NATURE VERSUS NURTURE

What makes you think, feel and behave the way you do? Were you born this way, or have a variety of experiences shaped the direction of your life?

There are a number of debatable issues in lifespan psychology. The major debate that overshadows all areas of psychology—and other disciplines such as biology—is the ‘nature versus nurture’ debate.

To what extent do our genetic inheritance (heredity) and our upbringing (environment) determine who we are? What role does each have to play in our developmental changes throughout the lifespan? Finding ways to understand how genetics and environment influence our physical development, cognitive thoughts, and social and emotional behaviours is of utmost importance in lifespan psychology.

In this chapter we will explore the ‘nature versus nurture’ debate as it relates to lifespan psychology. The research methods used to study developmental changes throughout the lifespan will also be considered.

KEY KNOWLEDGE

→ The interaction between hereditary and environmental factors ‘nature versus nurture’ in influencing psychological development.

[VCE Study Design 2013]
## CHAPTER OVERVIEW

| Genetic foundations | Genetic inheritance  
| DNA  
| dominant and recessive genes  
| gene characteristics  
| Genetic disorders  
| Down syndrome  
| Fragile X syndrome  
| Alzheimer’s disease |

| Nature/nurture in the lifespan | Genetic differences  
| molecular genetics  
| family studies  
| twin studies  
| genetics and schizophrenia  
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| Developmental patterns | Inborn reflexes  
| Motor development  
| gross motor skills  
| fine motor skills  
| developmental norms |

| The nature–nurture interaction |

In 1984, a baby boy was born and given his father’s name. His community started to expect great things of him as he grew up in an environment that encouraged AFL football. His father and namesake, Gary Ablett Senior, was a star on the football field. The young boy watched his father play his best football and become arguably the greatest Geelong football player—some would say the best football player ever! Gary Ablett Junior did not disappoint. The Gold Coast Suns community continues to appreciate this very skilled player.
Gary Ablett Junior has an uncle (Michael Tuck), a brother and a number of cousins who have played or are currently playing AFL football.

Was Gary Ablett Junior always destined to be an AFL star? How much of his success can be attributed to genetics? What role has his environment played in his AFL success? Have heredity and upbringing interacted to create a dynamic football player?

Newborn babies rely totally on their caregivers for care and support. They are born with genetic material inherited from their parents (hereditary factors) and have been under the influence of physical, social and emotional surroundings (environmental factors) since conception. Newborns develop rapidly in all areas: biological, cognitive, and social and emotional. Are their life patterns already mapped out for them? Do their first couple of years of experience (environment) determine what will happen for the rest of their lives?

Developmental change is continuous throughout our lifespan. It has been described as a lifelong process of gains and losses (Baltes 1987). Much of this change occurs in predictable patterns. Individual development is continuous and follows predictable milestones, although the rate of change and the timing of milestones varies between individuals.

In the past, hereditary and environmental factors were considered to be ‘black and white’, or operating separately from each other. It was one or the other—nature (heredity) or nurture (environment). This led to very heated arguments about which was more important. Some psychologists, such as John B. Watson, believed that an individual’s abilities and personality were entirely a product of their environment, while others believed that these were entirely dependent on genetic inheritance.

Today it is generally agreed that heredity and environment are both important factors—development is a combination of both. A baby’s genetic make-up determines its developmental potential, but reaching that potential is very much dependent on the environment in which the baby grows up. In addition, environmental factors can influence biological change. The idea that hereditary and environmental factors eventually interact to influence developmental change is known as an interactionist approach.

The extent to which heredity and environment influence developmental change is now the question. Both clearly play a role, but how much of a role? In many cases, genes produce a predisposition and the environment further determines the outcome. Perhaps ‘nature versus nurture’ should be changed to ‘nature and nurture’.

FAVOURITE ELITE PERFORMER

Choose a person you admire who is elite in their field of sport, music, art or their career. A combination of characteristics contributes to this person being at the top of their chosen field. They have specific skills, abilities, personality and/or physical features that make them good at what they do.

Questions

1. Create a list of the characteristics this person possesses that make them elite in their chosen field.

2. For each characteristic, decide whether it has been mainly influenced by heredity or by the environment, or a mixture of both.
3. Do you think your chosen person had unique and enriched opportunities in life that helped them reach elite status? Relate your answer to the ‘nature versus nurture’ debate.

4. ‘Heredity and environmental experiences interact to influence development.’ Do you agree with this statement? Explain your answer with reference to your chosen person.

Genetic foundations

The full collection of our genes (genetic material) is known as the human genome. The emergence of new technology and the mapping of the human genome have allowed researchers to look more closely at the impact of genetics on development. Fascinating discoveries have recently been made, and these promise to continue well into the future.

Genetic inheritance

We inherit our genetic material from our biological parents. Genes are the basic units of our genetic material—they carry our genetic information, instructions for biological functioning, and hereditary characteristics. Half of our genes are from our mother and the other half are from our father. They combine to create our genetic material.

We are made up of millions of cells. Except for male sperm cells and female ova (egg) cells, each cell (with a nucleus) in our body consists of identical genetic material. Our genetic material is in the form of thread-like structures known as chromosomes.

**Figure 8.1** Lauren Jackson is Australia’s greatest female basketballer. Both her parents played basketball for Australia. To what extent do you think Lauren’s success is due to heredity or environment?

