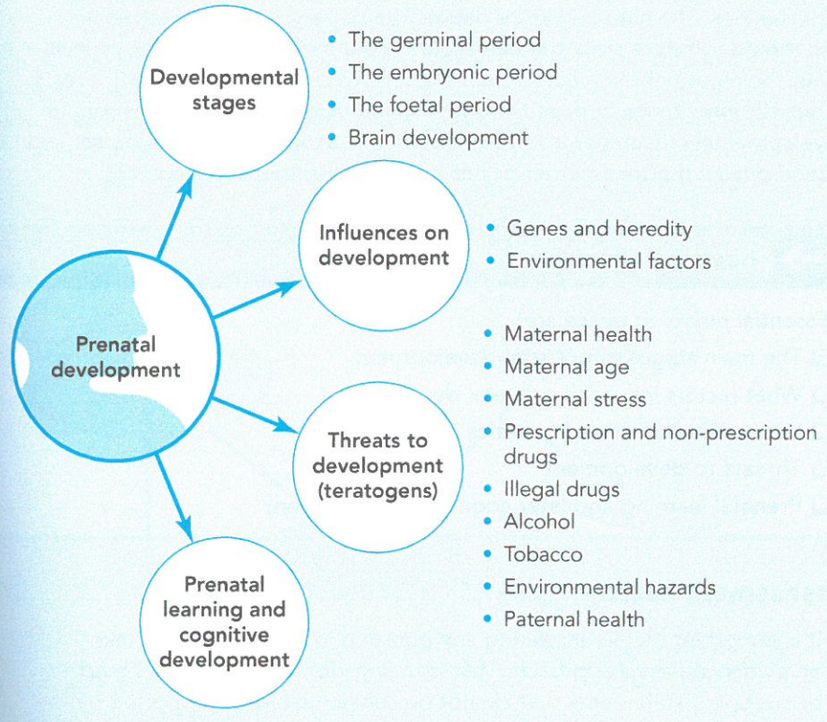
2

Prenatal development



A printable version of this topic map is available from
www.pearsoned.co.uk/psychologyexpress

Introduction

It is important to understand the stages of prenatal development so you can see the psychological effects that can occur if this development goes wrong. However, while you need to know what happens during the main stages of prenatal development you must also remember that you are studying psychology, not physiology. It is therefore important to think about the long-term impact of prenatal experiences on later social, emotional and psychological development. For this reason the focus of prenatal development in psychology tends to be on how development may be negatively affected by *teratogens* and the short- and long-term consequences on child development. Of course the flip side of this is the way in which avoidance of teratogens can be beneficial for future infant well-being. You are therefore advised to consider the advice that might be given to expectant parents to provide their child with the best developmental opportunities. The nature–nurture debate is also very important, especially with regard to future skills and behaviour. You therefore need to ask yourself about the nature of the influences on the unborn child: are they clearly a result of genetic inheritance or does the environment alone provide the answers to developmental outcomes? Is it less clear which factor has the most impact and indeed does it matter whether or not we can tease these two apart?

Revision checklist

Essential points to revise are:

- ❑ The main stages of prenatal development
- ❑ What factors influence prenatal development
- ❑ How environment and genetics interact
- ❑ Threats to development
- ❑ Prenatal learning and later cognitive development

Assessment advice

- It is important that in answering any question in psychology you take an *evidence-based* approach. That is to say, do not make generalised or sweeping statements that cannot be substantiated or supported by evidence from the literature. Also remember that the evidence should not be anecdotal. After all, you are not writing an opinion piece; you are crafting an argument that is based on current scientific knowledge and understanding.
- Furthermore, whatever type of assessment you have to undertake, it is important to take an *evaluative* approach to the evidence. Whether you are writing an essay, sitting an exam or designing a webpage, the key advice is to avoid simply describing how development takes place or the impact of

teratogens on developmental outcomes. Rather, it is necessary to think about the strength of the evidence in each field you are covering. One of the key skills for psychology students is critical thinking and for this reason the tasks featured in this chapter focus on developing this way of thinking. Thus you are not simply expected to learn a set of facts and figures, but to think about the implications of what we know and how this might be applied in everyday life. Better assessment answers are the ones that take this critical approach.

- Evidence is not static – it was once believed that certain drugs (DES) could help prevent miscarriage, however we now know that they also increase the risk of fertility problems for the sons and daughters of those women who took this hormone during a 30-year period from the 1950s through to the 1970s. Our knowledge of human development is continually evolving and awareness of the way our understanding is changing is important. Using this textbook alone, therefore, cannot guarantee success. What it can do, however, is point you in the right direction to find the resources that will enable you to keep your learning – and your assessment answers – up to date.
- Finally, remember that prenatal development is just one part of the developmental process. What happens during this period of life has implications for further development – physically, cognitively, socially and emotionally (see Figure 2.1). Good assessment answers will take account of this and will recognise that developmental psychology is just one element

