

**Lesson
Seventeen**

Biology: Human Reproduction

Aims

By the end of this lesson you should:

- know the structures and function of the human male and female reproductive systems
- understand how the developing foetus is fed and protected inside the mother
- understand the key differences between reproduction in humans and other mammals
- know the stages of the human life cycle

Context

This lesson builds on the study of reproduction in Lesson Thirteen, and considers reproduction in human beings.



Oxford Home Schooling

Introduction

As we saw in Lesson Thirteen, humans are **mammals** and share their pattern of reproduction. The key features of this are:

- reproduction is **sexual** (not asexual) involving the fusion of **gametes** (eggs and sperms)
- **fertilisation** is **internal** (not external) happening inside the female's body
- there is well-developed **parental care**, so the offspring are more likely to survive to become adults. This includes the embryo being carried inside the mother for protection during its early life.

In this chapter we shall look at the details of human reproduction, which is basically the same as that of other mammals, following the whole process through to the production of a new adult.

Male and Female Reproductive Systems

You need to know the parts of the reproductive systems of a man and a woman, and the function of each – the job each does in producing the new offspring. Given below are the “official” names for the parts – the correct name to use if you discuss them with your doctor. You may feel embarrassed about using these words. That is normal, but in fact there is nothing “rude” about any of these terms!

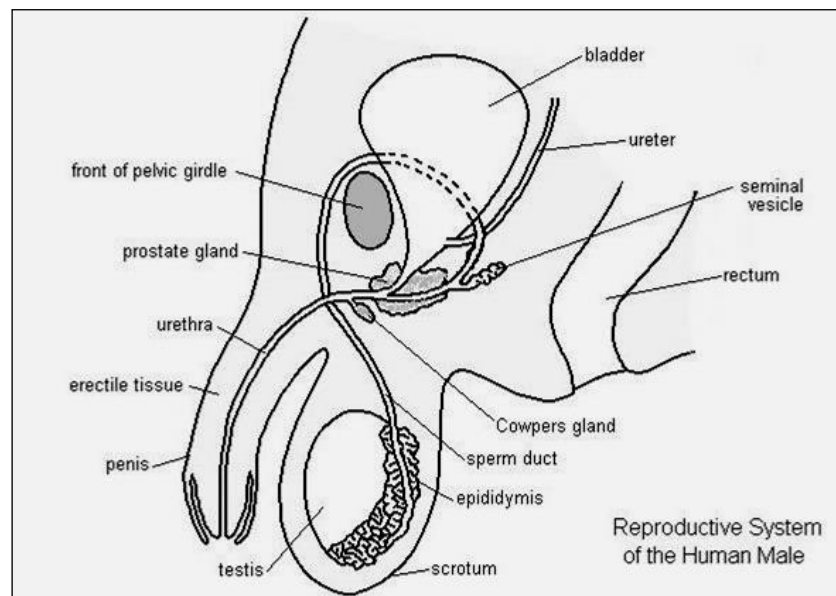


Log on to Twig and look at the film titled: **Fertilisation**

www.ool.co.uk/931ec

An introduction to human fertilisation and the challenges facing the sperm and egg. How do they find each other and how do they combine to form a new life?