**Figure 8.2** Human chromosomes. Which of these 23 pairs of chromosomes belongs to a female and which belongs to a male? (The answer is in the text.)
Most cells contain 23 pairs of chromosomes (46 chromosomes in total), with one of each pair inherited from our mother and the other from our father. One of the 23 pairs of chromosomes is made up of the sex chromosomes that determine what sex you are. Females have a matching pair of X chromosomes, as can be seen in Figure 8.2(a). Males have an unmatched pair made up of an X chromosome and a Y chromosome, as can be seen in Figure 8.2(b). Therefore males and females differ by just one chromosome.

Chromosomes are made up of DNA. DNA carries the genes—our genetic blueprint that influences our developmental behaviour.

Identifying and measuring the genes that make us unique is complex and, for most of our features, virtually impossible. A few characteristics, however, are straightforward examples of inheritance. These include characteristics that are controlled by a single pair of genes, such as the ability to roll your tongue, the shape of your ears, the length of your second toe, the presence or absence of a widow’s peak and red/green colour blindness (search for the Ishihara Test for Colour Blindness on the internet). A person can either roll their tongue or not—it is a characteristic that cannot be learned. If you can roll your tongue, you have at least one ‘tongue-rolling’ gene.

Remember that genes come in pairs. In many cases, one of these genes may be dominant over the other gene. The dominant gene will display its characteristics despite the other gene. This includes the ‘tongue-rolling’ gene. Even if your other gene is a ‘non-tongue-rolling’ gene, you will still be able to roll your tongue. Most people have the ability to roll their tongue because the ‘tongue-rolling’ gene is dominant. The ‘non-tongue-rolling’ gene is recessive—it’s characteristics are only expressed when there are two ‘non-tongue-rolling’ genes. Therefore, tongue rolling is dominant over non-tongue rolling and, consequently, a higher percentage of the population can roll their tongues.

Each individual reacts to their environment in a unique way. The role of both heredity and environment is extremely complex and very difficult to separate. Some development characteristics—such as learning to vocalise or babbling in the first year of life—appear to be set in our genetic material, with little influence from the environment. All infants across the world, even ones with severe hearing loss, babble in the same way.

Other characteristics—such as intelligence and personality—are influenced by environmental factors, although genetic material often appears to set boundaries or limits. An infant may be born with the genetic material that makes them capable of reaching a high level of intelligence. This does not guarantee that they will reach this level. Given the right environmental conditions, including good food, good health and a safe and stimulating environment, they will most likely grow up to realise their intellectual potential. Under poor conditions, such as malnutrition, neglect, disease or exposure to unsafe chemicals, they may end up less intellectually able than they could have been. They may not reach their potential.

We inherit dispositions, not destinies.

R.J. Rose, developmental psychologist in the area of gene–environment interactions
GENETIC CHARACTERISTICS

The following characteristics are probably controlled by a single pair of genes. The first-named characteristic for each example is the dominant characteristic; therefore, a higher percentage of the population display these dominant characteristics.

How many members of your class display the following characteristics? Copy and complete this table to record the results.

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>YOURSELF</th>
<th>NUMBER OF CLASS MEMBERS (INCLUDING YOURSELF)</th>
<th>PERCENTAGE OF CLASS MEMBERS (INCLUDING YOURSELF) WITH THIS CHARACTERISTIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tongue rolling</td>
<td>can roll tongue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earlobe shape</td>
<td>free earlobes attached earlobes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of second toe</td>
<td>longer than big toe shorter than big toe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Widow's peak</td>
<td>has a widow's peak does not have a widow's peak</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Questions

1. For each example, did a higher percentage of the class members display the dominant characteristic? If not, can you think of reasons for this discrepancy?
2. If you surveyed a larger sample, would you expect similar results? Give reasons for your answer.
3. Not all family members will display the same characteristics. It depends on whether they have at least one dominant gene or two recessive genes. Do you expect your family members to display the same characteristics as you? Explain your answer.
4. Most characteristics are a combination of many genes and are also influenced by the environment. Can you describe any characteristics (such as physical, personality and intelligence characteristics) that seem to run in your family? To what extent do you think these characteristics are inherited?
Genetic disorders

Currently there are over 7000 known genetic disorders, with many more expected to be added to the list. Most genetic disorders affect development and may ultimately contribute to one or more of the following: physical illness, mental illness, dementia and mental retardation (impaired cognitive functions). Notable examples include Down syndrome and fragile X syndrome. Others, such as Alzheimer's disease, are known to have a genetic component.

Australian researchers are leading the way with investigating the strong genetic contribution to many mental illnesses, such as autism, Alzheimer's disease and schizophrenia. It is hoped that further understanding of the important role of genetics will lead to better diagnosis, prevention and treatment.

**DOWN SYNDROME**

A person with Down syndrome has inherited an extra chromosome (chromosome 21). The extra chromosome is due to a mistake in cell division and growth at conception. The presence of this extra chromosome results in mild or moderate intellectual disability, growth and motor skill development impediments, congenital heart disease and characteristic facial features.

Down syndrome accounts for more than a quarter of institutionalised individuals with mental retardation.

**FRAGILE X SYNDROME**

Fragile X syndrome is the second most common cause of mental retardation. A person with fragile X syndrome has a high probability of mental retardation and delayed social skills, although these are not inevitable.

Fragile X syndrome is due to a defective single gene on the X chromosome. This gene has been identified to cause the breaking of the X chromosome. Twice as many females as males are diagnosed with this illness. However, it affects females less because of their other X chromosome. Males are more likely to be severely affected because they do not have another X chromosome that can help compensate for the defective gene.

