4.2 Reproduction and survival

Nothing lives forever. An insect may live for only a few weeks. A tree may last thousands of years. Since every individual will eventually die, there must be a way of producing new individuals or the species will become extinct. This production of new individuals by parents is called reproduction. It is one of the most amazing processes in nature.

INQUIRY science 4 fun

Flowers

What is in a flower?

No

Collect this…

- 2 different garden flowers (make sure they are not poisonous)
- pair of tweezers
- knife or fine pair of scissors

Do this…

1. Look at each flower and identify parts of the two flowers that look similar.
2. Carefully pull each flower apart and place its different parts into separate piles. Each pile should have parts that look similar.
3. Try to find some seeds.
4. Think about the function (role) of the different parts of the flower.

Record this…

Describe what you observed.

Explain how each part might contribute to the life of the flower.

Methods of reproduction

Unless you have an identical twin, no one else is like you. However, all the plants in a crop of potatoes can be identical. This is because humans and potatoes reproduce in different ways.

There are two basic methods of reproduction:

- sexual (needing two parents)
- asexual (needing only one parent). 'Asexual' means 'without sex'.

Although most plants and animals use only one of these methods, some can use both.

Sexual reproduction

Sexual reproduction happens when a sperm (from a male) and an egg (from a female) join together in a process called **fertilisation**. Sperm and eggs are special reproductive cells, called gametes. The male sex cell is sperm and the female sex cell is the egg. Fertilisation results in a new cell (called a **zygote**), which then grows by dividing to form many copies of itself. The zygote eventually grows and develops into a new individual. In Figure 4.2.1 on page 140 you can see many human sperm around a single egg.

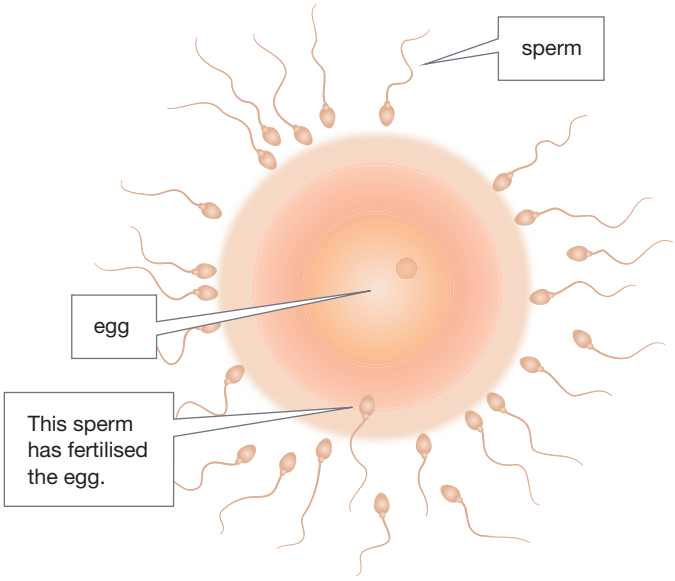
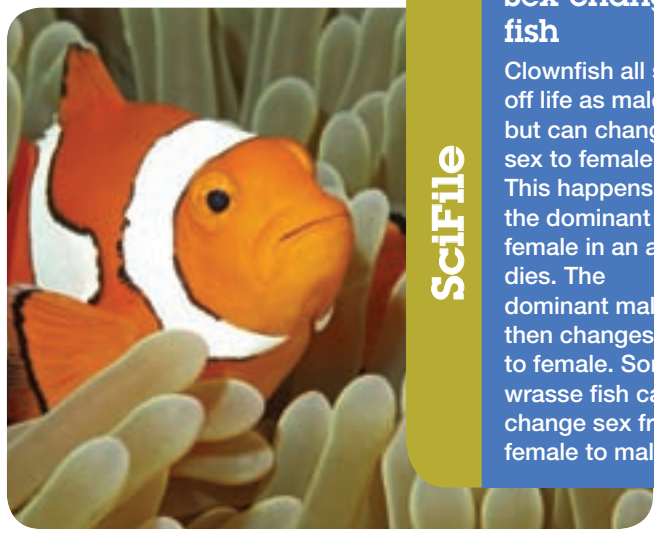


Figure 4.2.1 Human sperm and an egg. Sperm have a tail to help them swim. During fertilisation only one sperm enters the egg.

Humans, dogs, cattle, birds and kangaroos undergo sexual reproduction and need two parents, one male and one female.

A few species like tapeworms have individuals that have both male and female sex organs. They can therefore produce both sperm and eggs. Individuals with both sex organs are known as **hermaphrodites**. In Figure 4.2.2 you can see a flatworm, which is a hermaphrodite. The ovaries make the female gametes and the testes make the male gametes.



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Sex-change fish

Clownfish all start off life as males, but can change sex to female. This happens if the dominant female in an area dies. The dominant male then changes sex to female. Some wrasse fish can change sex from female to male.

Sexual reproduction in flowering plants

Flowers are reproductive structures in plants that produce the gametes and allow fertilisation to occur. This results in a seed. You can see a typical flower in Figure 4.2.3.

To form a seed, the pollen produced in the **anther** needs to be deposited on the **stigma**. The transfer of pollen to the stigma is known as **pollination**. The pollen grain develops into a long tube called the pollen tube that grows through the **style**. The pollen tube grows down to the ovary and into the egg. In flowering plants, the egg is inside a structure known as the ovule. During this process, the male gamete passes down the pollen tube to join the female gamete in the ovule. After this joining of male and female gametes, a seed gradually develops.

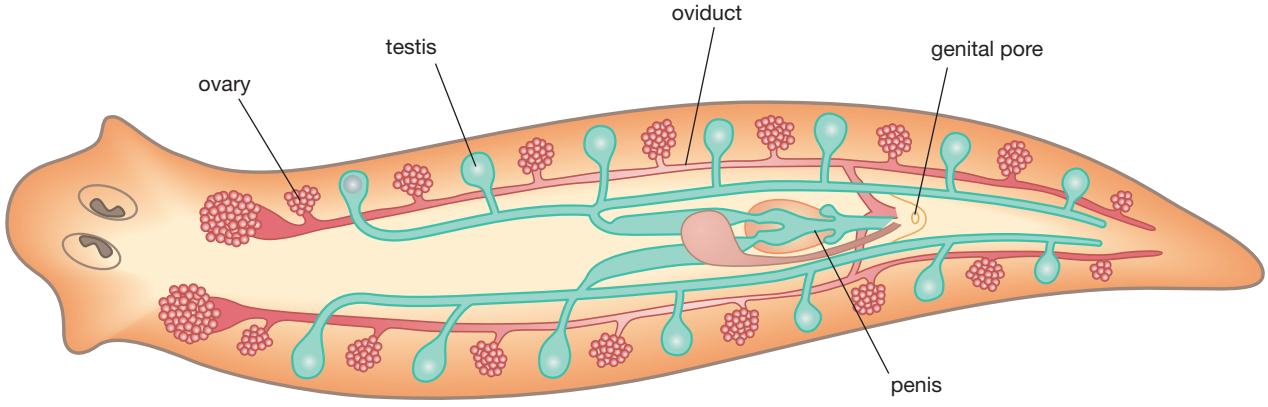


Figure 4.2.2 This flatworm is a hermaphrodite, with both male sex organs (shaded blue) and female sex organs (pink). The penis passes sperm to another flatworm through a small tube called the genital pore. The oviduct is a tube for the egg to move to the genital pore.

Seeds develop in a structure in plants called the fruit. A **fruit** is the remains of the ovary, plus all the seeds it contains. In some plants, fruit will appear as seed cases or pods. This means that fruit range from very juicy (like an apple) to hard and dry seed cases like a gumnut.

A seed is a capsule containing a new plant, called an **embryo**. The embryo is at a very early stage of its development, supported by a food supply inside the seed. You can see a seed in Figure 4.2.4.

The embryo in a seed is dehydrated (dried out) and requires water and warmth before it will grow. The seed swells up by absorbing water, and this triggers the growth of the embryo.

The embryo then sprouts out of the seed in a process called **germination**. The embryo uses the stored food in the seed and begins to grow. It will begin making its own food when it reaches the sunlight above the ground.

1 p148 2 p149 4.3

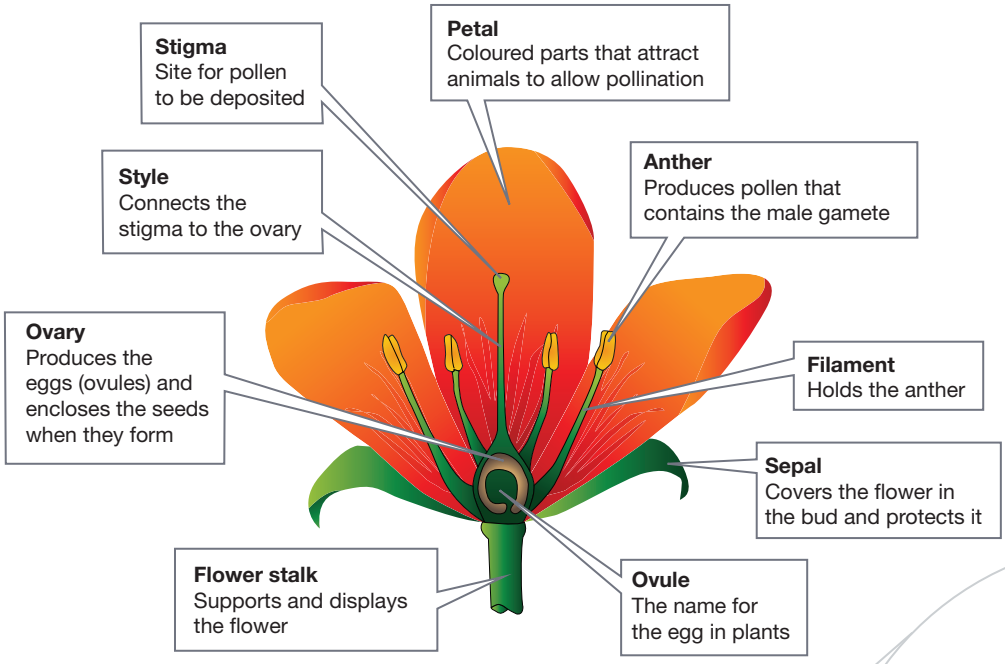


Figure 4.2.3 A flower is a reproductive structure.

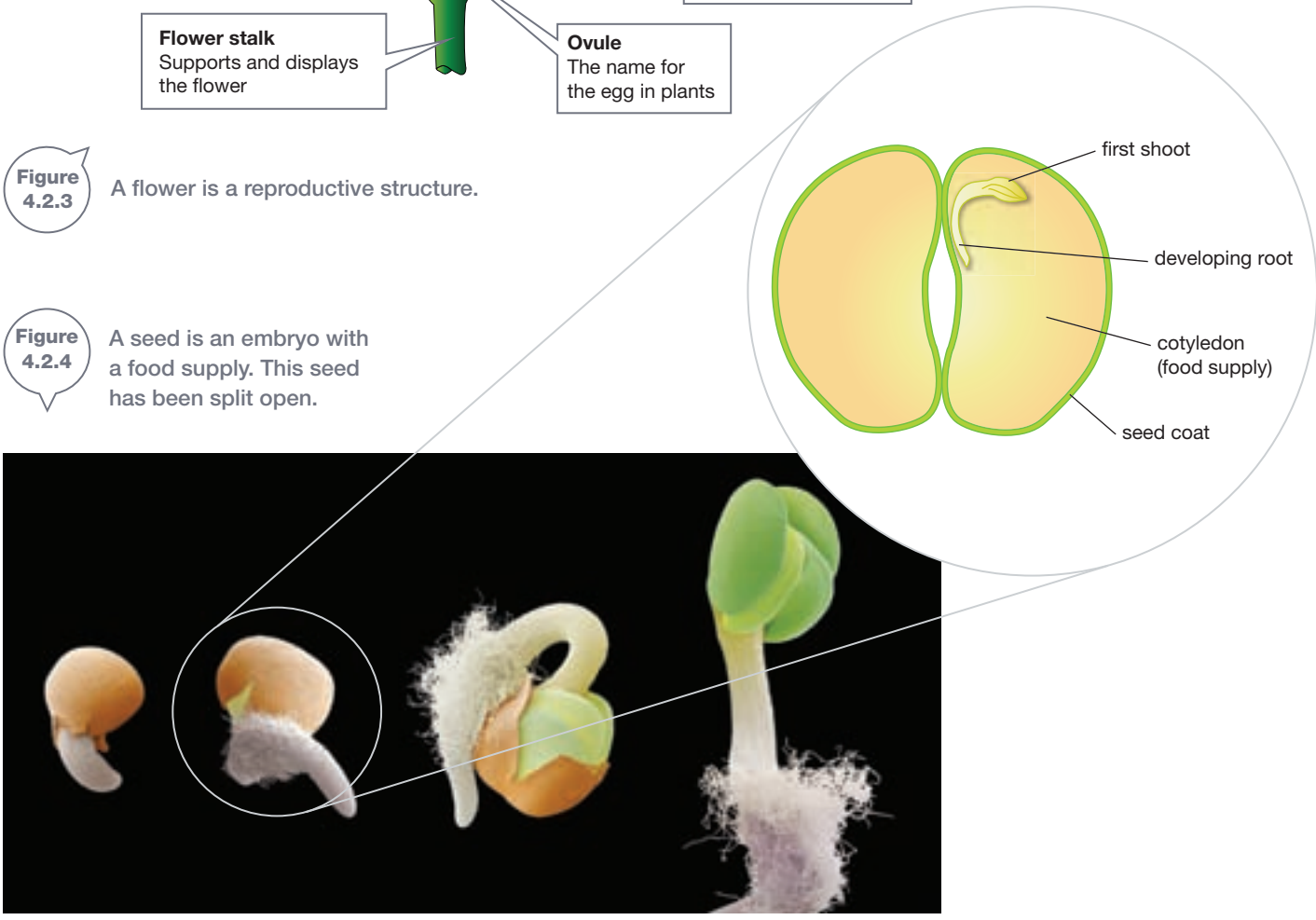


Figure 4.2.4 A seed is an embryo with a food supply. This seed has been split open.