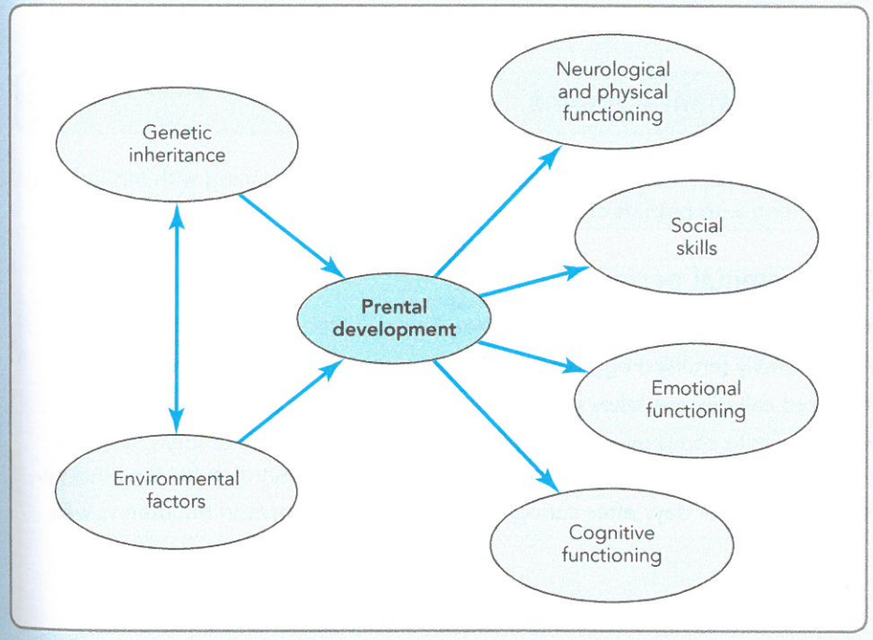


Figure 2.1 A schematic representation of the relationship between prenatal development and later functioning

of an extensive discipline. Making links between the different areas of psychology is an important part of the learning process; demonstrating such a synthesis of knowledge is also a feature of good assessment answers and will therefore be encouraged throughout this chapter.

Can you draw a similar diagram to demonstrate the relationship between developmental psychology and the other core areas of psychological study – for example, cognitive, social, individual differences and neuropsychology?

Sample question

Could you answer this question? Below is a typical essay question that could arise on this topic.

Sample question *Essay*

Critically evaluate the risks to development during the prenatal period.

Guidelines on answering this question are included at the end of this chapter, whilst further guidance on tackling other exam questions can be found on the companion website at: **www.pearsoned.co.uk/psychologyexpress**

Developmental stages

Prenatal development lasts approximately 266 days, beginning with fertilisation and ending with birth. It can be divided into three periods.

The germinal period

- First two weeks after conception (see Figure 2.2).
- The newly fertilised egg is known as a zygote.
- Rapid cell division takes place within the zygote by *mitosis*.
- The zygote comprises the blastocyst, which becomes the embryo, and the trophoblast, an outer layer of cells that will provide nutrition for the embryo.
- Finally, 10–14 days after conception the zygote implants in the uterine wall.

