areas of the brain and increase vulnerability for anxiety.

Obesity

Twin studies have clearly demonstrated that both body weight and the amount of fat in the body have a strong genetic basis (Allison *et al*., 1994). For monozygotic twins, the correlation for body fat is around 0.80; in contrast the correlation for dizygotic twins is low at about 0.40. Obesity is thought to be highly heritable, with a correlation for identical twins of about 0.70 (Borjeson, 1976).

In the case of obesity, there are two main biological components, as follows:

STUDY

Aim

Johnson *et al.* (2000) conducted a study to investigate the link between teenage smoking and anxiety in adulthood.

Method

A longitudinal study followed 700 teenagers through to adulthood. The number of cigarettes smoked a day as a teenager was recorded. As adults, the incidence of anxiety disorders was recorded.

Results

It was found that teenagers who smoked more than 20 cigarettes a day were 15 times more likely to have panic attacks as an adult. Such smokers were also five times more likely to have a general anxiety disorder as an adult.

Conclusions

Smoking as a teenager may cause anxiety disorders as an adult.

- The number of fat cells in the body. People who are obese have more fat cells than people who are about the right weight for their size.
- The body settles at a constant weight as an adult. This is regulated by a small but important area in the brain called the hypothalamus.

The number of fat cells in the body is genetically determined, as is the natural weight that the adult tends towards, which is regulated by the hypothalamus. This means that someone who wishes to lose a lot of weight when slightly overweight, which is also their 'natural weight', will find it very hard indeed! By contrast, someone who is overweight and over their 'natural weight' will find it relatively easy to lose weight. The ease with which someone can lose weight through dieting may also have a genetic basis.

Homosexuality

Evidence has been put forward to show that homosexuality among males may have a genetic basis. Buhrich *et al.* (1991) found that relatives of homosexual males showed a higher incidence for homosexuality than in the general population. Bailey *et al.* (1993) investigated homosexuality in twins. These researchers found that concordance rates for monozygotic twins was about 50%, compared with a concordance rate of about 20% for dizygotic twins. However, environmental factors play at least an equally important role in determining the sexual orientation of an individual. Given that concordance rates for monozygotic twins is just 50%, this means that half of the twins in Bailey's study were not both homosexual.

9.4.2 Chromosome anomalies

Individual genes are located on chromosomes in the nucleus of each cell in our body. For humans there are normally 23 pairs of chromosomes, where one of each pair comes from each parent. When the egg is fertilised by the sperm cell, 23 single chromosomes from the egg and 23 single chromosomes from the sperm come together to produce 23 pairs of chromosomes. Occasionally something happens to cause an abnormal number of chromosomes. When this happens most cases do not survive. However, some chromosome anomalies are viable in terms of life. Here we will look briefly at just three such anomalies: Down's syndrome, Turner's syndrome and Huntington's chorea.

Down's syndrome

Down's syndrome is a consequence of an extra chromosome on chromosome 21; this is known as trisomy. The extra chromosome usually comes from the mother's side. Generally, this syndrome affects about 1 in 700 children and occurs more frequently in women who get pregnant later in life. People with Down's syndrome have recognisable facial features and are of short stature. They often have heart defects, susceptibility to respiratory infections and have learning difficulties. Down's syndrome results in a wide range of physical and mental ability. With mental ability the range is from near normal mental functioning to quite extreme learning difficulties. Some people with Down's syndrome are able to live independently and have employment; others need constant nursing attention and cannot live without such continuous care.

Turner's syndrome

Turner's syndrome is an anomaly to do with the sex chromosomes. The normal female has two X chromosomes and the normal male an X and a Y chromosome. Turner's syndrome is where the female has only a single X chromosome. Women with this chromosome anomaly are usually sterile, and have other physical anomalies. Mental functioning is not affected generally, although some cognitive deficits have been identified. These include deficits in spatial ability and numerical ability.