Plants other than flowering plants have different methods of sexual reproduction. Conifers such as pine trees also make seeds, but they do not have flowers. They produce seeds in a cone. Ferns and mosses do not make seeds, but they still produce embryos. But all plant groups show the basic feature of producing male and female gametes that then join to form a new individual.

Sexual reproduction in animals

Sexual reproduction can be very different in different animals. The differences are:

- how and where fertilisation occurs
- where the young develop
- the amount of parental care.

Site of fertilisation

Fertilisation takes place outside or inside the body, depending on the animal involved.

External fertilisation happens outside the body. Figure 4.2.5 shows fish fertilising eggs in the water. The sperm are also shed into the water and swim through it to reach the eggs. Frogs and most fish do this, and so do sea urchins and jellyfish. The water stops the sperm from drying out and they can swim through it.

Internal fertilisation happens inside the body. All land animals use internal fertilisation, as do some water-based (aquatic) species.

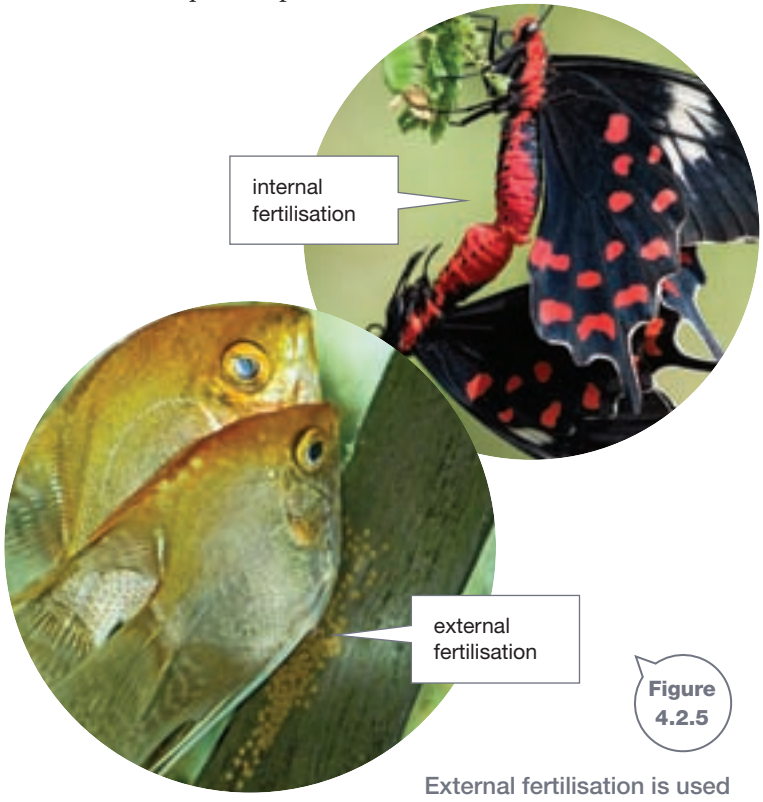


Figure 4.2.5 External fertilisation is used mainly by water animals like fish, and internal fertilisation is used mainly by land animals such as insects.

Internal fertilisation is better for land environments because sperm shed into the air may dry out and die. The act of joining together of the male and female to transfer sperm is called **copulation**. There are many different ways this happens. In dogs, the male inserts his penis into the female. In the octopus, the male transfers sperm with one of his tentacles.

Development

Development is the process in which the new individual changes to look like others of its type. The young can develop inside or outside the parent's body. Most mammals (animals that feed their young on milk) have internal development—the young develop inside the mother's body. Marsupials such as kangaroos have part internal and part external development. Most other animals, such as spiders, amphibians, birds and most reptiles and fish have external development. For example, birds lay eggs and the young develop inside the egg until they hatch. This is happening in Figure 4.2.6. Most aquatic animals also have external development.

Parental care

Parental care is common in animals such as mammals and birds. These animals have relatively large brains that need time to develop.

A human baby stays with its parents until it is mature enough to live independently. Birds also show a period of parental care. Most other animals show little or no parental care, especially once the eggs hatch. The general rule is that more complex animals need more parental care. As a human, you are a very complex animal and require a lot of parental care.

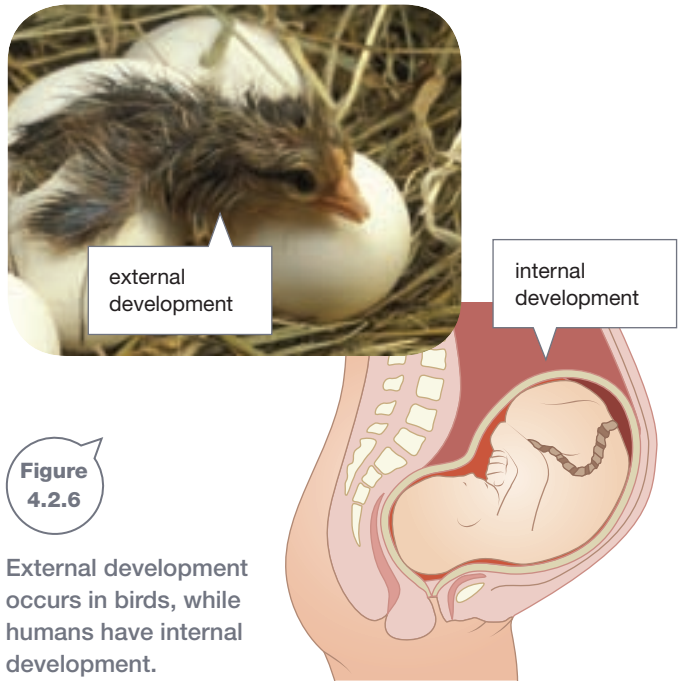


Figure 4.2.6 External development occurs in birds, while humans have internal development.

Asexual reproduction

Asexual reproduction requires only one parent. It occurs when a new individual grows from part of the parent's body. It does not involve sperm or eggs. An example is the freshwater animals called hydra. Hydra are relatives of jellyfish, and can reproduce both sexually and asexually. Figure 4.2.7 shows a young hydra growing from its parent. The young one was formed by asexual reproduction. It will break off the parent and lead a separate life.

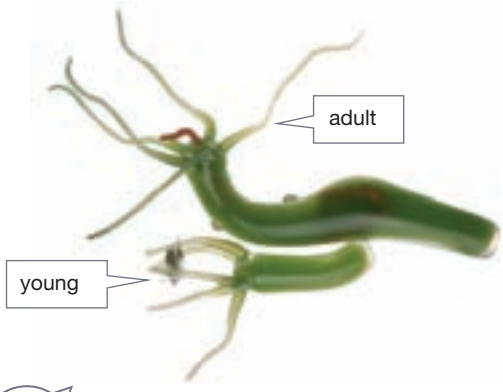


Figure 4.2.7 This adult hydra has a young hydra that was produced asexually still attached to it. The young one has caught a small water animal to eat.

INQUIRY science 4 fun

Hydra breakdown

What grows on a hydra?

No

Collect this…

- a live budding hydra in cavity slide without a coverslip (or a prepared microscope slide)
- hand lens

Do this…

Use the hand lens to observe your hydra carefully. Search its whole body looking for a bud.

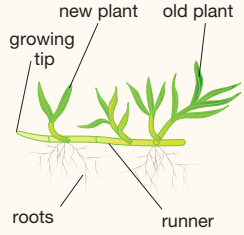
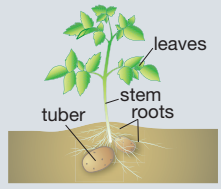
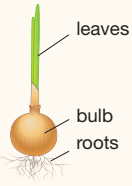
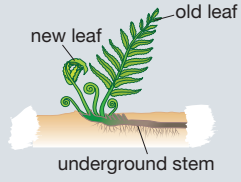
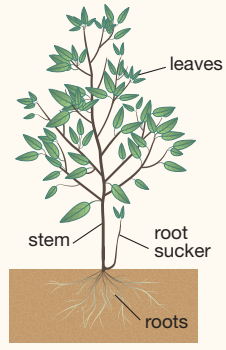
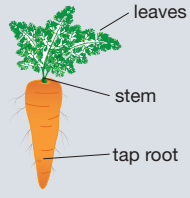
Record this…

Describe what you observed.
Explain what its function is.

Asexual reproduction in plants

In plants, asexual reproduction can occur by vegetative reproduction or by spores. Vegetative reproduction in plants is shown in the Table 4.2.1.

Table 4.2.1 Methods of vegetative reproduction

Vegetative reproduction method	Plants that show this	Structures involved	
Runners	Many grasses, strawberries, ivy, violets	Stems run along the ground surface. They send down roots at intervals.	
Stem tuber	Potato, yam	Swellings called tubers are attached to the stem underground and full of stored food.	
Bulbs	Onions, tulips, daffodils	Underground 'leaves' are full of stored food.	
Underground stem	Bamboo, bracken	Stems run along underground and send up leaves at intervals.	
Root suckers	Some eucalypts	Roots send up stems where they come near the surface.	
Tap root	Carrot, beetroot	Swollen roots are full of stored food.	

Fungi and plants such as ferns and mosses use spores to asexually reproduce. A spore is a microscopic single cell. Spores are used by plants and fungi to help them spread to many other places. This spread is called dispersal. Spores have a protective wall around them but are very light and easily carried by wind or water. They can also be carried by animals. You can see some places where spores are produced in Figure 4.2.8.

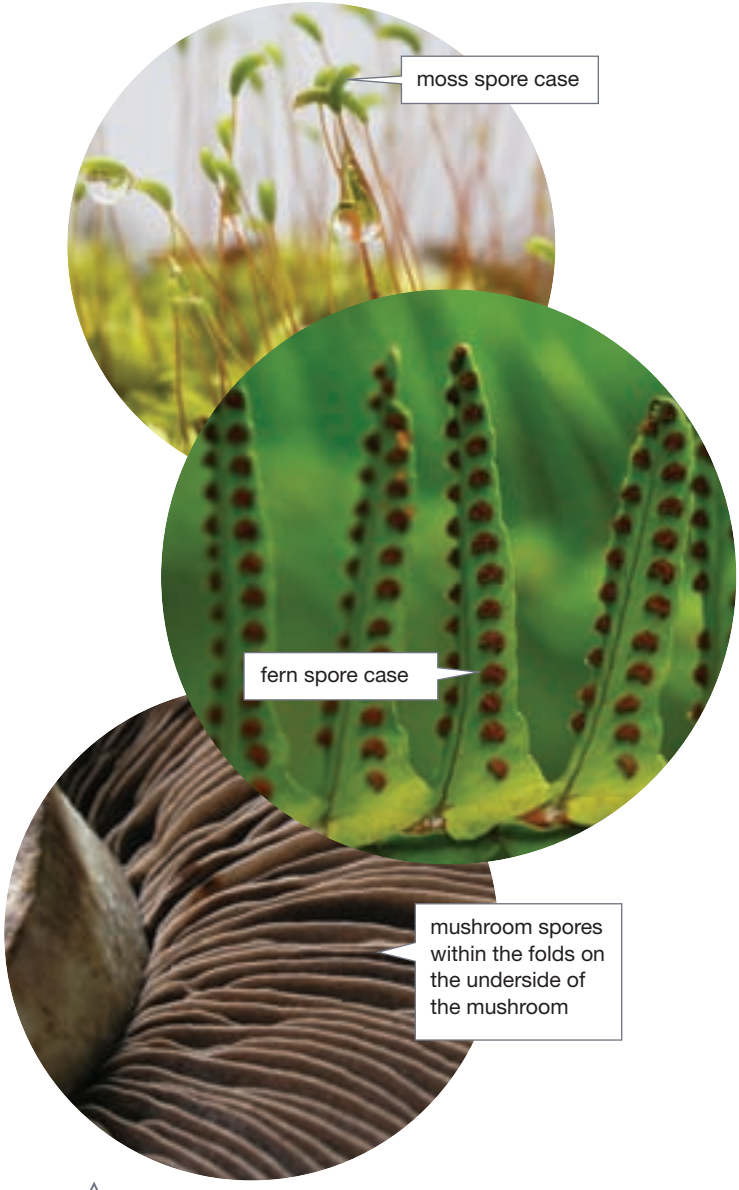


Figure 4.2.8 Plants such as ferns and mosses produce spores, as do fungi.