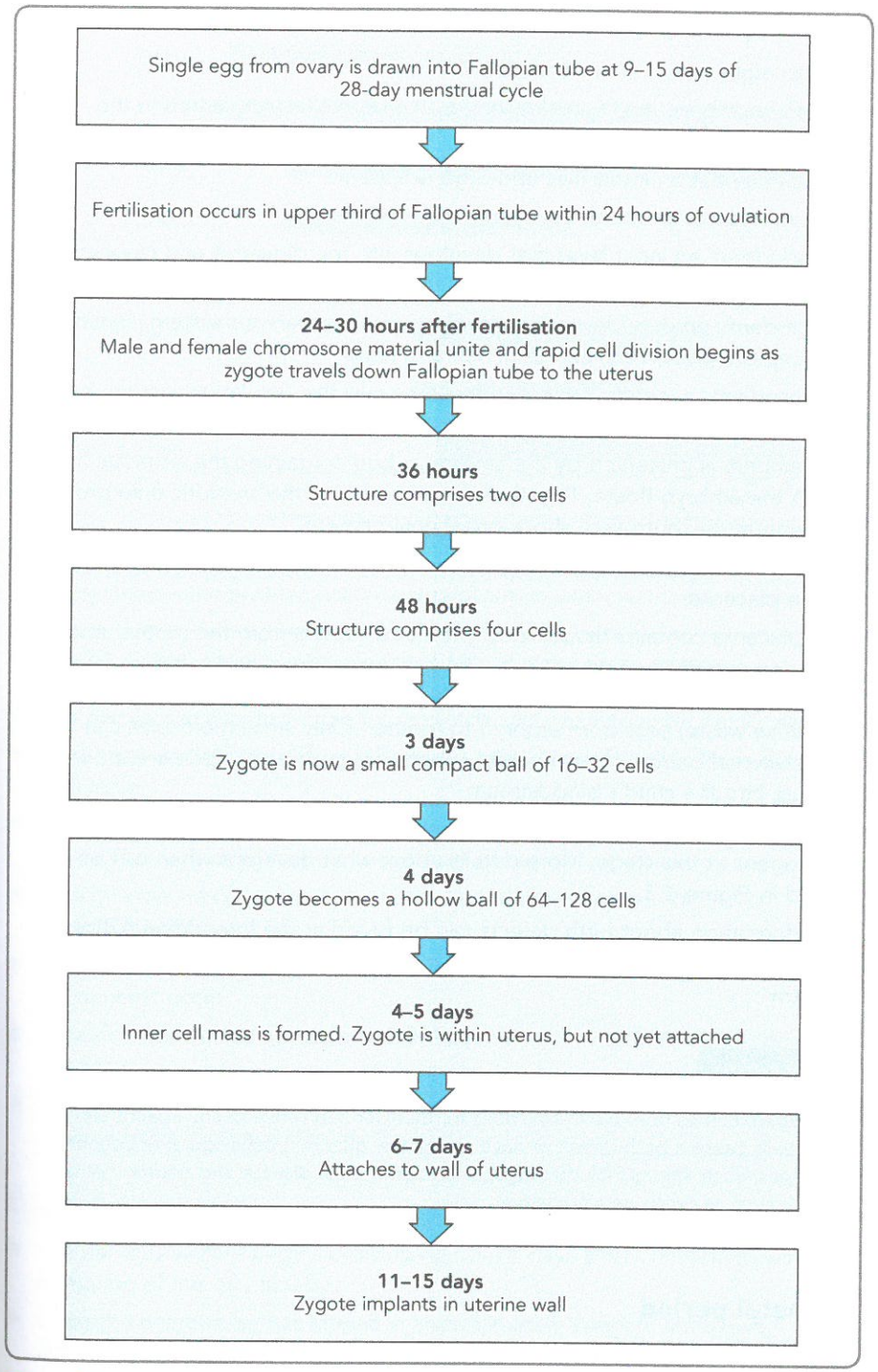


Figure 2.2 Main processes of the germinal period of development

The embryonic period

- Two to eight weeks after conception.
- Begins once blastocyst (now known as an embryo) has implanted in the uterine wall.
- Cell differentiation intensifies and organs appear.
- The embryo comprises three layers.
  - *endoderm*: an inner layer that develops into the digestive and respiratory systems.
  - *ectoderm*: an outer layer that develops into the nervous system, sensory receptors (eyes, ears) and skin, hair and nails.
  - *mesoderm*: a middle layer that develops into the circulatory system, bones, muscles, excretory system and reproductive systems.
- The embryo is protected by the *amnion*, a bag containing the amniotic fluid in which the embryo floats. Together the amnion and the amniotic fluid provide a temperature-controlled, shock-proof environment.
- The umbilical cord contains two arteries and one vein and connects the baby to the placenta.
- The placenta contains tissues in which blood vessels from the mother and offspring entwine but do not join. Oxygen, water, food and salt pass from the mother's bloodstream to the embryo, and waste products (carbon dioxide, digestive waste) pass from embryo to mother. Only small molecules can cross the placental barrier; many harmful substances such as bacteria are too large to pass into the child's bloodstream.
- Major organs are formed during this period and so are most vulnerable to teratogens at this stage. More details about what develops when can be found in Figure 2.3.

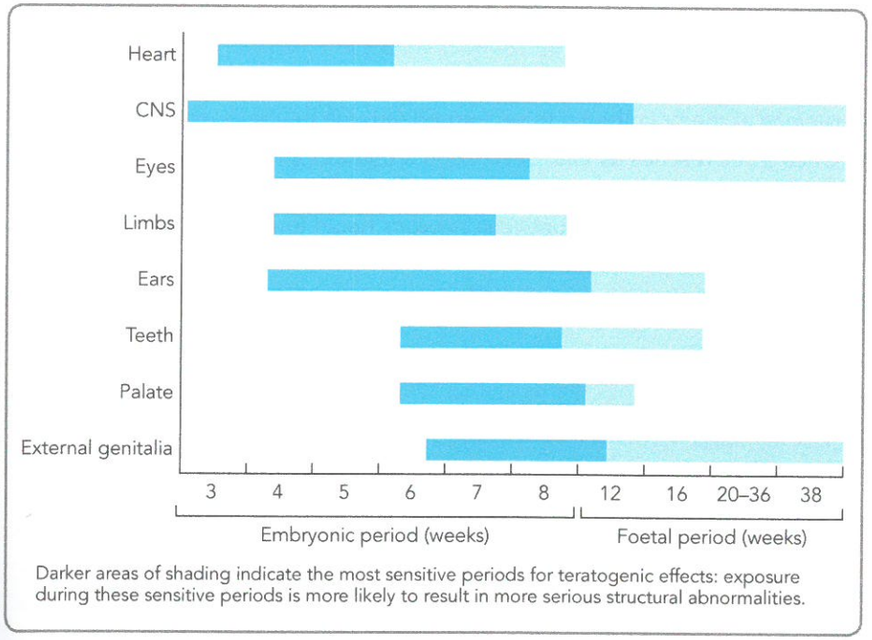
More information about birth defects can be found at the International Birth Defects Information System (IBIS) website: **http://www.ibis-birthdefects.org/index.htm**

Key term

Teratogen: comes from the Greek word for monster and refers to any agent that can potentially cause a birth defect or have a negative effect on behavioural or cognitive outcomes. Such agents include drugs, alcohol, maternal disease and environmental hazards such as exposure to radiation.

The foetal period

- Begins two months after conception and lasts on average for seven months.
- The organism is now known as a foetus.



Darker areas of shading indicate the most sensitive periods for teratogenic effects: exposure during these sensitive periods is more likely to result in more serious structural abnormalities.

Figure 2.3 Critical periods of development for the major organ systems

- The foetus is active, moving arms and legs and opening and closing mouth.
- Facial features can be distinguished and genitals can be identified as male or female.
- By the end of the fourth month a growth spurt occurs in the lower body and the mother begins to feel the movement of her unborn child.
- Activity increases over the fifth month and preferences are shown for particular positions.
- Grasp reflex develops by the end of the sixth month and irregular breathing movements occur.
- At seven months the foetus is viable, but will need help breathing if born at this time.
- During the last two months of prenatal development fatty tissues develop and organ functioning improves.

Brain development

- The nervous system begins developing 18–24 days after conception with the formation of the neural tube.
- Once the neural tube has closed in approximately Week 5, a massive proliferation of new immature neurons begins to take place.
- This neurogenesis continues throughout the prenatal period.

- At the peak of neurogenesis approximately 200,000 neurons are generated every minute.
- Around 6–24 weeks after conception the different levels, structures and regions of the brain begin to be formed through neuronal migration.
- Once a cell reaches its final destination it matures and develops a more complex structure.
- At 23 weeks connections between neurons begin forming, a process that continues postnatally.
- By the time they are born, babies have approximately 100 billion neurons.