**ALZHEIMER'S DISEASE**

Alzheimer's disease is characterised by progressive brain deterioration that leads to substantial loss of memory and other cognitive abilities.

There are two forms of Alzheimer's disease: early onset and late onset. Early-onset Alzheimer's disease occurs before reaching 60 years of age. It is rare, but runs in families. A single gene on chromosome 14 is responsible in most cases, and a single gene on chromosome 21 (interestingly, the same chromosome as in Down syndrome) in others.

Late-onset Alzheimer's disease appears to be more difficult to predict. It is most likely a result of a combination of genes. One gene has been identified that increases the risks of the disease. You may be at greater risk of Alzheimer's disease if you inherit two copies of this faulty gene (one from each parent), although this does not mean you will necessarily get the disease. Environmental factors can certainly play an important role as well. There are a number of other genes strongly suspected of being involved (perhaps over 100), making late-onset Alzheimer's disease more complex than researchers initially thought.
RESEARCH IN AUTISM

Autism is a developmental disorder that is not yet well understood. Research has shown that autism is probably caused by a combination of genetic and environmental factors, and that multiple genes are involved. It tends to run in families, but there are also cases of only one of identical twins having autism.

Autism is identified by behavioural markers. Early intervention to prevent developmental derailment is vital. Researchers have made progress by looking retrospectively at family videos of children diagnosed with autism to identify the earliest behavioural markers. Some now think that autism can be diagnosed as early as at 12 months of age.

Currently recognised effective interventions for autism require a lot of time, are costly, and are not equally effective for all children. Researchers continue to search for more effective methods that are less demanding on time and resources. Current innovations include focusing more precisely on teaching important target behaviours through everyday interactions with caregivers and teachers.

RESEARCH INTO GENETIC DISORDERS

Go online or search library resources to investigate the following genetic disorders; then copy and complete the table:

<table>
<thead>
<tr>
<th>SYNDROME</th>
<th>GENETIC PROBLEM</th>
<th>INCIDENCE</th>
<th>CHARACTERISTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turner syndrome (XO)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triple-X syndrome (XXX)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Klinefelter’s syndrome (XXY)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supernate syndrome (XYY)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. How many chromosomes exist in each human cell? How many chromosomes are inherited from the mother and how many from the father?
2. What is the difference between a dominant and a recessive gene?
3. Name one ability or characteristic that is controlled by one single pair of genes.
4. Will being born with ‘intelligent’ genes necessarily mean that a person will be highly intelligent? Briefly explain your answer.
5. Copy and complete this table:

<table>
<thead>
<tr>
<th>SYNDROME</th>
<th>GENETIC PROBLEM</th>
<th>CHARACTERISTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Down syndrome</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fragile X syndrome</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alzheimer's disease—early onset</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Studying nature/nurture in the lifespan

Is behaviour entirely due to genetics? Definitely not! Genetic researchers are not trying to demonstrate that everything is genetic. They are investigating whether genetic differences are important for specific behaviours and developmental patterns. When genetic differences are found, the researchers then consider the complex interactions between heredity and the environment.

In lifespan psychology, it is generally accepted that:
- Genes lay the foundation for developmental change, and the environment can influence the genes themselves. We know that genes and gene sequences are switched on (or not) through nurture, so the final expression of genetic predispositions is dependent on nurture. Perhaps it should be nature 'through' nurture rather than nature 'and' nurture.
- Our physical and psychological characteristics may be influenced by many genes.
- Genes express their effects in many different and often subtle ways.
- Some genes have more direct and inevitable effects than others.

Genetic differences

To study whether genetic differences are important for specific behaviours, two techniques are often used: molecular genetics and family studies.

Molecular genetics

Molecular genetics is genetic laboratory research using modern technology to map the coding of genes on chromosomes.

Molecular genetics is exciting research. It has demonstrated that while some genes are involved in certain characteristics, a person with these genes may not necessarily develop these characteristics. In most cases, genetic inheritance does not dictate outcomes. Environmental influences also play a role. This highlights the complex interaction between heredity and the environment.

Family studies

In family studies, researchers study relatives to determine if genetic similarity is related to similarity on a particular characteristic. Closely related people share more genes; therefore, if closely related people also share a similar characteristic, then there may be a genetic contribution.

Family studies include twin studies of identical twins (100 per cent gene match) and non-identical (fraternal) twins (approximately 50 per cent gene match), and studies of families with adopted and biological children.

Twin studies are one of the most powerful techniques used to compare characteristics.

Twin studies: identical twins

Identical twins have all their genes in common. If identical twins share a similar characteristic, then this characteristic is more likely to be due to a genetic contribution.
There is a problem with this assumption, however, because identical twins are likely to share the same environment. If they are raised together, in the same household with similar experiences, then the same environmental factors would impact on the development of their characteristics. Plus, they look the same and are more likely to be treated alike. Friends, teachers and extended family may have difficulties telling them apart or want to treat them fairly and equally—the environmental influences are the same. Are similar characteristics due to similar genetics, similar environment, or a combination of both?

It is important to note that identical twins, their immediate family members and their close friends will be aware of their differences and will probably treat them differently. In this way the environment may differ slightly. Identical twins are also likely to lead independent lives once they leave school. At this stage, their environment is likely to differ.

In a very few studies, identical twins reared apart have been used. This is when identical twins were separated at birth and raised in different environments. To a certain extent, this eliminates the problem with being influenced by identical environments. However, a limitation in generalising from these findings is due to the selection of adoptive parents. In most cases, the infants were matched with families of similar education and social background (Hay 1985). Therefore, although reared apart, the twins were raised in similar environments.