Asexual reproduction in simple organisms

Many simple organisms have bodies made of only one cell. One such group of single-celled organisms is the protozoa. Protozoa reproduce by dividing in two in a process called fission. You can see this in Figure 4.2.9.

Figure 4.2.9 This protozoa has nearly completed the process of dividing into two.

Asexual reproduction in animals

Few animals reproduce asexually. One that does is the hydra. Budding is the name for the process of asexual reproduction in the hydra, shown in Figure 4.2.7 on page 143. Another type of asexual reproduction is called **parthenogenesis**, where offspring develop from eggs that have not been fertilised by a male gamete. Parthenogenesis happens in water fleas, aphids, some bees, and a small number of reptiles and fish.

3 p150

Reproduction and the environment

Each type of reproduction, sexual and asexual, has advantages and disadvantages. The type of reproduction an organism uses is related to its environment.

Asexual reproduction and the environment

In some environments, asexual reproduction is an effective method of reproduction, particularly for:

- organisms that live a long way from others of their kind—they are able to reproduce without having to find a mate
- organisms that cannot move very far—they do not have to find a mate
- environments that do not change much—the offspring will all be identical and therefore all will be suited to surviving in the environment.

However, asexual reproduction can have disadvantages. The major problem is if the environment changes in some way. Then the problem is that all the individuals in a species that uses asexual reproduction are identical. Imagine if a new disease swept through a population. If every individual is identical, then they will all be vulnerable to the disease and they could all die. You can see an example of this in Figure 4.2.10. In this way, a species could become extinct.

Figure 4.2.10

Disease can easily wipe out a whole crop of plants if all the plants are similar. This is a fungus attacking a grass lawn and killing almost every plant.

Sexual reproduction and the environment

Sexual reproduction produces offspring that are all different from each other. This helps a species survive in a changing environment.

The survival of a species depends on some individuals being different enough to survive any changes in their environment. When a change occurs, there are likely to be some individuals that are able to cope with the new conditions. They can then breed and continue the species. So having differences means a greater chance of survival for the species.

An example of some individuals surviving because they are different occurred during the Great Plague. In 1346 in England and some other parts of Europe, a disease commonly called the Black Death killed up to half of the population of some towns. But not everyone who was exposed to the disease died. Some people had a natural resistance to the bacteria that caused it. Their bodies could fight the bacteria. Being different gave them a survival advantage.

Sex and differences

Snails are unusual animals. They are hermaphrodites with both male and female sex organs on the one individual. However, they do not fertilise themselves. They mate with another snail, each passing sperm to the other and each having its eggs fertilised by the other. Cross-fertilising is what is happening in Figure 4.2.11. This process is called **cross-fertilisation**.

Cross-fertilisation is also common in flowering plants. Most species have flowers that are both male and female. But the pollen rarely ends up on the stigma of the same flower. Occasionally it may be carried to another flower on the same plant. Usually it is

Figure 4.2.11

Cross-fertilisation in snails

transferred to a different plant. The flowers avoid **self-fertilisation** by having the stigma mature at a different time from the anthers. So the pollen cannot stick to the stigma of the same flower or even flowers on the same bush. An example is the geranium in Figure 4.2.12.

Cross-fertilisation is important for the survival of a species that uses it. This is because it produces greater differences in the offspring than with self-fertilisation. This is the same reason why sexual reproduction is an advantage to species in a changing environment—because it can produce greater differences in the offspring than asexual reproduction can.

4.4

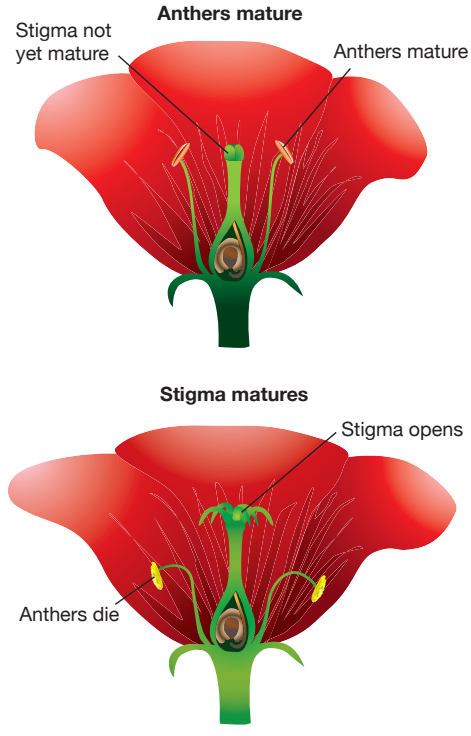


Figure 4.2.12

This geranium avoids self-fertilisation because the anthers and stigma mature at different times.

4.2 Unit review

Remembering

1 **Name** the two main types of reproduction.

2 a **List** five different ways that plants reproduce asexually.
b For each way **identify** one plant reproducing that way.

3 **Name** two methods of asexual reproduction in animals and for each give an example of an animal that uses the method.

4 **Name** the parts of the flower that have the following functions.
a produce pollen
b attract pollinators to the flower
c produce female gametes
d hold the seeds as they form

5 **State** where fertilisation takes place in:
a flowering plants
b frogs
c dogs.

6 **State** the type of reproduction that made you.

Understanding

7 **Explain** what is meant by reproduction and why it is necessary.

8 If you were told an animal was produced by sexual reproduction, **discuss** whether you could identify how many parents it had.

9 **Define** the following terms.
a fertilisation
b copulation
c embryo
d internal fertilisation
e external development
f hermaphrodite

10 **Explain** some advantages of asexual reproduction.

11 **Explain** some disadvantages of asexual reproduction.

Applying

12 **Identify** whether each of the following is cross-fertilisation or self-fertilisation and give a reason for your answer.
a A worker bee is produced from a queen that had mated with a male.
b A flatworm individual lives alone in a cow intestine for years and keeps reproducing.
c Platypus are mammals and are male or female. However, they lay eggs that have already been fertilised before they are laid. The young platypus hatches from the egg and is cared for by the parents.
d An Australian pea plant grown nowhere near others of its species flowered and produced seed in England.

Analysing

13 **Compare** the processes of sexual and asexual reproduction.

14 **Compare** the processes of copulation and fertilisation.

15 **Compare** the processes of internal and external development.

16 **Compare** the suitability of sexual and asexual reproduction for the survival of a species in a changing environment.

Evaluating

17 Honeyeaters are birds that drink sugary nectar made by plants such as eucalypts and banksias. They are attracted to the bright colours of the flowers. **Propose** why these birds are important to these flowering plants.

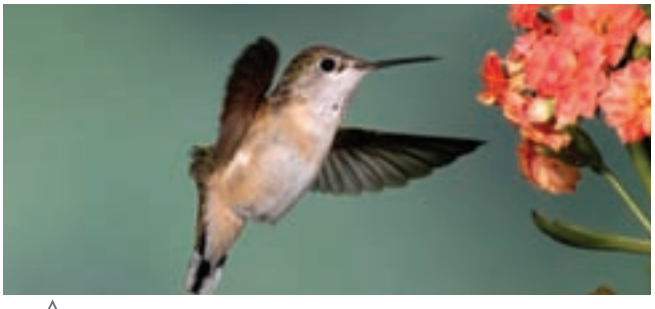


Figure 4.2.13 Honeyeaters have long thin beaks that allow them to get to the nectar inside the flowers.

18 **Propose** whether internal development is more likely to occur in animals that are internally fertilised or externally fertilised. **Justify** your answer.

19 Animals such as frogs produce hundreds of fertilised eggs and usually give them no parental care. Humans usually produce one at a time and give it lots of care. **Propose** a reason why there is such a large difference in the number of fertilised eggs produced by frogs and humans.

20 Whales are mammals that had ancestors that lived on land millions of years ago. The way they reproduce still shows this relationship to their land ancestors. **Propose** whether whales have:
- a internal or external fertilisation
- b internal or external development.

21 **Propose** what advantage there could be to a species that uses sexual reproduction to produce many offspring in an environment that is changing rapidly.

22 Asexual reproduction is more commonly found in water environments than terrestrial (land) environments. **Propose** reasons why this may be so.

23 Consider the following situations and **classify** them from those producing the most differences among the offspring to those producing the fewest differences. **Justify** your answer.
- a Bamboo plants connected to one underground stem
- b Plants from the seeds of one flower that was pollinated from another flower on the same bush
- c Plants from the seeds of one flower that was pollinated from a flower from a different bush
- d Plants from the seeds of a self-pollinated pea plant
- e Grass plants in a lawn grown from stem cuttings from three different gardens

Creating

24 **Construct** a table summarising some differences between animals in:
- a where the gametes are produced
- b how and where fertilisation occurs
- c where the young develop.

Inquiring

1 Research reproduction in the platypus and echidna, explaining why they are so unusual.

2 Research how temperature affects the proportion of male and female crocodiles hatched.

3 Research how plants are grown from cuttings. Design experiments that will test the suitability of several different plants for propagation by cuttings. Ask your teacher if you can try your experiments.

4 Research the impact of plant cloning techniques in agriculture, such as horticulture, fruit production and vineyards.

5 Research the amazing life cycle of aphids, which can reproduce by sexual reproduction and another process called parthogenesis. Use your research to explain why the aphid uses the different methods of reproduction in different seasons.

6 Research examples of animals that can change sex once they are born (this is known scientifically by the term *sequential hermaphroditism*).

Figure 4.2.14 All barramundi under 3–5 years old are male. They then all turn into females!

4.2 Practical activities

1 Flower structure and pollination

Purpose

To compare the structure of different flowers and to propose the method of pollination of each.

Materials

- blade and forceps
- hand lens or stereomicroscope
- selection of flowers

Procedure

Carefully observe the structure of each flower. To do this you may have to:

- use a stereo microscope or hand lens to study them
- dissect the flowers carefully using the forceps and blade.

Results

1. Construct a quick sketch of the basic shape of the flowers. Do not draw in fine detail. Write the name of the plant species on your diagram.
2. Identify all the flower parts and label these on your diagram.
3. On your diagram, write down the general features of the flower, such as its size and colour.
4. Using the table below, decide which method of pollination the flower may have.

Discussion

For each flower, **justify** your choice of the method of pollination.

Method of pollination	Flower structure/colour/size	Anther/stamens	Stigma/style
Wind	Often small but many flowers in one head, often no petals, not brightly coloured, no nectar, no scent	Long stamens with large anthers exposed	Long style with exposed stigma, stigma has large surface area—often look like brushes
Insect	Usually small, some with many flowers in one head, brightly coloured petals especially blues and yellows, small amounts of nectar, strong scent, often strongly marked with 'landing guides'	Often has short stamens and small anthers, which are close to nectar source in most flowers, sticky pollen	Short style, small stigma close to nectar source
Bird	Large strong flowers, some have petals but many don't, lots of nectar, often red	Often has long, strong stamens and large anthers a long way from the nectar source	Long style, smallish stigma, a long way from the nectar source
Mammal	Large strong flower heads, much nectar, often not brightly coloured and hidden in plant, nectar produced at night	Strong and rigid	Strong and rigid

2 Germination

Purpose

To find out what factors affect the germination of seeds.

Materials

- 5 test-tubes
- 25 wheat seeds
- cotton wool
- labels or waterproof pens
- 1 mL (cool) boiled vegetable oil
- 10 mL (cool) boiled water
- 100°C thermometer
- lamp
- access to dark cupboard and fridge
- digital camera or mobile phone with camera function (optional)

Procedure

The test-tubes will have the following conditions:

Test-tube	Conditions
A	Light, moisture, oxygen, warmth
B	Dark, moisture, oxygen, warmth
C	Dark, no moisture, oxygen, warmth
D	Dark, moisture, no oxygen, warmth
E	Dark, moisture, oxygen, cold

1. Label the test-tubes with your name and the correct letter A to E.
2. Put a centimetre of cotton wool in the bottom of test-tubes A to E as shown in Figure 4.2.15.
3. Add about 1 mL of tap water to test-tubes A, B and E.
4. Add five seeds to each of test-tubes A to E.
5. Add about 10 mL of boiled (but cooled) water to test-tube D. Add the boiled (but cooled) oil to this test-tube.
6. Put a loose cotton wool plug in the mouth of each test-tube.
7. Place test-tube A under a fluorescent lamp. Your teacher will place a thermometer next to the test-tubes to check the temperature. Place test-tubes B, C and D in a dark cupboard. Place test-tube E in a fridge.
8. Observe or photograph the experiment each day for about 5 days. Record the results in a table.