Key terms

Neural tube: the precursor to the central nervous system (CNS), which includes the brain and spinal cord.

Neuron: nerve cell that handles information processing. Neurons are the core components of the CNS. They form complex networks that communicate through the transmission of chemical and electrical impulses.

Neurogenesis: the process by which neurons are generated. During prenatal development, neurogenesis is responsible for populating the growing brain with neurons.

Test your knowledge

2.1 What are the three stages of prenatal development?

2.2 During which stage is the unborn child most vulnerable to outside influences?

2.3 Which organ system has the longest period of vulnerability to teratogens?

2.4 How does the placenta protect the unborn child?

2.5 At what age (in months) is the foetus viable?

2.6 What is neurogenesis?

Answers to these questions can be found on the companion website at:
www.pearsoned.co.uk/psychologyexpress

Influences on development

Genes and heredity

The importance of genetics and inheritance for physical traits such as eye colour, height, etc. are well established. Likewise, it is known that chromosomal abnormalities can result in atypical development, as seen in Down's syndrome

or Fragile X. Such syndromes are often associated with specific cognitive or behavioural deficits. However, the extent to which other cognitive or behavioural problems have a genetic basis is not known. Likewise, the importance of inheritance for psychological traits such as intelligence and personality remains highly controversial.

Key terms

Genes: units of hereditary information composed of DNA, the complex molecule that contains our genetic information. Each gene controls one hereditary characteristic. Genes direct cells to reproduce themselves and manufacture the proteins that maintain life.

Chromosomes: threadlike structures composed of bundles of genes. Chromosomes come in 23 pairs, a member of each pair coming from each parent. Chromosomal abnormalities occur when there are structural problems with the chromosome (for example, a portion is missing or altered) or where the number of chromosomes is atypical. Down's syndrome, for instance, results from an extra copy of chromosome 21.

Further reading Genes and heredity

Topic	*Key reading*
Behaviour and genetics	Kagan, J., Articus, D., Feng, W. Y., Snidman, N., & Hendler, J. (1994). Reactivity in infants: A cross-national comparison. *Developmental Psychology, 30*(3), 342–345.
Chromosomal abnormalities and atypical development	McGuffin, P., Riley, B., & Plomin, R. (2001). Genomics and behavior: Toward behavioral genomics. *Science, 291*, 1232–1249.

CRITICAL FOCUS

Are behavioural tendencies inherited?

In the paper 'Reactivity in infants: A cross-national comparison', Kagan et al. (1994) argue that behavioural traits such as the amount of motor activity seen in infants are innate. In this study, Kagan provides evidence for very different patterns of motor arousal in four-month-old infants in three different cultures: China, Ireland and the USA. The data suggests that Chinese infants are much calmer, quieter and less fretful than the American and Irish infants, which Kagan cites as evidence for *biological* differences in temperament between Caucasian and Asian infants.

As you are reading this paper, think very carefully about the evidence Kagan provides. Can we be certain that these differences are biological? He cites evidence of earlier studies showing this difference in younger infants. Does this therefore negate the experiential factor? At what point in development is experience relevant? For example, how might prenatal experiences have influenced the behaviours shown by these infants? How might this idea be tested further? For instance, would it be useful for studies to test Asian infants born in the USA?

An important issue highlighted by this paper is the role of culture in development, which is one of the environmental factors discussed in this section. The social context of development is clearly important as it helps define beliefs and social practices. Remember, though, that culture is not defined by geography: culture refers to the attitudes and behaviour that are characteristic of a particular social group or organisation. These attitudes and behaviours may therefore be influenced by social and economic factors as well as ethnicity. Can you think of different cultural groups in the UK for example? This paper therefore highlights one of the links between social and developmental psychology.

Environmental factors

A range of environmental factors have been suggested to impact on human development, including culture, socio-economic status and family context. Such factors are relevant from before birth as they will impact on issues such as access to, and uptake of, prenatal care, maternal and paternal lifestyle choices, exposure to potential teratogens, etc. They may also confound some of the other factors thought to influence prenatal development, as described in the paper by Nebot, Borrell and Villalbi (1997).

Further reading Environmental factors

Topic	*Key reading*
Socio-economic factors influencing adolescent motherhood	Nebot, M., Borrell, C., & Villalbi, J.R. (1997). Adolescent motherhood and socio-economic factors: An ecological approach. *European Journal of Public Health, 7*, 144–148.
Factors influencing prenatal care	Scholl, T. O., Hediger, M. L., & Belsky, D. H. (1994). Prenatal care and maternal health during adolescent pregnancy: A review and meta-analysis. *Journal of Adolescent Health, 15*, 444–456.

Gene–environment interactions

There is evidence to support a role for both inheritance and environment in the development of a range of psychological functions, including intelligence and personality, as well as psychological disorders such as schizophrenia. In terms of intelligence and personality, it is suggested that, while the *genotype* (a given combination of genes) is inherited, the *phenotype* (that which is observed) develops over time in response to environmental factors. Likewise it may be that an individual inherits a particular genotype that predisposes them to developing schizophrenia, but whether the disorder is actually manifest in an individual will depend on the presence of environmental triggers (diathesis-stress model). While the relevance of genetics prenatally may be evident, the role of the prenatal environment should also be considered and factors such as maternal health and well-being should not be dismissed lightly. Indeed there is increasing evidence that prenatal stress combined with a genetic predisposition affects changes in brain development associated with schizophrenia.

Key terms

Genotype: a person's actual genetic material.

Phenotype: the way that an individual's genotype is expressed in observed and measureable characteristics.