Male Reproductive System

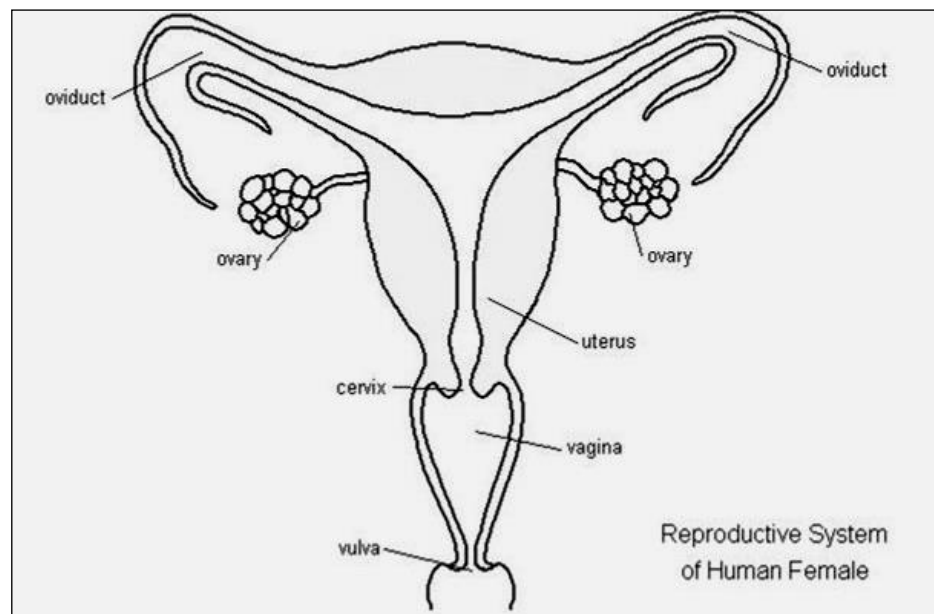


This diagram shows the male **reproductive system** seen from the side. It is partially joined with the **excretory system** (which produces and gets rid of the urine) so this is also included in the diagram. These are the functions of its important parts:

- **testis:** this is where the sperms are made. The male has two of these, one on the left and one on the right (the plural of testis is testes). Because the sperms will only develop properly at temperatures cooler than body temperature (37°C) the testes hang in a bag called the **scrotum** outside the body to keep them cool.
- **sperm duct:** also called the “sperm tube” or “vas deferens”. This carries the sperms away from the testis towards the outside.
- **seminal vesicle:** this produces the liquid that the sperms will swim in, called **semen**
- **prostate gland:** (*not prostrate*). This produces chemicals which start the sperms swimming. It often gets too big or develops cancer in later life, which is dangerous
- **ureter:** this carries waste urine from the kidney, where it is made, to the bladder, where it is stored.

- **penis:** a tube called the **urethra** runs down this, which carries both sperms and urine to the outside (but not at the same time). The penis is inserted inside the female's body during mating.

Female Reproductive System



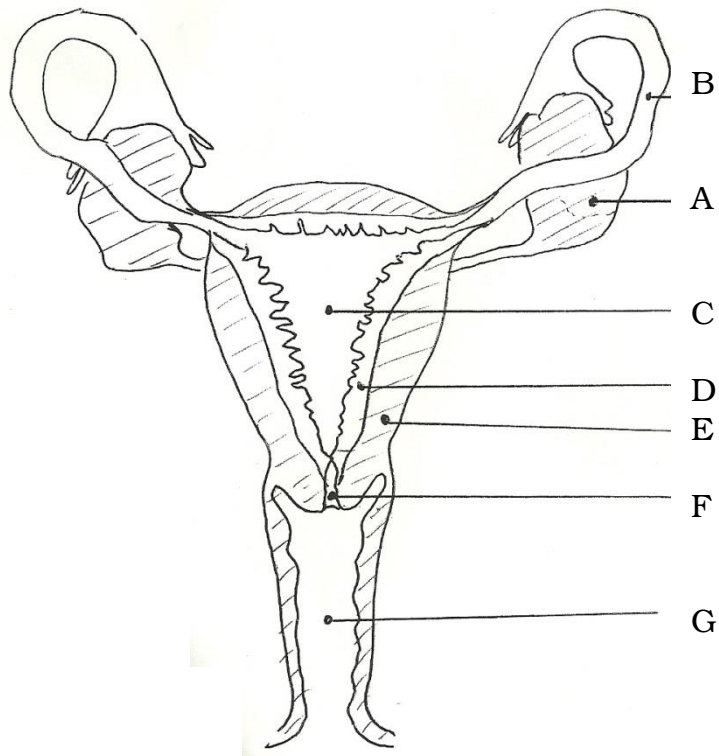
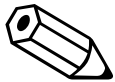
This diagram shows the female reproductive system seen from the front. Unlike in the male, it is *not* joined with the excretory system. These are the functions of its important parts:

- **ovary:** this is where the eggs (ova) are made. The female has two of these, one on the left and one on the right.
- **oviducts:** also called “egg tubes” or “fallopian tubes”. These carry eggs away from the ovaries towards the uterus
- **uterus:** also called the “womb”. This is where the foetus (baby) will grow and develop during pregnancy. It has a thick, outer **uterus wall** made of **muscle**, for pushing the baby out during birth, and an inner soft **uterus lining** (see later)
- **vagina:** this is where the male's penis fits during mating. It is also the route the baby takes to the outside during birth

- cervix:** this is the narrow part between the vagina and the uterus. Like the prostate gland in the male, it often develops cancer in later life, so older women are tested to make sure this is not happening.

Activity 1

Use the information and diagram above to label A - G on the following diagram.



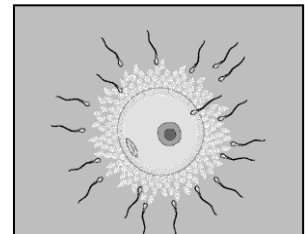
- A.
- B.
- C.
- D.
- E.
- F.
- G.

Mating and Fertilisation

Once a month, one of the two ovaries releases an egg, a process called **ovulation**. The egg moves slowly down the oviduct towards the uterus, taking about 48 hours to arrive. For pregnancy to occur, the egg must be fertilised by a sperm *while it is in the oviduct*. If it reaches the uterus without being fertilised it dies.

In human beings, mating is called **sexual intercourse**. The male's penis is inserted inside the female's vagina, and sperms are **ejaculated** (squirted) in their semen down the urethra and out into the top of the vagina. The sperms then swim through the cervix and uterus and up the oviducts.

If the sperms meet an egg in an oviduct they surround it and one enters and **fertilises** the egg to form a **zygote**.



Implantation

The zygote continues on down the oviduct, dividing as it goes to form a small ball of cells called an **embryo**. When it reaches the uterus, the embryo buries itself into the lining of the uterus, an event called **implantation**. It is now safe, will be fed by the mother's blood, and will start to grow. The woman is now **pregnant**.

Development



Log on to Twig and look at the film titled: **Birth**

www.ool.co.uk/936ts

A guide to how the mother and baby's bodies change and cope with labour - the most challenging and potentially dangerous phase of pregnancy.

The embryo will stay in the uterus for about nine months, a length of time known as the **gestation period**. During this time it will:

- grow (get bigger) and
- develop (change its structure)

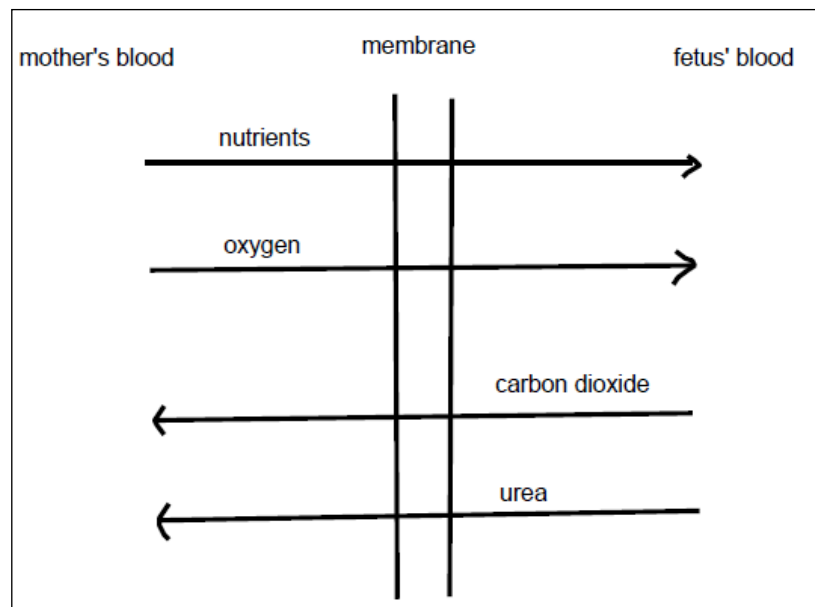
Once it develops organs, and begins to look like a baby, it is called a **foetus** (also spelled **fetus**).