Discussion

1. **List** which test-tubes had seeds that germinated, and the conditions in those test-tubes.
2. **Deduce** the conditions necessary for germination.
3. **Explain** which test-tubes you compared to form this conclusion.
4. **Explain** the result in test-tubes C, D and E.

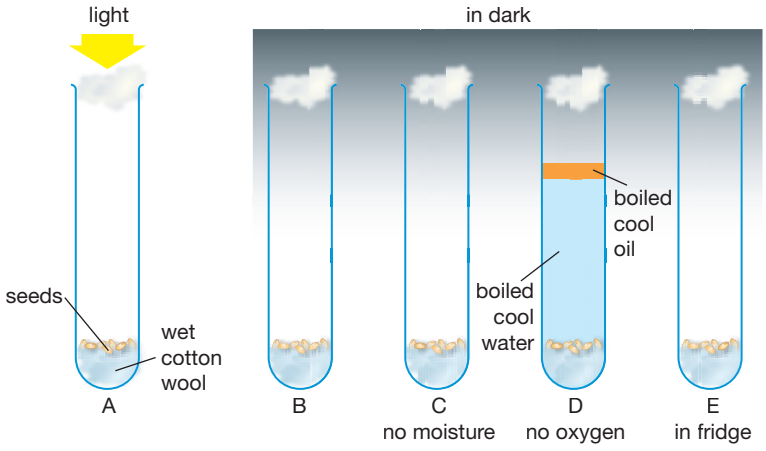


Figure 4.2.15

3 Asexual reproduction

Purpose

To observe examples of asexual reproduction.

Materials

- onion, garlic, potato, African violet or tree of life (Bryophyllum), geranium, grass, bamboo or bracken
- glass jars
- soil
- toothpicks
- glass slides
- ice-cream containers
- stereo microscope
- digital camera or mobile phone with camera function (optional)

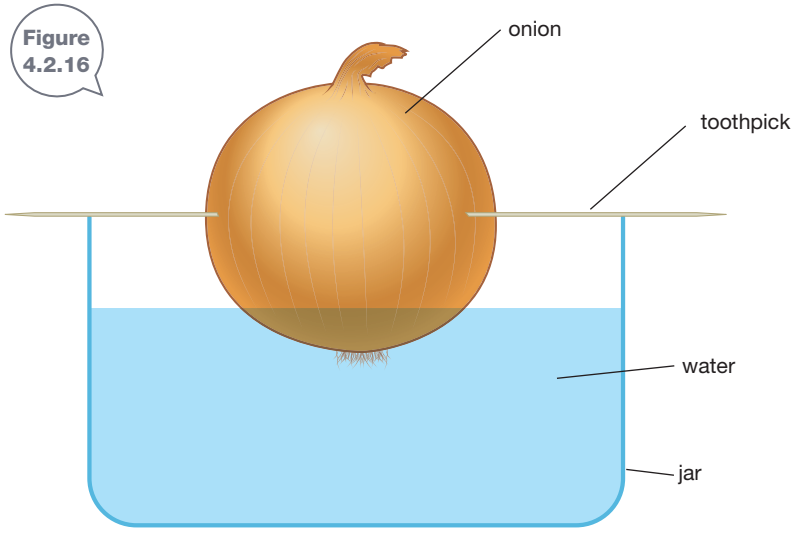
Procedure

1. Take an onion, a piece of garlic and a potato. Stick some toothpicks in them so that they can be supported on top of a jar of water and just touch the water at the bottom. Figure 4.2.16 shows how to do this using an onion. Fill each jar with water and place them away in a cupboard somewhere. You will check them over the next few weeks.
2. Place a leaf from a tree of life or a geranium on some soil in an ice-cream container. Place a glass slide over the top of the leaf to keep it pressed against the soil. Water the soil. Put the container in a cupboard and check it over the next few weeks. Keep the soil moist.
3. If you are provided with African violets, place the leaf stalk in a jar of water. When roots appear, plant it in soil.
4. Cut a piece of geranium stem about 10 cm long. Strip the leaves off. Stick it in soil, leaving a few centimetres above the soil and then water it.
5. If you have some bamboo stem or bracken stem, break about 10 cm off it and cover it in soil, watering it well.

Discussion

1. After several weeks, observe or photograph your experiment. **Describe** the appearance of the plant parts.
2. **Identify** the method of reproduction for each of the specimens you studied.

Figure 4.2.16



4.3 Human reproduction and growth

The human reproductive system enables us to produce offspring. Its structure suits that function, but it also affects how humans function as an organism. Chemicals from your reproductive organs affect your behaviour, the way you grow, your appearance and how your body works.

The female reproductive system

The female reproductive system has the role of producing a baby. All of its parts shown in Figures 4.3.1 and 4.3.2 cooperate in achieving this.

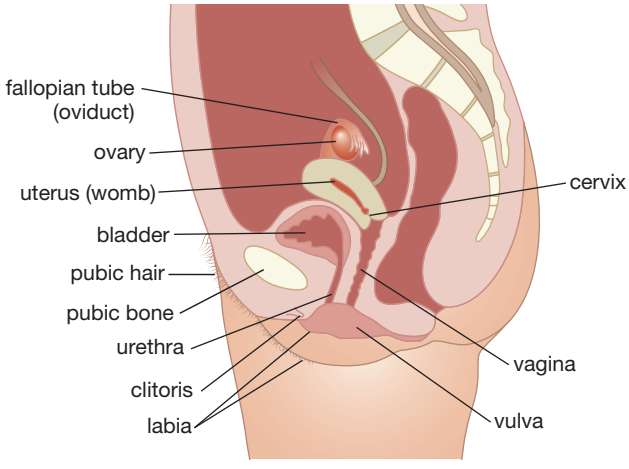


Figure 4.3.1 A side view of the human female reproductive system

The eggs, or ova, are produced in the **ovaries**. The ovaries are similar in size to an olive. They usually release only one ovum (a single egg) each month, alternating between left and right ovaries. The egg forms in a capsule called a follicle.The egg then bursts out of the follicle.

The **fallopian tubes**, or **oviducts**, are tubes down which the egg passes on its way to the uterus. If the egg meets a sperm and becomes fertilised, it is usually in this tube.

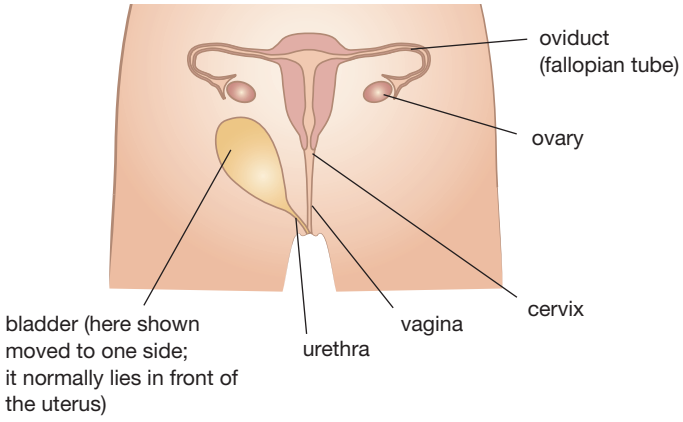


Figure 4.3.2 A front view of the human female reproductive system

The **uterus** (or **womb**) is a thick-walled muscular organ in the female reproductive system that is about 7 cm long and 5 cm wide. It has a lining called the endometrium that can change and become rich in blood vessels. The fertilised egg enters the uterus and burrows into the endometrium. This process is called **implantation**. The baby grows and develops in the uterus until birth. The uterus can swell up to many times its normal size to allow the baby room to grow. If the egg was not fertilised, then it passes out of the uterus through the lower end.

At the lower part of the uterus is a ring of muscle called the **cervix**. The cervix has the job of contracting tightly to hold the uterus closed while the baby is developing. This protects the baby in the womb. The cervix opens up when the baby is about to be born.

The role of the **vagina** is to allow the male penis to be inserted to deposit the sperm inside the female body. It is also the birth canal down which the baby passes.

The menstrual cycle

Reproduction in females is controlled by chemicals called **hormones** that are produced in the female body and travel around in the bloodstream. One hormone (known as FSH) causes the follicles to mature. A follicle is shown in Figure 4.3.3. Another hormone (known as LH) makes the egg burst out of the follicle. This is called **ovulation**.

A third hormone called estrogen (also spelled oestrogen) makes the lining of the uterus grow thicker and develop an increased blood supply. Estrogen comes from the follicles in the ovaries. There are other hormones involved as well. The amounts of these hormones change in a cycle over a month. These changes in the body over the month are called the **menstrual cycle**. The menstrual cycle is shown in Figure 4.3.4.

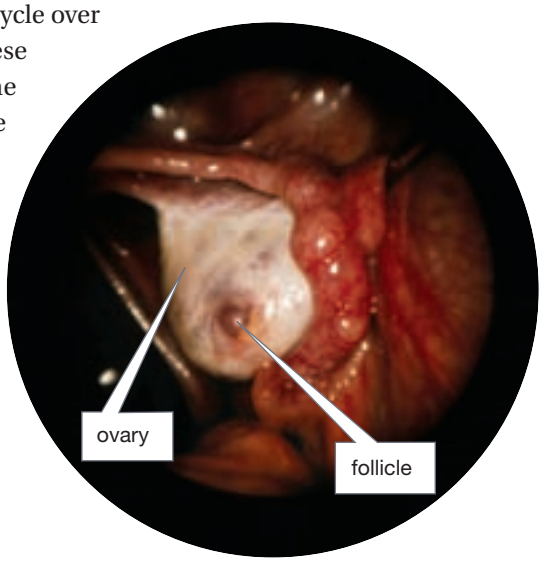


Figure 4.3.3 A photo inside a woman showing the ovary (the whitish area), and a follicle (red) starting to swell

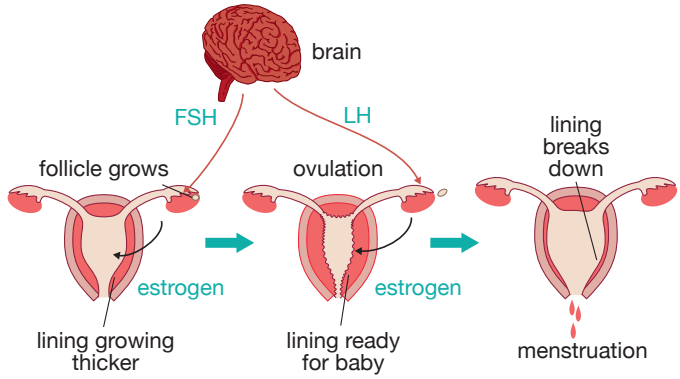


Figure 4.3.4 The menstrual cycle is controlled by hormones.

If the egg is not fertilised and implanted, the thickened lining of the uterus breaks down. Over the next few days some blood, along with much of the lining of the uterus, passes out of the body. These events are called a **period** or **menstruation**.

SKILL BUILDER

Menstrual cycles

Menstrual cycles can vary greatly in length, especially when they first begin. A typical menstrual cycle is about 28 days once it becomes fairly regular. In a typical 28-day cycle, the first day of menstruation (bleeding) is counted as day 1, and typically lasts 3–7 days. Ovulation occurs at day 14 of the cycle.

You can see this in Figure 4.3.5. In some cycles, ovulation can occur as early as day 9, while in others it may be after day 20. The part of the cycle that stays the same is the time from ovulation to the start of menstruation. This is always 14 days.

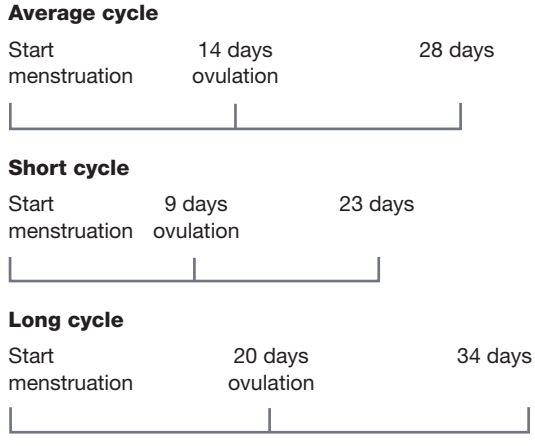


Figure 4.3.5 The menstrual cycle can vary in length.

WORKED EXAMPLE

Time of ovulation

Problem

In a 25-day cycle, on what day would ovulation occur?

Solution

Time from ovulation to menstruation is always 14 days.

Therefore 25 – 14 = 11 days

So ovulation would have been on day 11 of the 25-day cycle.