Diathesis-stress model: a psychological theory that explains behaviour as a result of both genetic factors and life experiences. The term 'diathesis' refers to a genetic predisposition towards a specific disorder. According to this model, this predisposition, in combination with certain kinds of environmental stress, results in atypical behaviour.

Further reading Gene–environment interactions

Topic	*Key reading*
Genes and prenatal environment in the development of schizophrenia	Koenig, J. I., Kirkpatrick, B., & Lee, P. (2002). Glucocorticoid hormones and early brain development in schizophrenia. *Neuropsychopharmacology, 27*, 309–318.

Test your knowledge

2.7 Which human characteristics are significantly affected by heredity?

2.8 How do environment and genetics work together to determine human characteristics?

2.9 How convincing is the evidence for the inheritance of behavioural tendencies?

Answers to these questions can be found on the companion website at: **www.pearsoned.co.uk/psychologyexpress**

Threats to development

A teratogen is any agent that has the potential to cause a birth defect or have a negative affect on cognitive and behavioural outcomes. The effects of teratogens may not always be evident at birth. Severity of damage is linked to a range of factors, including dose, developmental period during which exposure takes place (see Table 2.1) and genetic susceptibility. The most common teratogens are the following.

Maternal health

Illness in pregnancy can have devastating effects, depending on the timing. Rubella in the eleventh week of pregnancy can cause blindness, deafness, heart defects and brain damage as this is a critical developmental stage for organ development.

Rubella at later stages of pregnancy may, however, have no long-term impact on the unborn child. Other infections with the potential to harm include chickenpox, some sexually transmitted diseases (for example, syphilis) and AIDS. Table 2.1 lists other common diseases and their effects. An important issue here for psychologists is how these risks can be reduced. As noted earlier, strategies may be employed at either a social or an individual level. Once you have finished studying this section, create your own final column for this table – 'ways of reducing risk' – and enter as many different ways of reducing risk as you can think of, based on your reading.

Maternal diet and nutrition are also important, as the developing embryo or foetus relies solely on the mother for its own nutrition. Maternal malnourishment increases the risk of deformity, while maternal obesity has been linked to foetal death, stillbirth and CNS defects. Folic acid deficiency has been linked to neural tube defects such as spina bifida.

Table 2.1 Threats to prenatal development due to maternal health problems

Disease or health condition	*Common effects for the unborn child*	*Impact of timing on teratogenic effect*
Rubella	Blindness Deafness Cognitive deficits Heart defects Cerebral palsy Microencephaly	Infection in weeks 1–8 most likely to lead to deficits (60–85% of cases), reducing to 50% in weeks 9–12 and 16% in weeks 13–24
Chickenpox	Premature birth Slowed growth Limb, facial or skeletal malformation	Infection in weeks 1–12 most likely to lead to deficits. Infection up to four days before birth can also have implications for perinatal health, resulting in neonatal death in 30% of cases
AIDS	HIV infection	Infection is more likely during the birth process or perinatally than prenatally
Chlamydia	Premature birth Low birth weight Neonatal conjunctivitis Pneumonia in newborn infant	Of infants born to infected mothers, 25% contract pneumonia and 50% contract conjunctivitis. In both cases infection is transmitted during the birth process
Syphilis	Blindness Deafness Cognitive deficits Heart defects	Syphilitic organisms cannot cross the placental barrier until Week 18. Thus, if treatment can be given before this time teratognic effects are rarely seen
Herpes	Microencephaly Hydrocephalus Cognitive deficit Eye defects	Prenatal infection occurs in only 8% of cases. Infection is more likely to occur during the birth process
Toxoplasmosis	Blindness Deafness Cognitive deficit	Infection in weeks 1–8 most likely to lead to deficits

Key terms

Spina bifida: a developmental birth defect caused by the incomplete closure of the embryonic neural tube. Some vertebrae overlying the spinal cord are not fully formed and remain unfused and open. If the opening is large enough, this allows a portion of the spinal cord to protrude through the opening in the bones, leaving it vulnerable to damage or infection. In more severe cases, damage to the nervous system may result in a range of problems, including partial or total paralysis of the lower limbs, bowel and bladder incontinence or learning difficulties.

Further reading Maternal health

Topic	*Key reading*
Maternal nutrition	Derbyshire, E. (2007a). The importance of adequate fluid and fibre intake during pregnancy. *Nursing Standard, 21*, 40–43.
Maternal nutrition	Derbyshire, E. (2007b). Nutrition in pregnant teenagers: How nurses can help. *British Journal of Nursing, 16*, 144–145.
Herpes infection during pregnancy and birth	Avigil, M., & Ornoy, A. (2006). Herpes simplex virus and Epstein-Barr virus infections in pregnancy: Consequences of neonatal or intrauterine infection. *Reproductive Toxicology, 21*, 436–445.
Rubella	Dontigny, L., Arsenault, M. Y., Martel, M. J., Biriuger, A., et al. (2008). Rubella in pregnancy. *Journal of Obstetrics and Gynaecology Canada, 30*(2), 152–168.
AIDS	The Royal College of Obstetrics and Gynaecology (2004). Clinical green top guidelines: Management of HIV in pregnancy. Available online at www.rcog.org.uk/womens-health/clinical-guidance/management-hiv-pregnancy-green-top-39
Teratogens	Further information on teratogens and papers concerning this issue are available from the Organisation of Teratology Information Specialists (OTIS) website: www.otispregnancy.org

Maternal age

Delayed childbirth is increasingly common in Western societies and this can increase risks to the health of both mother and child. Risks to the infant include prematurity, low birth weight and certain chromosomal abnormalities such as Down's syndrome. Risks are thought to be greatest for mothers over 30 years of age and have been linked to the declining condition of a woman's eggs; however, there is some evidence that in women with no pre-existing maternal health difficulties the risk of problems in pregnancy are lower. There are also risks for the offspring of younger mothers: adolescent pregnancies are more likely to result in premature birth and infant mortality rates for this age group are higher than for any other. However, there are possible confounding factors here related to social circumstances and social support: teenage mothers are more likely to be from lower-income families and live in areas of greater deprivation.