The Placenta

A crucial structure called the **placenta** develops in the lining of the uterus, attached to the foetus by the umbilical cord. The foetus' blood flows down the **umbilical cord**, and in the placenta it flows very close to the mother's blood, but without mixing. Here, materials move by **diffusion** between the two bloodstreams across a thin membrane:

- oxygen and nutrients (e.g. glucose) diffuse from the mother's into the foetus' blood, while
- wastes including carbon dioxide and urea diffuse in the other direction.

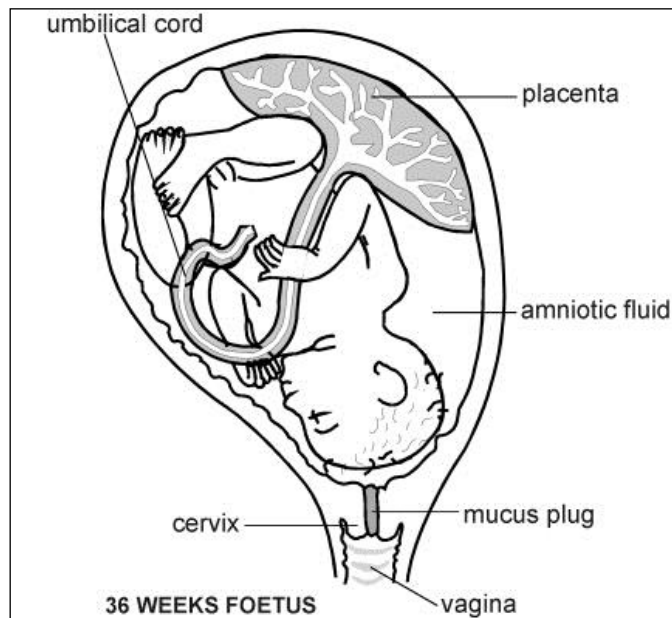
The foetus is thus provided with what it needs without it having to breathe or eat.



Unfortunately harmful materials can also cross the placenta, including alcohol, nicotine (from cigarette smoke), drugs like heroin, and some viruses including the one causing Rubella (German Measles). So if the mother smokes, drinks or takes harmful drugs during pregnancy, or if she catches Rubella, the foetus may be damaged.

Amniotic Fluid

The foetus is surrounded by liquid called **amniotic fluid**, and floats in its own private “pond”. The fluid cushions the foetus, and stops it being damaged by bumps as the mother moves around. The fluid is held in place by a membrane called the **amniotic sac**. This breaks at the start of birth, releasing the fluid through the vagina.



Birth

At the end of pregnancy, the foetus is pushed out head first through the cervix and vagina by powerful **contractions** of the muscular *wall* of the uterus. The umbilical cord is cut, and the newborn baby starts to breathe for itself, and to suck milk from its mother.

Further contractions of the uterus then push out the placenta and umbilical cord as the **afterbirth**.

Activity 2



There are some videos of childbirth available on YouTube. Go to www.youtube.com and type “childbirth” in the search box. However, you should let your parent or guardian do this activity with you.

After Birth

In humans, as in all mammals, parental care continues after birth. Mammals have the most advanced parental care of all animals, and humans the most advanced parental care of all mammals. This is why the survival rates of human infants are so high. In the UK, it is unusual for a human child to die before becoming an adult – that is certainly not the case for a UK tadpole!

Milk

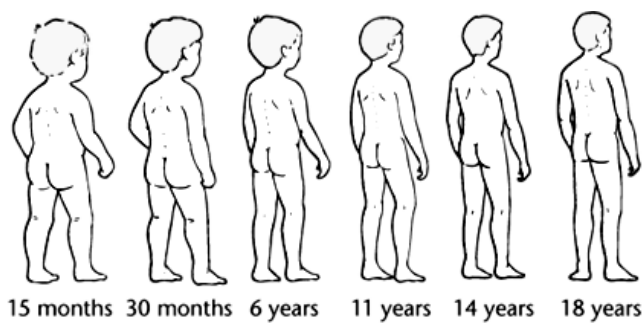
For the first few weeks the baby is fed on **milk** made by **mammary glands** in the mother's breasts. (Only mammals do this, and this is where the name "mammals" comes from.) The milk is rich in energy, and in protein needed for growth of the baby. For the first few days it also give the baby special molecules called **antibodies** to protect it against germs.