Male reproductive system

The role of the male reproductive system is to produce and deliver sperm. All of its parts cooperate in achieving this. The main parts are shown in Figures 4.3.6 and 4.3.7.

The sperm are produced in the **testes**. There are two testes (singular: testis), each about the size of a golf ball. Testes are also known as testicles. They hang outside the male abdominal cavity in a sac called the scrotum. This is because sperm are killed or deformed if they become too hot and it is cooler in the scrotum than inside the abdomen. The sperm are produced in tubes inside the testes. Then they are squeezed into a coiled tube called the epididymis. There is one on the outside of each testis. There the sperm mature.

To get to the outside of the body, sperm are squeezed by muscles lining the epididymis. They are pushed into a hollow tube about 45 cm long called the **sperm duct**, or **vas deferens**. This tube has muscles in its walls that squeeze the sperm along. On the way, fluid is added to the sperm from glands called seminal vesicles. This fluid contains various chemicals such as sugars that provide an energy source for the sperm. There is also fluid added to the sperm by the prostate gland and Cowper's glands. This mixture of sperm and other fluid is called **semen**. Semen passes out of the penis through the urethra, the same tube through which urine flows. However, urine cannot pass through at the same time as semen.

1 p157

SciFile

Acidic women and basic men

The vagina produces acid to kill infectious organisms like fungi. This acid would kill sperm if the fluid carrying it (semen) did not contain a chemical called a base. This destroys the acid and allows the sperm to survive.

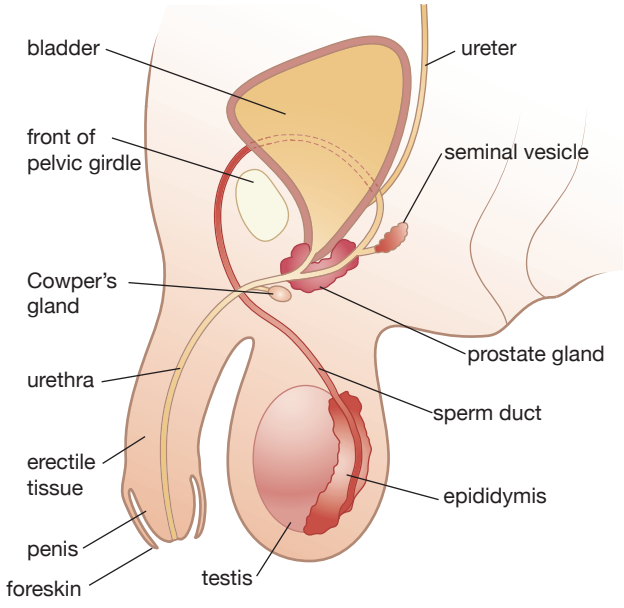


Figure 4.3.6 A side view of the human male reproductive system

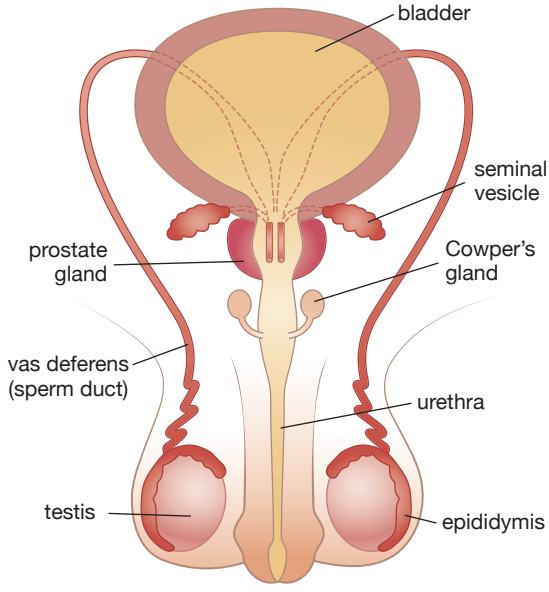


Figure 4.3.7 A front view of the human male reproductive system

4.5

Puberty

Puberty refers to the time in a person's life when they become able to reproduce. Puberty involves physical changes that bring sexual maturity. The physical changes of puberty take several years to complete. For boys, puberty is when fertile sperm are able to be produced. For girls, it is when the first ovulation occurs.

The time in the life cycle when puberty begins varies greatly. In Australia, girls begin puberty on average around 12 years of age, while boys are generally about 13, but it is not unusual to differ from this. Every person is different, and reaches puberty when their body is ready.

Changes in males

The early changes of puberty in males are increased levels of some hormones such as testosterone. These lead to some changes you can observe, such as:

- enlargement of the testes
- sperm formation by the testes
- growth of the penis
- the voice 'breaking' to become deeper
- hair growth on the face, arms, chest and groin
- increased muscle and bone growth and strength
- sudden increase in height and chest capacity.

You can see these changes in Figure 4.3.8.

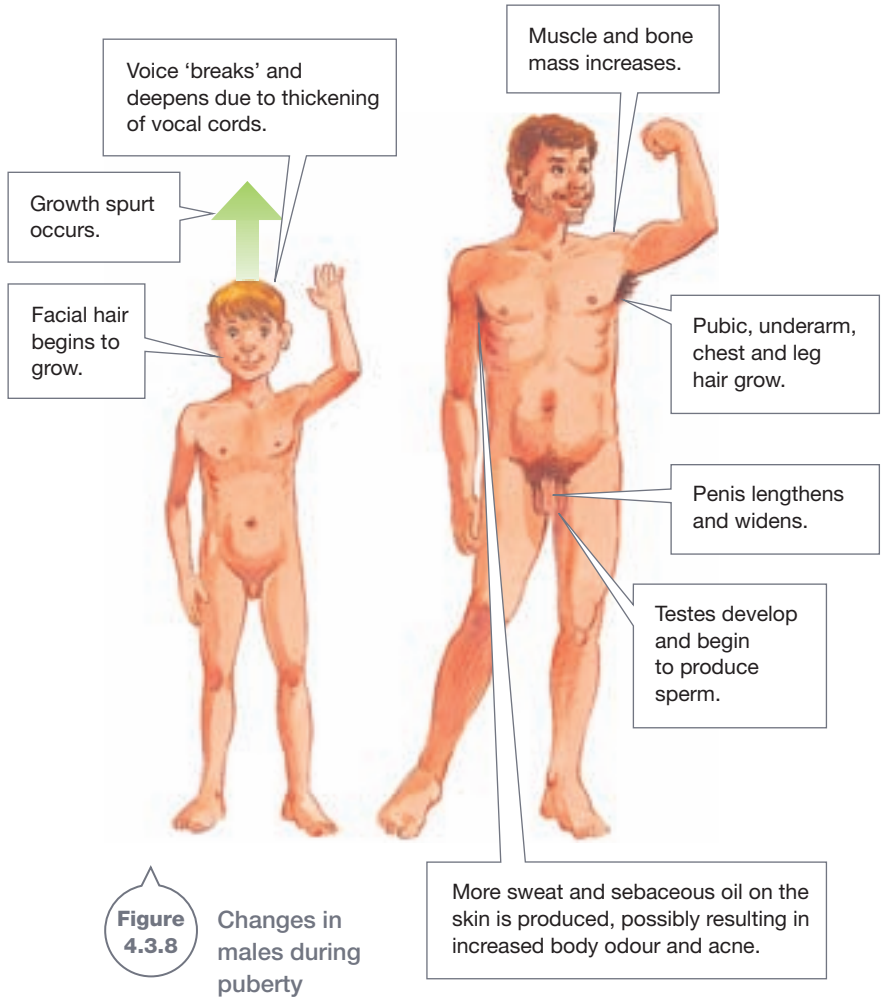


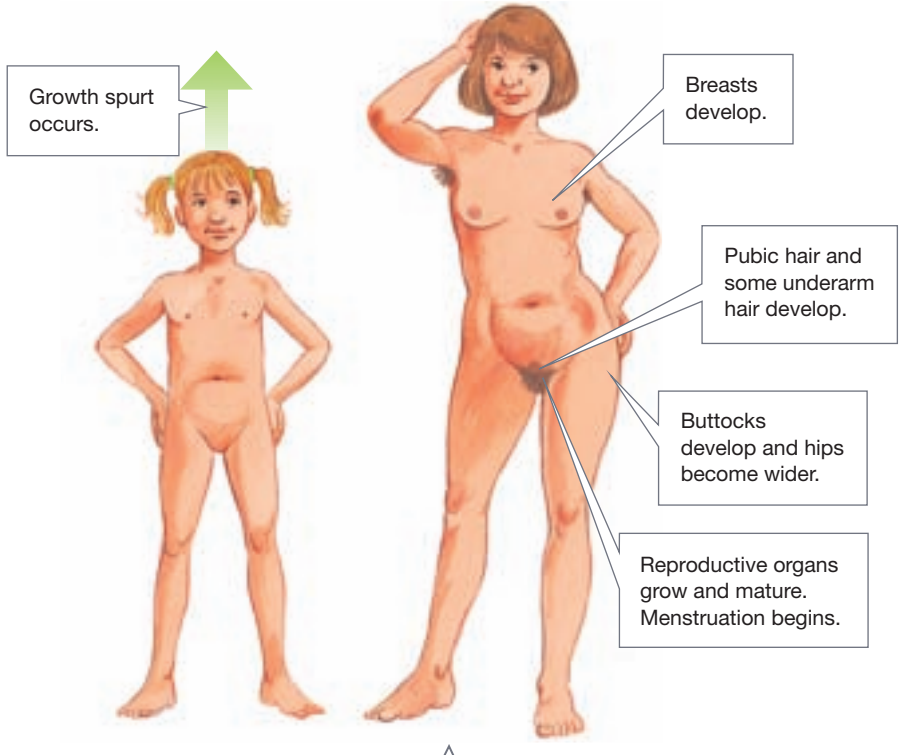
Figure 4.3.8 Changes in males during puberty

Changes in females

In girls, the early changes are increased levels of hormones such as FSH and LH. These hormones cause an increase in estrogen. These hormonal changes result in observable changes such as:

- the breasts begin to enlarge—generally the first sign of puberty
- hair grows on the armpits and groin
- a sudden growth spurt
- the first period
- widening of the hips
- more fat deposited in the hips.

You can see these changes in Figure 4.3.9.



2 p157

4.6

Figure 4.3.9 Changes in females during puberty

4.3 Unit review

Remembering

1 **Name** the parts of the female reproductive system that have the following functions.
   - a Produces eggs
   - b Keeps the uterus closed during pregnancy
   - c Carries the egg to the uterus
   - d Where the baby grows and develops until birth
   - e Site of fertilisation

2 **Name** the parts of the male reproductive system that have the following functions.
   - a Produces sperm
   - b Carries sperm to the penis
   - c Holds the testes
   - d Places sperm in the vagina
   - e Gland beginning with 'p' that adds chemicals to the semen

3 **Name** the female cycle that shows regular changes in hormonal levels.

4 **Name** the female hormones that have the following functions.
   - a Triggers ovulation
   - b Starts eggs maturing each month
   - c Causes the lining of the uterus to thicken

5 **List** the changes in males during puberty.

6 **List** the changes in females during puberty.

7 **Recall** on what day of a 28-day menstrual cycle a woman would ovulate.

Understanding

8 **Explain** why the lining of the uterus is important in reproduction.

9 **Explain** the role of hormones in the menstrual cycle.

10 **Define** the following terms.
   - a ovulation
   - b period
   - c puberty

11 **Explain** the importance of the testes being held in a sac outside the abdomen.

12 a **Name** two components of semen.
   b **Explain** the function of these components.

Applying

13 If a woman reaches puberty at age 12 and produces one egg each a month from puberty until she is 50 years of age, **calculate** how many eggs she releases in her lifetime.

14 **Identify** the male reproductive part that has functions in both the reproductive and excretory systems, and describe its role in each.

15 Figure 4.3.10 shows how the proportions of a human body change as they grow.

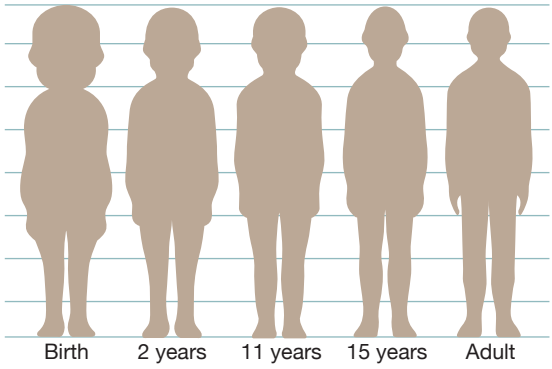


Figure 4.3.10

   - a **Calculate** the fraction of a newborn body taken up by the head.
   - b **Calculate** the fraction of an adult body taken up by the head.
   - c **Identify** the area of the body that appears to have grown fastest in the womb.