Figure 9.10 *Chromosome make-up of Turner's syndrome showing the single X chromosome instead of the normal XX chromosomes of the female.*

Huntington's chorea

Huntington's chorea is a disorder in which sufferers have severe memory impairment, personality change (both emotional and intellectual) and show uncontrollable body movements. The word 'chorea' means 'dance', and the body movements, particularly the arms and legs, resemble a bizarre type of whole-body dance. It is a rare disease affecting just 1 person in 10,000 and is more common in white people of European origin. The disorder is caused by an abnormal gene located on chromosome 4. This genetic defect causes certain areas in the brain, including the cerebral cortex, to degenerate more quickly than normal. The disorder can start early, or late in life. The faulty gene can be inherited from either the mother or the father, depending on who is the carrier for the gene. The chance of inheriting the disorder is about 50% if one of the parents has the disease.

9.4.3 Genetic engineering

Science has advanced enormously over the past 10 years with respect to understanding the structure and functions of genes. **Genetic engineering** is concerned with changing physical, behavioural or psychological characteristics by changing genes. The oldest means of manipulating genetic characteristics is through selective breeding. This has been practised for hundreds of years with the breeding of, for example, race horses and domestic dogs. Selective breeding is a bit of a hit-and-miss affair, since little or no understanding of the underlying genetics is known or required to be known. However, recent scientific advances have allowed for cloning to take place. The most famous example is that of Dolly the female sheep.

Figure 9.11 *Dolly the sheep was the first mammal to be artificially cloned.*

Advances in genetic technology are being used to study human genetic disorders. For example, researchers have used mice to help develop a treatment for Huntington's chorea. Lione *et al.* (1999) have conducted experiments on mice in which the human gene causing Huntington's chorea has been introduced. The mice show similar physical symptoms to those of humans. Researchers hope that from this research they can develop a gene which will knock out or replace the action of the faulty gene that is responsible for causing Huntington's chorea.

9.5 Strengths and limitations of the biological approach

Strengths

- The biological approach adopts highly scientific methods of investigation. It uses high technology in laboratory experiments and develops new methods of investigation.
- Because of the highly scientific approach, other researchers are able to replicate experiments quite precisely with the same laboratory conditions, to find out if the same results can be obtained through independent research. As a result, the biological approach is objective and open for all to see.
- The biological approach attempts to understand just how much of human behaviour, human characteristics and thought processes can be explained by genetics and inheritance.
- The use of twin studies and adoption studies has provided a way of estimating the heritability of a range of psychological characteristics, including intelligence, personality and certain types of mental disorders.
- Experiments can be conducted on non-human animals that cannot, for ethical reasons, be conducted on humans. Whilst experimenting on animals is controversial, many of the advances of science, especially the development of drugs, could not happen without studies taking place.

Limitations

- The biological approach adopts a reductionist explanation for human behaviour and thought. This means that psychological characteristics are reduced to biological processes, such as the action of parts of the brain and the action of genes. Reductionism ignores the whole person in ways that humanistic psychologists regard as essential (see Chapter 14).
- There are ethical issues with research conducted on animals. Also, with advances in areas such as cloning and genetic engineering, ethical considerations are both very important and divide people with different views.
- The biological approach comes down more in favour of the nature side of the nature–nurture debate (see Chapter 16). It overemphasises the importance of biological processes and heritability at the expense of environmental influences.
- With modern advances in technology and equipment, research can be very expensive to conduct. This may mean that some areas for research are prioritised over others, which may result in some important areas being overlooked or under-researched.

9.6 Applications of the biological approach

We have seen throughout this chapter that the biological approach enjoys a wide range of applications. Drugs that operate at the level of the neuron and affect neurotransmitters have been developed to treat severe mental disorders such as schizophrenia and unipolar depression (see Chapter 5).

Knowledge of the structure and function of the brain provides an understanding of how damage to the brain may affect thought and behaviour. In some circumstances, this allows for neurosurgery to treat abnormalities of the brain that may be caused by, for example, tumours or strokes.

Genetic engineering has resulted in cloning of animals and possible treatments for genetic disorders such as those we have considered above. Great advances are expected in this area in the future and such advances will be surrounded by ethical controversy. The futuristic novel by Margaret Atwood called *Oryx and Crake* depicts the use of body parts in cloned people to prolong the life of the person from whom the clones were made.

Further Reading

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