Childhood

During childhood the young human is still dependent on its parents for survival. It continues to *grow* and *develop* physically, and it learns what it needs to know for success in adult life.


Activity 3

The following diagram shows the changes in the relative size of the head, legs and trunk (from the neck to the top of the legs) as a human baby grows into an adult.



	<ol style="list-style-type: none">1. What happens to the relative sizes of (i) the head (ii) the legs during growth?2. Measure as many members of your family as you can. Do your measurements agree with your answers to (a)?
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Puberty and Adolescence

	<p>Log on to Twig and look at the film titled: Intro to Puberty www.ool.co.uk/1023qa</p> <p>An introduction to the biological processes which transform children into adults. Hormones encourage growth, alter thought processes and emotions, and prepare the body for reproduction.</p>
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Puberty is the stage at which the reproductive organs become mature, and the ovaries or testes start to release eggs or sperms. Other features called **secondary sexual characteristics** develop at this time:

- in *girls* the breasts enlarge, the hips get broader, and extra hair grows under the arms and in the **pubic** region (between the legs)
- in *boys* the muscles and penis grow bigger, the voice becomes deeper and extra hair grows, as in the woman but also on the face

Adolescence is the name given to the stage in the life of the young person while all this is going on. Adolescence includes the psychological and social changes that occur (how the

young person thinks, feels and acts) as well as the physical changes of puberty.

Once adolescence and puberty are completed, the young human being is now an **adult**, ready to have children of their own.

Humans and other Mammals

Although reproduction in most mammals is the largely the same, there are significant variations in two things.

Gestation Period

The gestation period – the time spent in the uterus – varies from a few weeks to over a year depending on the species. In general:

- the larger the mammal, the longer the gestation period, and
- the longer the gestation period for a given size of mammal, the more mature the baby is at birth, and so the more rapidly it can take care of itself after birth.

Strange mammals found in Australia called Marsupials (kangaroos, etc.) do not have placentas. So they give birth while the foetus is very young, and carry the baby it around in a protective *pouch* instead of in the uterus.

Activity 4

Find out the gestation periods of a mouse, cat, horse and elephant from http://en.wikipedia.org/wiki/Gestation_period . Do the periods increase with the size of the animal?



Length of Childhood

Human beings are unique in having their offspring dependent for many years – often for over twenty years. (If you doubt this, consider when *you* are planning to run your own house and earn your own living without any help at all from mum and dad!) This is connected with how complicated human society is – it takes many years to learn all you need to know to be a success in the modern world.

The Menstrual Cycle

The **menstrual cycle** is the name given to the changes that occur in a woman's uterus and ovaries over the course of a month.

At the start of the cycle the uterus grows a thick *lining*, rich in blood vessels, ready for implantation of the embryo. At about day 14 one of the two ovaries releases a single egg, which moves down the oviduct as described above. If the egg is not fertilised, towards the end of the cycle the uterus lining breaks down. It, and quite a lot of blood, is lost through the vagina over a few days. This is called **menstruation**, or a “period”. When this is completed, a new lining is grown.

In human beings, the cycle takes about 28 days. It goes on from puberty until the **menopause**: the stage (usually in a woman's late 40s) when the cycles stop and she is no longer able to have babies.

Twins

There are two different ways in which a woman can have twins:

- **Identical twins:** A single sperm and egg form a zygote and embryo in the usual way. However the embryo drops into two halves before implantation, and each half grows into a separate foetus. Because they come from the same egg and sperm, these twins have the same genes, so they are very similar (and always the same sex).