16 If ovulation occurs at day 23 in a particular cycle, **calculate** when menstruation occurs.

17 **Calculate** the time from menstruation to ovulation in a 36-day cycle.

4.3 Unit review

Analysing

18 **Compare** ova, ovulation and oviduct.

19 **Compare** oviducts and sperm ducts.

20 **Compare** ovaries and testes in:
- a their position
- b number of gametes produced.

Evaluating

21 **Propose** why there are millions of sperm in a single ejaculation, but usually only one egg is produced in each menstrual cycle.

22 Study a diagram of the male reproductive system and then **propose** why swelling of the prostate gland could cause difficulty in urinating.

Creating

23 **Construct** a diagram of the female reproductive system from the front. Next to each organ write its function.

24 **Construct** a diagram of the male reproductive system from the front. Next to each organ write its function.

Inquiring

Research how twins are formed. Find out what the differences are between:
- identical twins
- fraternal twins
- conjoined twins.

SciFile

Unisex

While in the womb everyone has the same basic reproductive parts up to about the first eight weeks of development. Then these are reshaped and turn into male or female organs.

4.3 Practical activities

1 Reproduction models

Purpose
To construct models representing the structure of the male and female reproductive systems.

Materials
Choose from the different materials provided by the teacher, such as cardboard, scissors, felt-tip pens, sticky tape, modelling clay, string.

Procedure
1. Make a model of the male or female reproductive system. Use the materials provided. Your model should be 3D, and can have cutaway sections to show what the insides of different parts look like. The aim is to make a model that teaches people about the structure of the reproductive system.
2. You can either suspend the model from string or cotton, or have it on a stand.
3. When all the models are complete, display them around the room.
4. Observe the other models and decide which ones you think are the best.

Discussion
1. **Justify** why you chose a particular model as the best.
2. **Evaluate** your model and suggest improvements you could have made to produce a better teaching model.

2 My changing body

Purpose
To identify the changes that occur in the human body at puberty and to discuss why these changes occur.

Materials
- A3 sheet of paper or roll of butcher's paper
- coloured sticky note
- sticky tape, Blu-Tack or similar

Procedure
1. Choose a partner. Trace or draw an outline of your bodies on separate sheets of paper.
2. On your outline, add labels to each part of your body that changes as you go through puberty. Describe the changes that occur to each body part as puberty proceeds.
3. At the bottom of your page, demonstrate in a sentence or two that you understand what causes these changes. Be as specific as possible, giving correct terms if possible.
4. Swap outlines with your partner and read their page. Identify any differences with yours. Discuss differences with your partner and combine the information onto one of the outlines and stick it up on the wall to create a gallery with the other students.
5. When all the outlines in the class are up, wander around the gallery. Read all the posters and then place a sticker on the one you think best represents all the changes that occur during puberty.
6. Your teacher will ask the class what was good about the poster that won. Listen carefully and remember what is said so that you can answer the questions below.

Discussion
1. **Justify** why the class chose a particular outline as being the best representative of changes during puberty.
2. **Evaluate** your page and suggest improvements you could make to it.
3. **Summarise** in 25 words what causes the changes during puberty.

4.4 Pregnancy

Pregnancy and birth are often described by people as the most amazing experiences of their lives, reducing many parents to tears. They are overwhelmed by the realisation that they have created a life. You are in the womb for close to 9 months before you are born. A lot happens in those 9 months!

Copulation

Copulation is the term for two individuals joining together for sexual reproduction. In humans it is also called **sexual intercourse**. In sexual intercourse, the penis becomes stiff and erect. It is then inserted into the vagina. Stimulation causes sperm to be squeezed out of the penis in a process called **ejaculation**.

Ejaculation deposits several hundred million sperm near the cervix. Sperm can swim, propelled by their tail. Their energy source is sugar in the semen. However, not all sperm are healthy. Some have two tails and some have deformed tails. There are many different ways a sperm can be defective, as you can see in Figure 4.4.1.

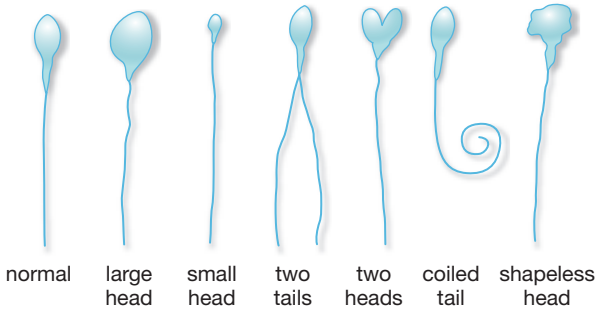


Figure 4.4.1 Sperm can swim, but defective sperm are poor swimmers.

Sperm enter the uterus (womb) through the cervix. They swim through the uterus and into the fallopian tube. Most sperm die along the way, leaving a few hundred healthy sperm to make it to the upper fallopian tube to meet the egg. When they encounter the egg, the sperm swarm over its surface (Figure 4.4.2). One sperm manages to bury its head into the egg, and the tail breaks off. The egg surface changes as soon as one sperm head makes it through to ensure that no more sperm can enter the egg.

Figure 4.4.2 Sperm swarm around an egg, trying to penetrate its surface.

Implantation

When the egg is fertilised, the first cell of the new individual is called a zygote. The zygote begins to divide as it continues its journey down the oviduct. You can see this in Figure 4.4.3. The zygote keeps dividing until it forms a hollow ball of cells called a blastocyst. About five days after fertilisation, the **blastocyst** reaches the uterus. Then the blastocyst burrows into the wall in a process called implantation. Now it is correct to say the woman is pregnant.

Embryonic development

A baby takes about 38 weeks to develop from fertilisation to birth. The first 8 weeks are called the embryonic period and the developing baby is referred to as an **embryo**. During this time, all the different types of cells, such as nerve, muscle and bone, are developing. These are being built into the different organs and systems of the body. In this critical period of development, the baby can be severely affected by many things. This means that smoking, alcohol and some drugs (legal and illegal) have the potential to cause damage. So, too, do some illnesses, such as rubella. These can cause deformities such as missing limbs and can also cause brain damage. Any chemical that can affect cells could damage the embryo. In Figure 4.4.4 you can see an embryo.

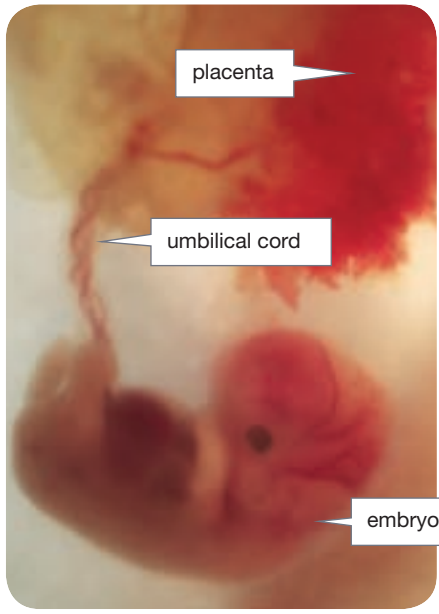


Figure 4.4.4 Major tissues, organs and systems form during the early development of the embryo.

SciFile

A fast but brief life

The fastest sperm take about 15 minutes to make their journey to the fallopian tube. Sperm can live for up to 2 days and fertilisation is possible if the egg encounters the sperm in this time. This means that intercourse up to two days before ovulation can result in pregnancy.

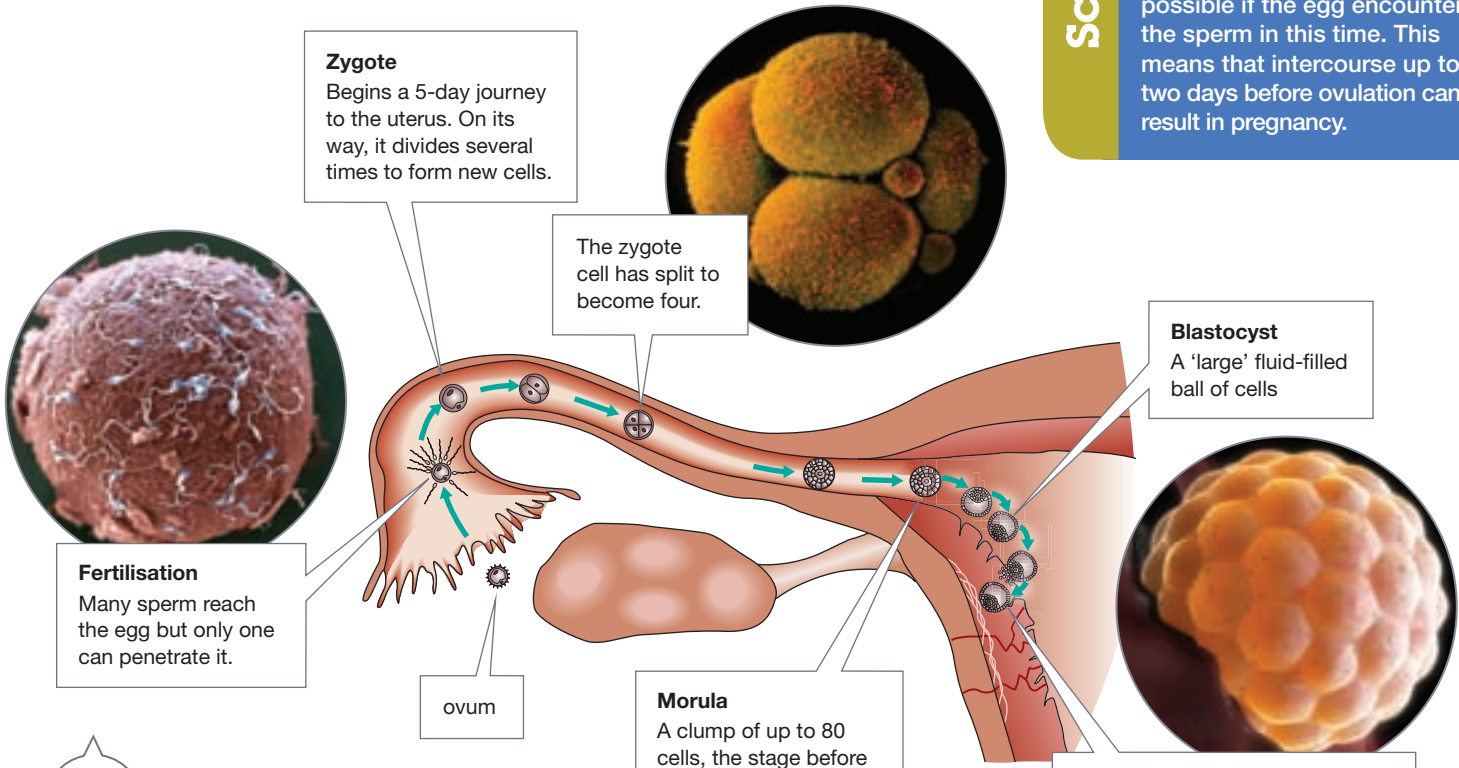


Figure 4.4.3 The sequence of steps from ovulation to implantation takes about 5 days.

Amniotic fluid

The embryo floats in a fluid enclosed in a 'balloon' or membrane (thin layer of living tissue) called the amnion. The **amniotic fluid** acts as a shock absorber, protecting the embryo from bumps. It also helps keep the embryo's temperature constant.

The placenta

In its early development, the embryo is fed from the yolk sac and secretions (fluids) from the lining of the uterus. The yolk sac is similar to the yolk in a chicken egg. Later, another structure called the placenta develops. The placenta develops from branching structures called villi, which are on the outside of the blastocyst. You can see these in Figure 4.4.5. The **placenta** is a highly folded series of membranes and blood vessels. It allows nutrients and oxygen from the mother to enter the baby. It also allows the embryo's waste materials such as carbon dioxide to enter the mother's blood so her body can remove it.

SciFile

Belly buttons

The umbilical cord joins the embryo in its abdomen. Your 'belly button' is where your umbilical cord joined you to your mother in the womb.