Key terms

Down's syndrome: a genetic abnormality that causes physical and intellectual impairments. Typical physical features include a flat facial profile, eyes that slant upwards, small ears, a flat back of the head and protruding tongue. People with the syndrome also tend to be shorter than average with poor muscle tone and have short, broad hands. Heart defects, intestinal problems and thyroid disorders are also common. People with Down's syndrome have varying degrees of learning disability, which may range from moderate to severe. Autistic spectrum disorders are also more common.

Further reading Maternal age

Topic	*Key reading*
Teenage pregnancy	Fraser, A. M., Brockert, J. E., & Ward, R. H. (1995). Association of young maternal age with adverse reproductive outcomes. *New England Journal of Medicine, 332*, 1113.
Older mothers	Jacobsson, B., Ladfors, L., & Milsom, I. (2004). Advanced maternal age and adverse perinatal outcome. *Obstetrics & Gynecology. 104*(4), 727–733.
Maternal age	Further information is also available from the Royal College of Obstetricians and Gynaecologists at: www.rcog.org.uk/what-we-do/campaigning-and-opinions/statement/rcog-statement-later-maternal-age

Maternal stress

Intense emotional states during pregnancy can affect the unborn child as the physiological changes experienced by the mother may have consequences for uterine blood flow and available oxygen levels. High levels of corticotrophin-releasing hormone (CRH) have been linked to maternal stress and subsequent premature birth and infant distress. Maternal stress may also have an indirect effect on the health of the unborn child by increasing the likelihood of maladaptive behaviours such as drug-taking, smoking and alcohol use.

Further reading Maternal stress

Topic	*Key reading*
Long-term effects of maternal stress in pregnancy	Talge, N. M., Neal, C., Glover, V., & the Early Stress, Translational Research and Prevention Science Network (2007). Fetal and neonatal experience on child and adolescent mental health: Antenatal maternal stress and long-term effects on neuro-development. How and Why? *Journal of Child Psychology and Psychiatry, 48*, 245–261.

Prescription and non-prescription drugs

Potentially harmful prescription drugs (see Table 2.2) include certain antibiotics (for example, streptomycin), anticonvulsants, antidepressants and synthetic hormones (for example, DES). Thalidomide prescribed for morning sickness in the 1960s is a commonly cited example of the disastrous effects of drugs on the unborn child. Non-prescription drugs with potential to harm include diet pills and aspirin.

Key terms

DES (diethylstilbestrol): a non-steroidal synthetic oestrogen, once prescribed for some women during pregnancy to prevent miscarriages. It was banned for such use when it was discovered that daughters born to mothers who took this drug had abnormally high rates of cervical and vaginal cancer.

Thalidomide: this drug was prescribed to pregnant women to prevent morning sickness in the late 1950s and early 1960s. Unfortunately the drug caused severe deformities in babies known as phocomelia, a condition in which the limbs either do not develop or present as stumps.

Table 2.2 Drugs and their effects on prenatal development

Drug	*Drug type and use*	*Effects*
Carbemazepine and phenytoin	Prescription drugs. Used to control seizures (anticonvulsants)	Cleft lip and palate Neural tube defects Kidney disease Restricted growth
Aspirin, ibuprofen and other non-steroidal anti-inflammatory drugs (NSAIDs)	Non-prescription pain relief. Occasional use is not problematic	Neonatal bleeding Raise the risk of delayed labour
Sotretinoin and etretinate	Prescription drugs used to treat chronic acne and psoriasis	They may cause chronic malformations during the stage of organ development
Ergotamine and methysergide	Prescribed for migraine attacks	Raise the risk of premature labour
Coumarin	Anticoagulant drugs used in the treatment of heart disease and stroke to slow blood clotting	Taken during early pregnancy, they are associated with facial malformations and mental retardation. Later on they raise the risk of uncontrolled bleeding
Tetracycline	Antibiotic. Safe to use in the first four months of pregnancy	Discolouration of teeth Reduced bone growth

Illegal drugs

Cocaine use in pregnancy has been linked to low weight, body length and head circumference at birth, as well as more long-term neurological and cognitive deficits, including impaired motor development at two years of age, lower arousal, poorer self-regulation, higher excitability and poorer reflexes at one month of age. However, confounding variables linked to the environment and lifestyle of drug users should also be considered (for example, poverty and malnutrition). Children born to heroin users have been found to show withdrawal symptoms immediately after birth, including tremors, irritability, abnormal crying, disturbed sleep and impaired motor control. Heroin use in pregnancy has also been linked to behavioural problems and attention deficits in later childhood.

Alcohol

Consistent heavy drinking in pregnancy can result in foetal alcohol syndrome (FAS), a cluster of abnormalities that include facial deformity, defective limbs, heart problems and cognitive impairment. Binge drinking has also been found to lead to cognitive impairment and behavioural problems in offspring. Some studies have suggested that even moderate drinking in pregnancy can result in reduced attention and alertness that lasts at least through early childhood (four years of age).