Twin studies: non-identical twins

Non-identical twins share approximately 50 per cent of their genetic material with their twin—the same amount as any set of brothers and sisters. Again, the issue of sharing the same environment comes into play and is difficult to separate from genetic inheritance.
THE ‘JIM TWINS’

The ‘Jim twins’—identical twins separated early in life and reared apart—became important participants in the renowned Minnesota Twins Study, which highlighted the genetic and environmental connections that underlie developmental change.

Jim Lewis was adopted when he was four weeks old. When he was in his 30s, he decided to search for his biological family. Some years later, he finally found his identical twin brother, Jim Springer. Both had grown up not knowing they had a twin.

Jim Lewis and Jim Springer discovered some amazing similarities in their lives. As children, both had been fretful sleepers and nail-biters. Both suffered from migraines, haemorrhoids, and high blood pressure. The similarities went further—both had pet dogs named Toy when they were young, both had married women named Linda, and both had divorced and then remarried women named Betty. Jim Lewis named his first son James Allen and Jim Springer named his James Alan. Both worked as sheriff’s deputies, enjoyed stock-car racing, made dolls’ furniture and constructed unusual circular benches around trees in their garden. Both liked to go to the same Florida beach on holidays, drink the same brand of beer and smoke the same brand of cigarettes!

The Minnesota Twins Study found that identical twins raised together or apart were far more similar on many psychological tests than non-identical twins and siblings raised in the same family. The Jim twins, for example, scored strikingly similar scores on a series of personality and intelligence tests, and even had very similar handwriting (Tellegen et al. 1988).

Families with adopted and biological children

Comparing psychological characteristics, including developmental changes, between adopted and biological children growing up in the same family can help researchers pinpoint environmental influences. Biological children share 50 per cent of their genetic material, while adopted children are not genetically similar.

Comparing psychological characteristics with both biological and adoptive parents can indicate the influence of genetics and environment. If a child has a characteristic that is very similar to a biological parent, then a strong genetic influence on that characteristic is likely. If the characteristic is similar to an adoptive parent, then environmental factors are probably more influential.

Genetics and schizophrenia

Schizophrenia is a mental illness that is characterised by perceptual, emotional and intellectual distortions, and loss of contact with reality. In one study, the families of adopted children who were diagnosed with schizophrenia as adults were investigated (Kety et al. 1978). It was found that 12 per cent of biological family members had been diagnosed with schizophrenia, whereas only 3 per cent of adoptive family members had been diagnosed. This large difference between biological and adopted families suggests a hereditary link.
Gottesman (1991) also supports the idea of a hereditary link. When one non-identical twin is diagnosed with schizophrenia, the other twin will also be diagnosed about 17 per cent of the time. Compare this to the figure for identical twins. When one identical twin is diagnosed, the other has a 48 per cent chance of being diagnosed. The rate is not 100 per cent, as you would expect if schizophrenia was entirely due to genetic forces; while the rate is much higher for identical than for non-identical twins, environmental influences are obviously very important.

One tragic story concerns identical quadruplet girls, known as the ‘Genain quadruplets’. Born in 1930, all four girls ended up suffering from schizophrenia by the time they were 24 years old (Mirsy et al. 2000). The chances of any four unrelated people suffering from schizophrenia are around 1 in 100 million. (‘Genain’ is not the girls’ real surname, but a fictitious name derived from a Greek word meaning ‘dreadful gene’).

The Genain quadruplets appeared to have a genetic disposition for the mental disorder. The degree of severity, however, differed between the sisters and this highlighted complex environmental interactions. All four girls, dubbed Nora, Iris, Myra and Hester (NIMH—an acronym for the National Institute of Mental Health), suffered severe abuse throughout their childhood. Their father was irritable, controlling and sexually abusive. Their mother had peculiar sexual preoccupations and even went as far as attempting to have Hester and Iris circumcised at the age of 11 years to stop them from masturbating (the surgery was unsuccessful) (Rosenthal 1963).

Nora and Myra were considered to be the brightest of the four girls, with Myra receiving the most preferential treatment, including less abuse from her father. Both experienced more success in life, with Myra being the only one to avoid hospitalisation, and the last to experience schizophrenia-symptoms.

Hester was dubbed a ‘moron type’ and a ‘sex maniac’, and Iris was paired with her sister as being ‘not bright’. Both suffered severely from schizophrenia and some suggestions have been made that they may have experienced brain damage at birth (Mirsy et al. 1992).

In 2000, all four sisters where still living in the same town, with Myra employed in a part-time job, Nora and Hester living together but unemployed (with Nora running the household), and Iris in a nursing facility with severe dementia (Mirsy et al. 2000).

![Figure 8.8](https://example.com/image.jpg) © AP photo.
The Genain quadruplets, who all became schizophrenic later in life. The chances of four unrelated individuals all being schizophrenic is 1 in 100 million.
Research methodology and ethics in lifespan psychology

Research psychologists are likely to employ a number of research methods in their investigations, including case studies, observations, interviews, surveys, correlational studies, and experiments in laboratory and naturalistic settings.

As with all research, lifespan development research must be approved by an ethics committee prior to being carried out, and ethical considerations must be followed. A research psychologist must balance the ethical issues associated with extreme or sensitive cases (such as abuse), the age of the participant and the importance of collecting scientific data. Working with infants and children requires additional care, and a researcher must be sensitive to the participant’s developmental stage. Respect for the person and doing no lasting harm are of paramount importance.