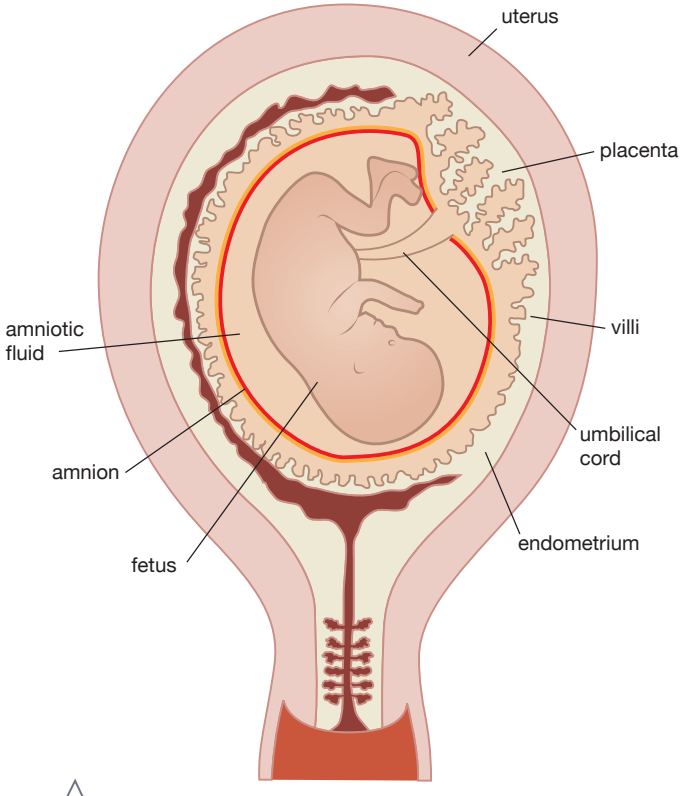


Figure 4.4.5 The umbilical cord connects the baby to the placenta.

Figure 4.4.6 shows how the placenta is connected to the embryo by the umbilical cord. This contains blood vessels from the embryo. The blood supplies of the mother and embryo do not mix together. They are kept apart by a membrane. The materials to be exchanged between the mother and embryo pass across this membrane.

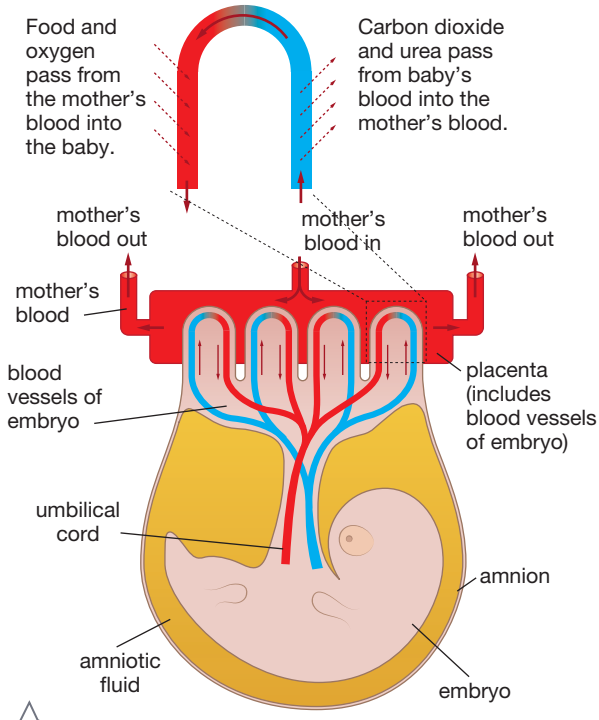


Figure 4.4.6 The placenta allows exchange of materials between the mother and the developing baby.

SKILL BUILDER

Weeks pregnant

The period during which the baby develops in the uterus is known as the **gestation** period.

A baby develops for about 266 days (38 weeks) from fertilisation to birth. However, doctors can't be sure when ovulation actually occurred in a cycle, because cycles can vary in length. So, they usually talk about 'weeks pregnant', counted from the start of the last menstrual cycle. Since this is usually about 14 days before fertilisation, birth is at '40 weeks', or 280 days, from the last menstruation. So a doctor talking about 'weeks pregnant', is probably referring to the weeks since the last menstrual period. But the actual time it took for the baby to develop was really 38 weeks, or 266 days.

Fetal development

Most of the major organs and systems have been formed when the embryo reaches about 9 weeks old. The external appearance looks more human-like. The developing baby is now classified as a **fetus** (also spelled foetus.) During the fetal period, the developing baby increases in size and the organs mature so they can function at birth.

Birth

Birth is part of the process called **labour**, which can last for a few hours to a day or more. The first sign of labour is pain in the abdomen. This is due to the uterus contracting and relaxing. The pains come and go. These gradually get stronger and more painful and come closer together. When the pains are regularly a few minutes apart, birth is not far away. The cervix relaxes and widens. This process is called dilation. The amniotic sac usually bursts, and then the baby's head begins to pass through the cervix. Usually the head goes through first, as you can see in Figure 4.4.7. Then the baby is born. This may take from 10 minutes to a few hours. The umbilical cord is cut and tied. A short time after the baby is born the placenta is expelled from the mother. This is called the **afterbirth**.

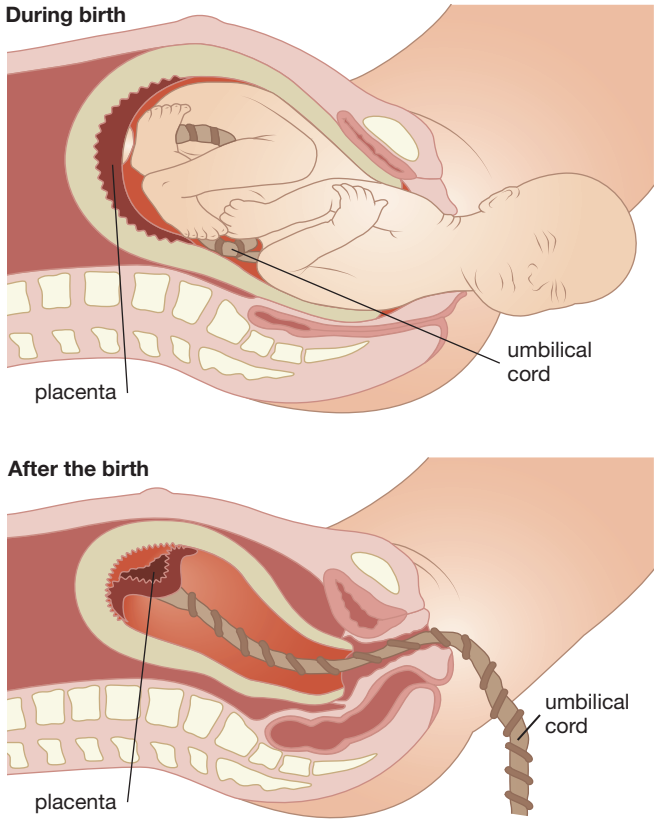


Figure 4.4.7 Labour involves birth of the baby and expulsion of the afterbirth.

SciFile

Big baby

The largest baby on record was born to Anna Bates, in Canada in 1879. The baby boy had a mass of 10.77 kg, about three times as heavy as the average baby born in Australia. He survived for only about 9 hours. Both his parents were over 2.2 metres tall.

SciFile

Pregnancy tests

The blastocyst produces a hormone known as HCG. This keeps the lining of the uterus thick to support the blastocyst. HCG is detected in pregnancy tests of the mother's urine.

SCIENCE AS A

HUMAN ENDEAVOUR

Use and influence of science

Drugs and pregnancy

Scientists have known for over 50 years that some drugs can damage the developing baby.

Figure 4.4.8 Alcohol and smoking can do great harm to a developing fetus.

One of the earliest examples of drugs doing damage to babies was discovered by the Australian scientist Dr William McBride in the 1960s. He identified a drug called thalidomide as the cause of deformities in babies. Many pregnant women experience morning sickness, a feeling of wanting to vomit that is particularly strong in the morning, and the drug was taken by mothers as a sedative to help relieve these symptoms. Thalidomide crossed the placenta and entered the developing embryo. It affected cell development, resulting in missing or deformed limbs. Thalidomide is now banned for use by pregnant women, but it is still used to treat many diseases in people who aren't pregnant.

Alcohol and pregnancy

Drinking alcohol while pregnant can also have consequences for the baby. Alcohol crosses the placenta, which means the baby has the same blood alcohol level as the mother. If the mother is drunk, the baby is too, and can be damaged.

High alcohol intake may cause a condition known as fetal alcohol syndrome (FAS). Some signs of FAS are:

- low birth weight
- smaller head
- small eyes and flattened face and nose
- heart defects.

The children are affected for life and cannot be cured.

Some serious effects are:

- low intelligence, poor memory and learning difficulties (because the growing brain is damaged)
- behaviour problems, for example ADHD (attention deficit hyperactivity disorder)
- increased risk of mental illness
- increased risk of alcohol and drug misuse.

Smoking and pregnancy

Smoking during pregnancy damages both the mother and the baby. Effects can include:

- death of the fetus in the womb
- miscarriage—bleeding and expulsion of the fetus
- premature birth
- retarded growth and development
- increased risk of facial deformities such as cleft lip and cleft palate
- lower birth weight
- twice the risk of sudden infant death syndrome (SIDS).

Smoking damage can cause health problems in the baby for years to come once it is born. Effects may include:

- decreased lung function
- higher incidence of asthma
- increased risk of developing behavioural problems, such as antisocial behaviour.

1 p164

4.7

4.4 Unit review

Remembering

1 **Name** the following.
   - a The cell formed by fertilisation
   - b Both terms for the place where fertilisation occurs
   - c The site of implantation
   - d The fluid that surrounds the embryo
   - e The connection between the embryo and the placenta
   - f The time period from fertilisation to birth

2 **List** the major events from fertilisation to implantation.

3 **List** the signs that labour is occurring.

4 **List** some events in childbirth after dilation of the cervix.

Understanding

5 **Explain** the function of the amniotic fluid.

6 **Explain** the function of the placenta.

7 **Define** the following terms.
   - a copulation
   - b ejaculation
   - c implantation
   - d blastocyst
   - e placenta
   - f labour

8 **Explain** what prevents mixing of the blood supply of the mother and the fetus.

Applying

9 If a woman last had a period on 1 January, and is clearly pregnant, **calculate** the date when her baby should be born.

10 If a zygote was definitely formed on 1 January, **calculate** the date when the baby should be born.

Analysing

11 **Compare** the major features of an embryo and a fetus.

12 **Distinguish** between the placenta and umbilical cord.

13 **Compare** the meaning of labour and birth.

14 **Distinguish** between fertilisation, implantation and pregnancy.

Evaluating

15 A pregnant woman complains that she is feeling sick every morning. She wants to use a natural remedy that a friend suggested. What would you **recommend** she do, and why?

16 A baby's skull bones do not lock together to make the skull rigid until well after birth. **Propose** why this is an advantage in childbirth.

17 To induce labour (to make it happen), a chemical called oxytocin can be injected into the mother. **Propose** what effect the chemical would have on the uterus.

Creating

18 **Construct** a diagram of a developing fetus and the uterus. Next to each part on the diagram, write its function in reproduction.

19 **Create** a pamphlet for pregnant women to warn them how drugs might hurt their unborn baby.

Inquiring

1 Research the use of the following in prenatal diagnosis (checking the health of the developing baby).
   - a ultrasound
   - b amniocentesis
   - c chorionic villus sampling

2 Research dietary advice for pregnant women, particularly the recommended type and amount of food (for example, should they eat soft cheeses and 'cured' raw meat products?).

3 Research how in-vitro fertilisation can help with infertility problems.

4 Research the effect and treatment of the condition called incompetent cervix.

5 Research the condition called placenta previa and the problems it can cause.

6 Research the condition called eclampsia, particularly the threat it poses to the mother and baby.

4.4 Practical activities

1 Interview a mother

Purpose

To interview a mother to discover her experiences of pregnancy and the advice she received.

Materials

- paper
- pen
- tape recorder if available

Procedure

1 You are going to interview a woman who has been a mother—either your own mother, or someone you know who is keen to help. It is important that the woman agrees to participate freely. If your mum does not want to do it, ask someone else. The aim is to find out what advice they received about pregnancy and birth before they occurred, and what they think of their experiences.

The first step is to think about the questions you should ask them, and write these down. Some examples follow:

- What changes did you think having a baby would make to your life?
- What changes did you find you had to make to your life after having a baby?
- What advice were you given about diet during pregnancy?
- What did you know about the possible effects of alcohol and smoking?
- What advice were you given about exercise?
- What care did you take during the pregnancy?

2 After compiling your list of questions, discuss them with another student to get their opinion on them. Check with your teacher if you are not sure.

3 Show the questions to the mother and ask her if she could help you. Tell her that her name will not appear in the report and that her answers will not be shown to anyone else other than the teacher. It would be best if you could actually talk to her and write out what she says. If she doesn't want to talk about it, but would be happy to write out some answers, then accept the offer. Don't hassle her to tell you things. Some things may be personal.

4 Obtain the answers to your questions by interview or in writing from the person. Make sure that you keep your promises about her privacy.

Discussion

Assess what you learnt in this activity, including any lessons that could help if you become a parent.

4 Chapter review

Remembering

1 **Name** the following:
   - a the type of insect life cycle with four stages
   - b changes in body form and shape in an organism's life
   - c sex cells that must join together in sexual reproduction
   - d the human organ that produces male gametes
   - e the human organ that produces female gametes.

2 **State** the following times:
   - a the length of human gestation in weeks and days
   - b the average age for the start of puberty in girls and boys
   - c how long a sperm can live in the oviduct
   - d when ovulation occurs in a typical 28-day menstrual cycle
   - e when a blastocyst implants after fertilisation.