Tobacco

Smoking cigarettes during pregnancy reduces the oxygen content while increasing the carbon monoxide content of the mother's blood and this in turn reduces the amount of oxygen available to the unborn child. This has been shown to increase the chance of premature birth, low birth weight, foetal and neonatal death, sudden infant death syndrome (SIDS) and respiratory problems. Nicotine withdrawal has also been noted in neonates of smoking mothers. Links have also been made to attention deficit hyperactivity disorder (ADHD) in childhood. Second-hand smoke may also affect the mother's health and thus the health of her unborn child; father's smoking may therefore have negative consequences for the child's health.

KEY STUDY

Mattson et al. (2010). Toward a neurobehavioral profile of fetal alcohol spectrum disorders

Excessive prenatal alcohol exposure can result in a number of developmental difficulties, including problems with cognitive functioning and behaviour. However, not all infants exposed to large amounts of alcohol prenatally go on to develop FAS. A primary goal of recent research is to enable better and quicker diagnosis of problems in infants exposed to alcohol to enable more timely interventions. The study by Mattson and her colleagues is a good example of recent work that has attempted to use neuropsychological data to develop a battery of tests to identify and differentiate FAS. The researchers were able to distinguish children with FAS from a control group not exposed to alcohol prenatally with 92 per cent accuracy. More importantly, they were able to distinguish children with heavy prenatal alcohol exposure but without FAS and non-exposed controls with 84.7 per cent accuracy. Overall, the neuropsychological test battery was more successful at distinguishing the groups than IQ testing. Measures of executive function and spatial processing were found to be especially sensitive to prenatal alcohol exposure.

Mattson, S. N., Roesch, S. C., Fagerlund, A., Aulti-Ränö, I., Lyons Jones, K., May, P. A., Adnams, C. M., Konovalova, V., Riley, E. P. & the CIFASD (2010) Toward a neuro behavioural profile of fetal alcohol spectrum disorders. *Alcoholism: Clinical & Experimental Research, 34*(9), 1640–1650.

Further reading Drug, alcohol and tobacco use in pregnancy

Topic	*Key reading*
Alcohol	Sayal, K., Heron, J., Golding, J., & Emond, A. (2007). Prenatal alcohol exposure and gender differences in childhood mental health problems: A longitudinal population-based study. *Pediatrics, 119*, e426–e434.
FAS	Caley, L., Syms, C., Robinson, L., Cederbaum, J., Henry, M., & Shipkey, N. (2008). What human service professionals know and want to know about fetal alchohol syndrome. *Canadian Journal of Clinical Pharmacology, 15*, e117–e123.
Tobacco use	Shea, A. K., & Streiner, M. (2008). Cigarette smoking during pregnancy. *Nicotine and Tobacco Research, 10*, 267–278.
Alcohol, marijuana and tobacco	Faden, V. B., & Graubard, B. I. (2000). Maternal substance use during pregnancy and developmental outcome at age three. *Journal of Substance Abuse, 12*, 329–340.
Cocaine and/ or opiates	Lester, B. M., Tronick, E. Z., LaGasse, L., Seifer, R., et al. (2002). The maternal lifestyle study: Effects of substance exposure during pregnancy on neurodevelopmental outcome in 1-month-old infants. *Pediatrics, 110*(6), 1182–1192.

Environmental hazards

Radiation can cause gene mutations; chromosomal abnormalities are higher in the offspring of fathers exposed to high levels of radiation through their occupation. X-rays in the first few weeks of pregnancy (when expectant mothers often do not know they are pregnant) increases the risk of microencephaly, cognitive problems and leukaemia.

Other hazards include pollutants such as carbon monoxide, mercury (sometimes found in fish such as tuna), certain fertilisers and pesticides.

Further reading Environmental hazards

Topic	*Key reading*
Environmental hazards such as air pollution	Hertz-Picciotto, I., Park, H.- Y., Dostal, M., Kocam, A., Movec, T., & Sram, R. (2008). Prenatal exposure to persistent and non-persistent organic compounds and effects on immune system development. *Basic & Clinical Pharmacology & Toxicology, 102*(2), 146–154.

Sample question *Problem-based learning*

Your sister's best friend Lisa is pregnant with her first child at the age of 17. Lisa is not known for her healthy lifestyle – like many of her friends she smokes and drinks and says she 'hates' exercise. She is not keen on giving up her partying lifestyle now she is pregnant. In fact she thinks she should 'make the most' of her freedom before being 'tied down' by a baby. Your sister is worried that Lisa might be putting herself and her unborn baby at risk.

What sort of things could your sister encourage Lisa to do to make sure she gives birth to a healthy baby?

Paternal health

As noted earlier, fathers who smoke risk affecting the health of their unborn child through effects on the mother's health. However father's health preconception is also important and can directly influence the development of their child. Thus exposure to environmental pollutants, poor diet and drug and alcohol use have all been suggested to cause abnormalities in the father's sperm, resulting in miscarriage, childhood disease such as cancer and infant deformity. More recently father's age has been suggested to increase the risk of birth defects.

Further reading Paternal health

Topic	*Key reading*
Paternal exposure to environmental hazards	Cordier, S. (2008). Evidence for a role of paternal exposures in developmental toxicity. *Basic & Clinical Pharmacology & Toxicology, 102*, 176–181.
Paternal age	Yang, Q., Wen, S. W., Leader, A., Chen, X., Lipson, J., & Walker, M. (2007). Paternal age and birth defects: How strong is the association? *Human Reproduction, 22*, 696–701.

Test your knowledge

2.10 How can fathers ensure the health of their future child?

2.11 Which maternal diseases pose the greatest threat during the birth process or perinatally?

2.12 What are the main characteristics of FAS?

Answers to these questions can be found on the companion website at:
www.pearsoned.co.uk/psychologyexpress

Sample question *Essay*

Discuss the importance of timing for ameliorating or enhancing the teratogenic effects of maternal disease, drug and alcohol use and environmental agents such as radiation.