Extreme case studies may offer important insight into the ‘nature versus nurture’ debate. While research is essential in order to advance our understanding of developmental changes and well-being, it is not ethically or morally correct to undertake some experiments. Extreme case studies can provide a window into this very sensitive area, although the nature of the situations involved makes generalising the results very difficult.

1. What is molecular genetics?
2. Why are identical twins often used to investigate developmental changes?
3. Explain why the research findings from adopted and biological children in families contribute towards the ‘nature versus nurture’ debate.
4. What ethical considerations need to be considered when researching young children?
5. What are the limitations with generalising findings from extreme case studies?

EXTREME CASE STUDIES: WILD CHILDREN

In 1970, community care workers in Los Angeles rescued a 13 1/2-year-old girl, Genie, who had been raised in appalling and unimaginable conditions (Curtiss 1977). Genie had spent much of her life in a dark isolated room, strapped to a child’s potty chair for most of the day and fed only baby food. She had virtually no contact with other people, apart from minimum contact with her parents, and was punished if she ever made any sounds. When Genie was found, she had the appearance of a six-year-old girl, was painfully thin, barely able to walk and made hardly any sounds. Curtiss described her as unsocialised, primitive and hardly human.

Genie had never learned to talk and had been deprived of social contact, including language. After she was rescued, she spent time with psychologists who both cared for her and studied her behaviour. Genie had to learn her first language at the age of 13 1/2 years. She did learn some aspects,
such as vocabulary, but showed very poor understanding of grammatical rules. For instance, she would say, 'Spot chewed glove' instead of 'the dog named Spot chewed the glove'.

Her story after her rescue continued to be tragic. Genie never adjusted socially. She had difficulties with her placement in foster families, including one where she was abused, and was eventually placed in a nursing home.

Genie's story draws parallels with another extraordinary case. Victor, the wild boy of Aveyron, was found in an isolated place in the south of France in 1800 at the age of about 12, having apparently been living wild in the woods for most of his life.

(For more information, see Reichard, 1978)

Extreme deprivation cases such as those of Genie and Victor suggest that we may be genetically programmed to learn the rules of language within a sensitive period of our lives—we must be exposed to language early in life to be able to learn it properly. Genie and Victor failed to master language after being deprived of exposure to it during childhood. Once the sensitive period has lapsed, we may be able to learn some aspects of language, such as vocabulary, but it is harder to acquire this outside this period.

This highlights the interplay between nature and nurture. Nature allows the development of language during the sensitive period (an innate ability), and nurture allows the development to occur in the right environment. In terms of language development, Genie and Victor were beyond the age of rescue.

There are difficulties in drawing inferences from such tragic cases because there are many complicating factors. Genie's father believed that she was mentally retarded—if this was so, it could affect language development. Genie also suffered extreme emotional and physical abuse, another factor that would affect language development. Psychological and physiological tests could not determine whether Genie's behaviour was a result of mental retardation or extreme abuse. Separating such complex issues is impossible.

Victor's case raises similar problems. His early childhood experiences remain a mystery, and it is unclear whether he had an intellectual disability.

Extreme deprivation cases highlight important ethical issues. Should psychologists have been concerned with providing psychological care and linguistic (language) support for Genie as well as collecting research data? Ongoing arguments about who should look after Genie and whether she should be subject to scientific study took place following her discovery. Funding for the research finally stopped due to not enough research data being published. Interestingly, Genie's mother threatened to sue the psychologists because in her view the psychologists and carers were more involved in research and rigorous testing than caring for Genie!

Extreme deprivation cases can provide useful examples from which inferences can be drawn, but these inferences are limited because it is difficult to regard the data as scientific.
Developmental patterns

Amazing changes occur during the first two years of life. An infant’s body and motor skills develop rapidly, largely due to maturation. Maturation is a genetically programmed process that governs growth. It directs physical and biological development, including the development of an infant’s muscles and brain. Being able to reach out for a toy, rolling over, walking, talking and toilet training are all under the initial control of maturation.

Learning can be defined as a relatively permanent change in behaviour due to experience. Maturation and learning work together—babies cannot learn skills such as walking until their brains and bodies are physically ready (sufficiently mature) to carry them out. Note that learning can be achieved through practice. Although maturation is necessary to reach motor development milestones, practice is required to become proficient at them.

Motor skill milestones, such as reaching out for a toy, link hand–eye coordination skills with perceptual abilities. Movement, such as crawling, stimulates cognitive and social engagement. Being able to crawl means that infants are able to investigate their surroundings and play near others. Motor skill milestones are easily observable and demonstrate how maturation (genetically controlled development) impacts on psychological development.

Inborn reflexes

Motor skill development begins with inborn (innate) reflexes before proceeding to voluntary movement. Babies are born with a set of inborn reflexes—automatic responses to specific stimuli. These reflexes are not learned behaviours; they are not a product of the environment as they do not rely on experience or the development of cognitive skills. Essentially, inborn reflexes are entirely due to nature (heredity). Genetic material programs them to occur in newborn babies. Babies do not have to think about inborn reflexes—they occur automatically.