3 **List** five different methods of asexual reproduction and for each name an organism reproducing that way.

Understanding

4 **Discuss** the advantages of:
   - a sexual reproduction
   - b asexual reproduction.

5 **Discuss** the role of hormones in human reproduction.

6 **Explain** the important role of the lining of the uterus in human reproduction.

Applying

7 **Identify** the following:
   - a a structure in a pregnant woman that allows the embryo's carbon dioxide to enter the mother's circulation
   - b a drug that can affect the fetus and cause brain damage, behavioural problems, reduced brain size, and learning difficulties for life.

8 Animals such as humans, dogs, sheep and horses are classified into a group called placental mammals. The echidna and platypus are classified into a different mammal group called monotremes because they lay eggs. **Identify** the key difference between these two mammal groups.

Analysing

9 **Compare** the life cycles of a human, a butterfly and a frog, discussing the main stages and processes.

10 **Compare** the processes of sexual reproduction in plants and animals.

11 **Compare** the structures involved in sexual reproduction in plants and animals.

12 **Contrast** between sexual and asexual reproduction.

13 **Compare** cross-fertilisation and self-fertilisation.

14 **Compare** the effects of alcohol and smoking on the developing fetus.

15 **Compare** the changes in male and female bodies during puberty.

Evaluating

16 *Sexual reproduction is superior to asexual reproduction if the environment is changing.* **Justify** this statement.

17 **Justify** the argument that illegal drugs should not be taken during pregnancy.

Creating

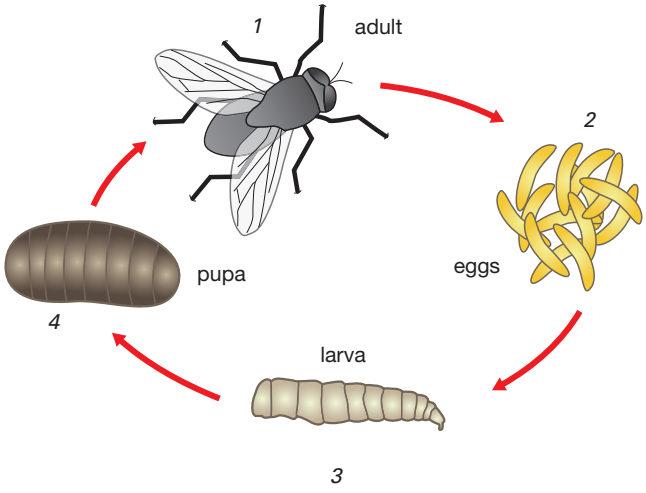
18 Make flash cards about the male and female reproductive systems. Each card can be either a word or a diagram. Do some as words and some as diagrams. Write the answer on the back without your partner seeing it. Use the flash cards to test a partner. If you flash a word, they must tell you the function or meaning. If you flash a diagram, they must tell you the name. Take turns testing each other with your flash cards.

19 **Use** the following ten key terms to **construct** a visual summary of the information presented in this chapter.

life cycle	development
sexual	asexual
plant	animal
reproductive structure	reproductive process
fertilisation	placenta

Thinking scientifically

Questions 1 and 2 refer to the following diagram of the life cycle of a housefly.



Q1 Between which two stages does fertilisation occur?

A 1 and 2 **B** 2 and 3
C 3 and 4 **D** 4 and 1

Q2 Between which two stages is this cycle most similar to the stage in the life cycle of a flowering plant when the seed germinates (the plant breaks out of the seed)?

A 1 and 2 **B** 2 and 3
C 3 and 4 **D** 4 and 1

Q3 Bats are placental mammals. Which of the following should occur in the life cycle of a bat?

A Bats would lay eggs in nests, like birds.
B Bats would give birth to live young and carry them in a pouch like marsupials.
C Bats would give birth to babies that go through a metamorphosis like butterflies.
D Bats would develop in a uterus with the fetus connected to the mother by an umbilical cord.

Questions 4 and 5 refer to the following table listing some reproductive structures in a human and a flowering plant.

Pair number	Human part	Flowering plant part
1	testis	stigma
2	uterus	seed
3	sperm	pollen
4	egg	anther
5	fetus	ovule
6	fallopian tube	fruit

Q4 Which of the following pairs in the table names parts that have the same role in human reproduction as they do in plant reproduction?

A pair 1 **B** pair 2
C pair 3 **D** pair 6

Q5 Which of the following pairs in the table names parts found in the female human and the female part of the flower?

A pair 1 **B** pair 3
C pair 4 **D** pair 5

Q6 The methods of reproduction of several species are shown below.

Organism	Method of reproduction
Pea	Self-fertilisation
Bracken fern	Underground stem, spores, sexually—mostly self-fertilisation
Amoeba	Asexually by fission
Dog	Cross-fertilisation

Which of the following species would probably show the greatest variation in its offspring?

A pea **B** amoeba
C bracken fern **D** dog

Glossary

Unit 4.1

Biosecurity: preventing pest and disease organisms from entering our country

Development: changes in body form and shape in an organism's life

Egg: female cell that must be fertilised to start a life cycle

Growth: an increase in body size

Imago: the adult stage in an insect life cycle (complete metamorphosis)

Larva: the second stage in an insect life cycle (complete metamorphosis)

Life cycle: the changes that happen to an individual from its formation until it has produced offspring similar to it

Larva

Metamorphosis: the changes in structure that happen as an organism develops into an adult

Nymph: the stage of an insect life cycle that gradually develops into the adult without becoming a pupa (incomplete metamorphosis)

Pupa: the stage in an insect life cycle when the larva changes into an imago (complete metamorphosis)

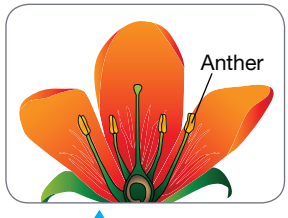
Reproduction: the process of parents producing new individuals, or offspring

Pupa

Unit 4.2

Anther: the part of the flower that produces the pollen

Asexual reproduction: a new individual growing from part of its one parent's body with no joining of gametes



Anther

Copulation: two individuals joining to allow gametes to become fertilised

Cross-fertilisation: when gametes from two separate individulas join together

Asexual reproduction

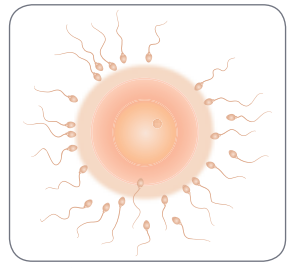
Development: the process by which the cell formed by fertilisation divides and develops to begin to look like an adult

Embryo: a developing offspring at a very early stage of development

Fertilisation: the joining of gametes

Flower: the reproductive structure in plants that makes male sex cells and female sex cells

Fruit: the structure that the ovary of a flowering plant turns into as the seeds ripen



Fertilisation

Germination: when the young growing plant sprouts out of the seed

Hermaphrodite: an individual with both male and female sex organs

Parthenogenesis: where offspring develop from eggs that have not been fertilised by a male gamete. A form of asexual reproduction

Pollination: transfer of pollen from the anther to the stigma

Self-fertilisation: when gamates from the same individual join together

Sexual reproduction: the process of a sperm and an egg joining together and then growing into a new individual

Stigma: the flower part that receives the pollen

Style: connects the stigma to the ovary

Zygote: the first cell of the new individual after fertilisation

Glossary

Unit 4.3

Cervix: part of the uterus that keeps it closed while the baby is developing

Fallopian tubes (oviducts): tubes down which the egg passes and where fertilisation occurs

Hormones: chemicals made in the body to control reproduction and physical characteristics

Implantation: process of the blastocyst burrowing into the lining of the uterus

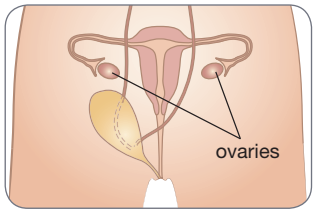
Menstrual cycle: regular monthly changes in the hormones and reproductive organs of adult females

Menstruation: blood and tissue loss from the lining of the uterus at the start of a menstrual cycle

Ovaries: organs that produce the eggs or ova

Ovulation: the egg bursting out of the follicle

Period: shedding of blood and dead tissue from the the lining of the uterus



Ovaries

Puberty: the time in life when physical changes bring sexual maturity

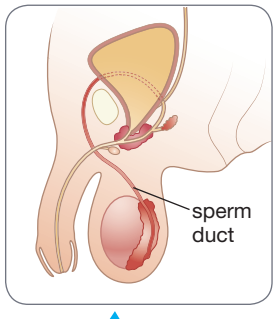
Semen: a mixture of sperm and other fluid released from the penis

Sperm duct (vas deferens): tube carrying sperm from the testes to the urethra

Testes: male organs that produce the sperm

Uterus (womb): organ in which the fetus grows and develops

Vagina: organ that allows the male penis to be inserted to deposit the sperm and also acts as the birth canal down which the baby passes



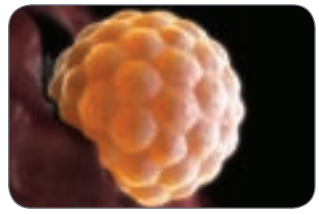
Sperm duct

Unit 4.4

Afterbirth: placenta expelled from the mother after birth

Amniotic fluid: fluid surrounding the embryo that acts as a shock absorber and helps to maintain a constant temperature

Blastocyst: a hollow ball of cells that becomes an embryo


Blastocyst

Copulation: two individuals joining together for sexual reproduction

Ejaculation: process of sperm being squeezed out of the penis

Embryo: early stages of development before the major organ systems are formed

Fetal alcohol syndrome (FAS): damage caused by alcohol in pregnancy where the baby is small, has a small head, unusual facial features, and heart defects

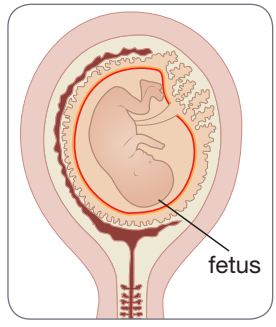
Fetus (foetus): stage of development when most of the major organs and systems are present

Gestation: the time period from fertilisation to birth

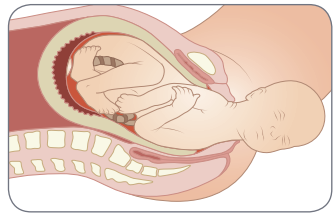
Labour: process leading to birth, from first contractions of the uterus to expulsion of the afterbirth

Placenta: membranes of the fetus and mother that allow nutrients and oxygen to be exchanged and waste to be removed

Sexual intercourse: a male and female copulating



Fetus


Labour

SCIENCE TAKES YOU PLACES

Look who is using science

HAIRDRESSER

My name is Aldijana Petovic and I am a hairdresser at a salon called Stylistic.

My job is to colour, cut and style clients' hair. I have a ten-minute meeting with clients to discuss what look they're trying to achieve. During this consultation I check the condition and colour of the client's hair. Then I know what type and strength of coloured dye or peroxide I need to use to give them the colour they're after. Peroxide is a chemical used in salons that bleaches (removes) the colour from the hair. If the client hasn't used our brand before, then I do a skin test, where I apply a small amount of the dye behind the ear. If the person is allergic to it, they will feel a burning sensation on the test spot and the skin will redden. When using chemicals, I wear gloves so that I won't get colour stains on my skin or burns from the peroxide.

CHIROPRACTOR

My name is Dr James Nicola and I'm a chiropractor at The Parker Clinic.

Damage to the joints of your skeleton can cause pain and affect your general health. It's my job to use the science I've learnt to work out what has happened to these joints and how they can be fixed.

The adult human skeleton consists of 206 bones that are very different from any non-living bones you may have seen in a museum. Living bone is like a green branch on a tree; it's strong yet flexible. Dead bone becomes like a dried-up dead branch. While still quite strong, dead bone loses its flexibility, making it more brittle (easy to break). Your spine is particularly remarkable because it allows a significant amount of movement while still protecting the body's most vital and delicate organs, the brain and spinal cord.

PROSTHETIST

My name is Amy Emons and I am a prosthetist, which means I fit artificial limbs for people who have lost all or part of their arm or leg.

I meet with patients who have lost a limb through accident or disease, or who have been born with a limb missing. First, I complete a full physical and biomechanical assessment of the patient's motion. Then I make a cast from the patient's remaining limb and construct an artificial replacement, which is called a prosthesis, to suit the needs and lifestyle of the patient. I try to select the most appropriate prosthetic foot, ankle and knee joint components to build into the prosthesis.

Some components are now controlled using computer microprocessors. The prosthesis has a soft gel or foam part to fit onto the patient's skin and a hard outer covering of fibreglass or carbon fibre. I make sure that the prosthesis fits the patient comfortably and I assist the patient with learning to use it. I enjoy my work because I love helping my patients get back to the lifestyle they once had and I enjoy working with developing technology.