Sample question *Information provider*

Design a website for parents with information about the impact of environmental and other agents on the future cognitive and psychological health of their unborn child.

Prenatal learning and cognitive development

Evidence of prenatal learning is linked to infant auditory perception. Hearing develops at around the sixth month prenatally and it has been well established that the foetus can perceive and respond to sounds, such as speech and music. The recognition of, and preference for, their mother's voice shown by neonates is thought to be a learnt response based on prenatal experience. Research studies have also shown that neonates can recognise either music or prose they have been exposed to prenatally, suggesting the development of cognitive skills such as memory before birth. A burgeoning industry has also built up around the idea that prenatal sonic stimulation with classical music (for example, Mozart and Bach) can have a positive effect on prenatal development, although the evidence for this is equivocal.

Hormonal levels have been found to influence later cognitive skills, including sex differences. Increased levels of testosterone are thought to result in more rapid growth of neurons in the foetal brain and have been linked to enhanced spatial skills.

Further reading Prenatal learning and cognitive development

Topic	*Key reading*
Prenatal learning	DeCasper, A. J., & Spence, M. J. (1986). Prenatal maternal speech influences newborns' perception of speech sounds. *Infant Behavior and Development, 9*, 133–150.
Prenatal learning	DeCasper, A. J., & Fifer, W. P. (1980). Of human bonding: Newborns prefer their mothers' voices. *Science, 280*(6), 1174–1176.
Prenatal/early influences on later cognitive development	Caulfield, R. (2002). Babytalk: Developmental precursors to speech. *Early Childhood Education Journal, 30*, 1573e–1707e.

? Sample question *Problem-based learning*

A pregnant neighbour has read about prenatal learning programmes and is wondering whether or not to invest in one. She asks for your opinion as a student of psychology. What would you tell her about the evidence for such systems and the pros and cons of her investment were she to make one in terms of time and money? Can you suggest anything else she could do to give her baby the best start in life?

CRITICAL FOCUS

DeCasper and Spence (1986). Prenatal maternal speech influences newborns' perception of speech sounds

In this study mothers read the Dr Seuss story *The Cat in the Hat* to their foetuses during the last six weeks of gestation. After birth, babies were given dummies linked to recordings of this and another story that were read aloud by their mother. Babies sucked more on the dummy linked to the recording of the Dr Seuss story, suggesting a preference for *The Cat in the Hat*. This indicates that newborns could recognise the story read aloud by their mothers prenatally and the study is therefore often cited as evidence for prenatal learning. However, it has also been used as evidence to support the burgeoning industry that has developed around prenatal learning programmes. See **www.babyplus.com/WhatIsIt.php** for one example of such a programme.

While reading this paper you should consider the following types of questions. Can you think of any problems with the way this study has been used? Just how much does it tell us about prenatal learning? Does the study provide *any* evidence to support the idea that education should begin prenatally?

Do a literature search using an academic search engine such as Psycinfo to find further evidence about prenatal learning and postnatal preferences. To what extent does the evidence fit the claims of those advocating prenatal learning?

DeCasper, A. J. & Spence, M. J. (1986). Prenatal maternal speech influences newborns' perception of speech sounds. *Infant Behavior and Development, 9*, 133–150

? Sample question *Essay*

To what extent does the evidence support the suggestion that prenatal experiences may affect postnatal preferences and behaviours?

Chapter summary – pulling it all together

- Can you tick all the points from the revision checklist at the beginning of this chapter?
- Attempt the sample question from the beginning of this chapter using the answer guidelines below.
- Go to the companion website at **www.pearsoned.co.uk/psychologyexpress** to access more revision support online, including interactive quizzes, flashcards, You be the marker exercises as well as answer guidance for the Test your knowledge and Sample questions from this chapter.

Answer guidelines

✱ Sample question *Essay*

Critically evaluate the risks to development during the prenatal period.

Approaching the question

Your answer should aim to provide an analysis of risks to psychological development, describing what these risks are and discussing how they will impact on later outcomes for the child. Remember to keep the focus on psychological impacts rather than purely physical outcomes.

Important points to include

- Begin by outlining the factors that are relevant, including genetics, environmental (teratogenic) agents and the possiblity of gene–environment interactions.
- Discuss the ways in which genetics can influence prenatal development and what impact this might have on future psychological functioning.
- Discuss some of the different types of environmental teratogens such as:
  - maternal infectious disease or malnutrition
  - impacts of maternal drug or alcohol use
  - noxious agents in the physical environment
  - paternal health.
- For each you will need to:
  - highlight how the vulnerability of the organism and different organ systems change at specific stages of development
  - demonstrate the importance of timing of exposure to potential hazards, and show how this differs for different teratogens
  - show what the effect of any damage to the organism might be for later psychological well-being.

Make your answer stand out

It is really easy to fall into the trap of simply describing a number of teratogens and how they affect human development during the prenatal period. A good answer will take a critical stance, evaluating the impact of the risk for later development and will focus clearly on psychological aspects of development, including cognitive, social and emotional elements. Linking your evaluation to what you know about other periods of development will demonstrate your ability to synthesise the information you have learnt. Evaluating the methodological approaches of any research studies cited will also make your answer stand out.

Explore the accompanying website at www.pearsoned.co.uk/psychologyexpress

- → Prepare more effectively for exams and assignments using the answer guidelines for questions from this chapter.
- → Test your knowledge using multiple choice questions and flashcards.
- → Improve your essay skills by exploring the You be the marker exercises.

Notes