**Figure 8.9** A baby grasping a finger is an inborn reflex and disappears within 12 months.

**Figure 8.10** When you stroke the sole of a baby’s foot the feet twist in and the toes spread out. This is known as the Babinski reflex.
Some reflexes, such as the **sucking, rooting, grasping, swimming, tonic neck** and **Moro reflexes** (see Table 8.1), are temporary and tend to have survival purposes for that stage of life. Others, such as coughing, blinking and yawning, stay with us throughout life. Some reflexes have survival functions (nourishment or protection), while the purposes of others, such as the **Babinski reflex**, are unclear. These reflexes may prepare infants for movement, or may have had survival functions in primitive times.

The absence of a reflex at birth (for full-term babies) or the persistence of a reflex beyond the age when it is meant to disappear may indicate problems with the functioning of the brain. Further assessment into brain activity is often required.

**TABLE 8.1 Inborn reflexes**

<table>
<thead>
<tr>
<th>NAME OF REFLEX</th>
<th>STIMULUS</th>
<th>DESCRIPTION OF REFLEX</th>
<th>DEVELOPMENTAL PATTERN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Babinski</td>
<td>Sole of the foot stroked from heel to toes</td>
<td>Foot twists in and toes spread out</td>
<td>Disappears around 9 to 12 months of age</td>
</tr>
<tr>
<td>Blinking</td>
<td>Flash of light or puff of air</td>
<td>Closes both eyes</td>
<td>Permanent</td>
</tr>
<tr>
<td>Grasping</td>
<td>Object placed in palm</td>
<td>Palm of hand closes</td>
<td>Weakens and disappears between 3 and 12 months of age</td>
</tr>
<tr>
<td>Moro (startle)</td>
<td>Loss of support or sudden loud noise</td>
<td>Throws head back, arches back, throws arms and legs out and then rapidly brings them to centre of their body</td>
<td>Disappears after 3 to 4 months</td>
</tr>
<tr>
<td>Rooting</td>
<td>Cheek stroked</td>
<td>Head turns towards touch, mouth opens and sucking begins</td>
<td>Disappears after 3 to 4 months</td>
</tr>
<tr>
<td>Stepping</td>
<td>Held upright with feet touching a surface</td>
<td>Makes rhythmic stepping movements</td>
<td>Disappears after 3 to 4 months</td>
</tr>
<tr>
<td>Sucking</td>
<td>Object touches mouth</td>
<td>Sucking begins</td>
<td>Disappears after 3 to 4 months</td>
</tr>
<tr>
<td>Swimming</td>
<td>Placed in water</td>
<td>Makes coordinated swimming movements</td>
<td>Disappears after 6 to 7 months</td>
</tr>
<tr>
<td>Tonic neck (fencer’s pose)</td>
<td>Placed on back</td>
<td>Hands form fists and head usually turns to the right</td>
<td>Disappears after 2 months</td>
</tr>
</tbody>
</table>

The majority of the inborn reflexes disappear as the baby’s nervous system and muscles mature. As this happens, movement becomes more voluntary in nature, for example being able to sit up, or pull oneself up to stand. The learning of voluntary movements also follows a sequential pattern—they are the same for all infants and are therefore considered to be largely due to maturation.
INBORN REFLEXES

In pairs, consider the inborn reflexes outlined in Table 8.1.

1. Imagine that one person in your pair is an infant. Role-play each reflex. Present two role-plays to the class and see whether other members of the class can guess the reflex.

2. What happens to your foot when it is stroked from your heel to your toes? How does your response differ from the Babinski reflex?

3. Which reflexes are for survival purposes (nourishment and protection), and which reflexes are more likely to prepare infants for voluntary movement (and may have had primitive survival purposes)? Give reasons for your answers.

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**Match these inborn reflexes with their correct descriptions.**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>1</td>
<td>Babinski</td>
</tr>
<tr>
<td>2</td>
<td>Blinking</td>
</tr>
<tr>
<td>3</td>
<td>Grasping</td>
</tr>
<tr>
<td>4</td>
<td>Moro</td>
</tr>
<tr>
<td>5</td>
<td>Rooting</td>
</tr>
<tr>
<td>6</td>
<td>Sucking</td>
</tr>
<tr>
<td>7</td>
<td>Tonic neck</td>
</tr>
</tbody>
</table>
Motor development

The patterns of physical development are seen as infants develop motor skills. *Gross motor skills*, such as walking and kicking a ball, are skills that use large muscle groups. *Fine motor skills*, such as holding a pen correctly, use small muscle groups. Gross motor skills develop before fine motor skills. It takes time before infants can feed themselves or young children can learn to hold a knife and fork correctly—their small muscle groups must mature before they can learn.

Can you remember receiving your pen licence? Most primary school teachers recognise important fine motor skill ability by issuing a pen licence when the child can correctly hold a pencil and write clearly.

The motor development milestones can influence psychological developmental changes. For instance, motor skill milestones can change the way children play with blocks and a ball. Young children will be able to grasp and move blocks, select ones they like, create various constructions, knock them down and help others play—or, as anyone who has spent time with a two-year-old will know, knock down other people’s constructions! Motor development links to the child’s social and emotional relationships with others, and thinking and problem-solving skills.

The age at which infants reach each milestone varies between individuals, although the milestones occur in an orderly sequence in children throughout the world. This sequence can be seen in Figure 8.12.

*Figure 8.11 At what age did you learn to bounce and catch a ball?*

*Figure 8.12 Milestones in infant motor development. If you have your baby records, compare these milestones with your own pattern of development.*
DEVELOPMENTAL NORMS

Developmental norms indicate the average age that a certain behaviour or skill will be achieved. They are based on the mean age of a large sample. Developmental norms provide feedback on whether the infant is progressing normally in relation to the rest of the population. Comparing an infant’s progression to developmental norms can be useful. It can alert health professionals to a situation and allow appropriate action.

Developmental norms can also cause unnecessary anxiety because the mean score does not take into account the large variations within the population. An infant who takes longer to reach one milestone may be identified as being ‘at risk’, although they are perfectly healthy and normal. Indicating a spread of ages, as in Figure 8.12, may help alleviate some of this unnecessary concern.

FIGURE 8.13 How old were you when the training wheels came off your bike?

FIGURE 8.14 At what age did you first hold an animal by yourself?

UNDIFFERENTIATED MOTOR SKILLS

When infants first try to grab a small object, they do so in an uncoordinated manner. The whole hand may reach out, but it takes time and practice before the infant can move their fingers separately and grasp the desired object. This initial difficulty occurs because the motor skills of infants are undifferentiated—they cannot differentiate between, or perform, two skills at once. Myelination of the brain’s neurons [part of brain growth] and learning through practice leads to the development of motor skills.

Some motor skills can remain undifferentiated, even in adults. Try these skills:

→ Pat your belly with your left hand while rubbing your head in a circular motion with your right hand.
→ Bend your little finger of your left hand without moving your ring [fourth] finger.
→ In each of these situations, could you perform the activity? If not [and most likely you couldn’t], you have failed to differentiate between the two tasks.

→ Did someone in the class demonstrate differentiation? If yes, find out if they had previously practised those skills. You could even ask them to perform the task activity again, this time counting backwards from 300 by 3 at the same time [300, 297, 294 …]!
The nature–nurture interaction

Nature and nurture influences have been discussed throughout this chapter. In most cases, the impact of the environment has been discussed in relation to genetic inheritance, including:

- biological characteristics that you are born with (for example, genetic diseases such as Down syndrome)
- innate abilities (for example, inborn reflexes)
- an innate predisposition to learn, including possible innate constraints to learning (such as learning the syntax of your first language).

Obviously, heredity is very important and, in many cases, it drives developmental change. Be careful though—do not fall into the trap of thinking the environment is less important. The environment is crucial.

The influence of the environment begins from conception, or even earlier. There are times during pregnancy when an unborn baby (embryo/fetus) can be highly susceptible to environmental factors. In fact, the impact of the environment can be more obvious during the early stages of life than at any other time. While the unborn child is in the relatively safe and protective environment of the womb, there are still some risks. A mother’s healthy diet and lifestyle can be of significant assistance to the development of the unborn child.

RUBELLA AND BIRTH DEFECTS

In 1940 in Australia, there was an outbreak of rubella (German measles). An Australian ophthalmologist, N. Gregg, reported a link between this outbreak and the number of babies born afterwards with eye problems. A rubella outbreak in the United States in 1964–65 resulted in over 30,000 prenatal and neonatal (newborn) deaths and 20,000 babies born with malformations.

If a pregnant woman is not immunised against rubella and comes in contact with the disease during the first three months of pregnancy, the baby is more likely to be born with a congenital abnormality, such as a heart defect, deafness or mental retardation. Routine vaccinations for children have helped decrease the incidence of this disease. Women who are planning a pregnancy are often advised to be tested to determine if they are immune to the disease.
Early experiences shape our psychological development. These include social interactions, parenting styles and customs. A rich, supportive environment can stimulate brain growth, which in turn can influence cognitive, and social and emotional development.

But we continue to develop and change throughout life. We are shaped by more than our genes and early experiences. Think of your life at the moment. Your psychological development is being shaped by many environmental settings—your family relationships, culture, friendships, school environment, wealth and religion, just to name a few. Your close friends are important to your well-being now, and they will continue to be in later stages, including being a key to successful ageing.

Physical, cognitive, and social and emotional development are influenced by both heredity and the environment, as well as by intelligence and personality. This highlights the significance of the nature–nurture question as a central issue in psychology.

Does our genetic material provide a blueprint for developmental change? Under certain environmental conditions a blueprint for developmental change may indeed be experienced. A person’s physical environment and social context, as well as cultural aspects, contribute greatly to psychological development. Researchers are still trying to understand the complex ways that experience interacts with the expression of our genetic material and therefore influences our psychological development.

LAYNE BEACHLEY—A SURFING LEGEND

Layne Beachley grew up in a caring family, with an older brother and a father who loved surfing. She loved the ocean and led a very active lifestyle. Tragically, her mother died when she was six years old, and so began a rough period in her life. Three years later, her father told her that she was adopted. Layne felt instantly isolated and alone, and wondered if she was worthy of love since her birth mother had abandoned her. She says this was the time in her life when she decided she would be the best in the world at something in an attempt to gain love.

Layne won her first professional surfing title at the young age of 20. This instilled the confidence to continue her pursuit and she went on to win seven world surfing titles while battling injuries and chronic fatigue. During this time she met her biological mother and they began a rocky relationship. She also had to deal with the realisation that she was conceived through date rape.

Layne is now raising funds and awareness for her charity, Aim for the Stars, in an attempt to support female athletes. She is also involved with other community work. Layne has struggled with relationships throughout her life, but has finally found a soul mate and overcome the fear of abandonment.

Questions

1. Consider Layne’s life story. What contributed to her success, both professionally and personally?

2. How have nature and nurture interacted?
When a baby is born, there is much talk about their personality and prospects in life. It is not uncommon to hear comments such as ‘Oh, he is just like his father’ or ‘He takes after his grandmother’ or ‘He is totally different to his sister’ or ‘He is going to grow up to be an engineer, like his uncle’.

Odds are that you have been (and still are) told similar things.

Do comments such as these encourage certain behaviours? Do they help create an environment that encourages the child to develop in a certain way? Is it in our genes? To what extent do nature and nurture interact as we develop psychologically? Take a moment to reflect on your own psychological development and the impact that nature and nurture have had on your life.

**FIGURE 8.15** Layne Beachley overcame childhood difficulties to win seven world surfing titles and find true love.

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**REVIEW 8.4**

1. What is maturation?
2. Why does the development of motor skills in infants encourage cognitive, and social and emotional development?
3. A baby is born with a number of reflexes. Are these reflexes due to genetic or environmental factors? Explain.
4. Why are a baby’s first sounds (babbling) considered to be genetically programmed without needing environmental input?
5. List five environmental factors that are likely to be influencing your cognitive, and social and emotional development at this stage of your life.
Each individual reacts to his or her environment in a unique way. The roles of both heredity and environment are extremely complex and very difficult to separate.

- The idea that hereditary and environmental factors interact to influence developmental change is known as an interactionist approach.
- Genes are the basic unit of our genetic material. They carry our genetic information and instructions for biological functioning and hereditary characteristics. Half of our genes are from our mother; the other half are from our father.
- Identifying and measuring the genes that make us unique is complex and, for most characteristics, virtually impossible. A few characteristics, however, are straightforward examples of inheritance. These include characteristics that are controlled by a single pair of genes, such as the ability to roll your tongue.
- In many cases, one of these genes may be dominant over the other gene. The dominant gene will display its characteristics despite the other gene. These other genes are known as recessive genes. Recessive characteristics are only expressed when there are two recessive genes.
 Genetic inheritance includes the biological characteristics you are born with. This encompasses genetic diseases such as Down syndrome, fragile X syndrome and, to some extent, early-onset Alzheimer’s disease.

 Genetic researchers investigate whether genetic differences are important for specific behaviours and developmental patterns.

 Molecular genetics is genetic laboratory research using modern technology to map the coding of genes on chromosomes.

 Family studies are used to determine if genetic similarity is related to similarity on a particular characteristic. These include twin studies (identical, non-identical, reared together and reared apart), and adoption and biological family studies.

 Extreme case studies may offer important insight into the ‘nature versus nurture debate’. Such case studies can provide a window into this very sensitive area, although the extreme nature of the situation makes generalising the results very difficult.

 Maturation is a genetically programmed biological process that governs biological growth. It determines physical and biological development, including the development of an infant’s muscles and brain.

 Learning can be defined as a relatively permanent change in behaviour due to experience. Maturation and learning work together—babies cannot learn skills until their brains and bodies are physically ready (sufficiently mature) to carry them out. Learning can be achieved through practice.

 Babies are born with a set of innate reflexes—automatic responses to specific stimuli.

 Gross motor skills are skills that use large muscle groups (for example, walking and kicking a ball). Fine motor skills use small muscle groups (for example, holding a pen correctly). Gross motor skills develop before fine motor skills. They are under the control of maturation, but are influenced by learning.

 Some developmental characteristics may consist of an innate predisposition to learn, including possible innate constraints to learning (for example, sensitive periods for learning the rules of your first language).

 Environmental factors are equally crucial and can drive developmental change. These factors begin from the time of conception and continue throughout life. Family relationships, culture, friendships, school environment, wealth and religion all contribute to psychological development.
→ TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

1. Developmental changes are likely to be influenced by genetic or biological factors, known as _______________, and environmental conditions, known as _______________.
   a. nurture; nature
   b. nature; nurture
   c. inheritance; maturation
   d. maturation; inheritance.

2. Which group of the following examples are all environmental factors that could influence development?
   a. viruses, parenting style, poisons
   b. parenting style, chromosome abnormality, bullying
   c. friendships, inborn reflexes, accidental brain damage
   d. friendships, viruses, genetic defect.

3. Most cells in the human body contain _______________ pairs of chromosomes.
   a. 15
   b. 23
   c. 32
   d. 46.

4. Chromosomes are composed of the substance _______________ which contains _______________.
   a. genes; DNA
   b. DNA; genes
   c. genes; cells
   d. cells; DNA.

5. Which of the following is not a reflex that is present at birth?
   a. sucking
   b. grasping
   c. crawling
   d. swimming.

6. Rani and Bree are identical twins. The estimated chance of one developing the same characteristic as the other is about:
   a. 0 per cent
   b. 50 per cent
   c. 100 per cent
   d. impossible to determine.

7. The grammatical rules of language are called:
   a. babbling
   b. morphemes
   c. utterances
   d. syntax.

8. Most psychologists today take an _______________ approach to developmental change over the lifespan. What does this mean?
   a. Define maturation.
   b. Use an example to explain how maturation can encourage psychological development.

9. Is the main goal of genetic researchers to demonstrate that all developmental characteristics are genetic? Explain your answer.

10. Mandy has inherited a gene that is linked with a disease, but does not have the disease. Why not? In terms of the ‘nature versus nurture’ debate, outline one possible reason.

11. What do extreme case studies, such as those of Genie and Victor, suggest about sensitive periods in learning one’s first language? How does this relate to the ‘nature versus nurture’ debate?

12. Explain why it is incorrect to state that heredity is more important for psychological development than the environment.