Identical Twins

<http://creativecommons.org/licenses/by-sa/3.0/deed.en>

- **Non-identical twins:** Two eggs are released at the same time by accident, and are fertilised by separate sperms. Each grows into a foetus. Because these twins are formed from different eggs and sperms they have different genes. They are no more similar than siblings (brothers or sisters) and they can be different sexes.

Activity 5



Go to "BBC Bitesize" at

www.bbc.co.uk/schools/ks3bitesize/science/,

click on "organisms, behaviour and health", and then work through all the material under "Reproduction".

If you would like some more on this, you can also try "skool.co.uk" at

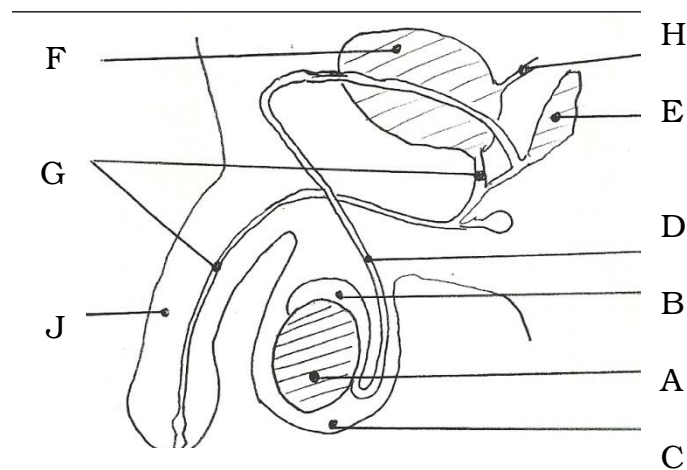
<http://lgfl.skool.co.uk/keystage3.aspx?id=63>

and work through sections 18 – 25.

Keywords**Testis****Scrotum****Sperm duct****Seminal vesicle****Prostate gland****Ureter****Urethra****Penis****Umbilical cord****Amniotic sac****Mammary glands****Adolescence****Sexual intercourse****Implantation****Gestation period****Menstrual cycle****Ovary****Oviduct****Uterus****Vagina****Cervix****Embryo****F(o)etus****Placenta****Diffusion****Amniotic fluid****Puberty****Ovulation****Ejaculated****Secondary sexual
characteristics****Menstruation**

Self-Assessment Activities

1. Label parts A, C-G and J on this diagram of the human male reproductive system:



2. Choose the one correct answer in each of the following questions:
- (a) The menstrual cycle prepares the uterus for a fertilised egg. How long is an average menstrual cycle from start to finish?
- 20 days
 - 2 weeks
 - 28 days
 - 7 days
- (b) What happens to the lining of the uterus during menstruation?
- It grows and becomes thicker, ready to receive the fertilised egg.
 - It is absorbed back into the body.
 - It gets thinner and thinner.
 - It breaks down and leaves the body through the vagina.
- (c) At what point in the menstrual cycle is fertilisation most likely?

- a. During menstruation
 - b. Between 14 and 16 days
 - c. At 20 days
 - d. Between 25 and 28 days
- (d) When the foetus is growing inside the uterus it needs nutrients. What provides these nutrients?
- a. Placenta
 - b. Amniotic sac
 - c. Uterus
 - d. Oviduct
- (e) What does the mother's blood take away from the foetus at the placenta?
- a. Oxygen
 - b. Water
 - c. Carbon dioxide
 - d. Food
- (f) What is the job of the amniotic fluid?
- a. It supports the foetus and protects it from shocks.
 - b. It gives the foetus room to grow and move.
 - c. It provides water for the foetus to drink.
 - d. It stops the baby from drying out.
- (g) Why is protection against Rubella important for women?
- a. Rubella is dangerous to women.
 - b. Rubella can cause women to become infertile.
 - c. Rubella can cause damage to a growing foetus.
 - d. Rubella will stop a woman from menstruating.
- (h) Which of these things will harm a growing foetus?
- a. Chemicals in cigarette smoke
 - b. Alcohol
 - c. Drugs
 - d. All of the above

Suggested Answers to Activities

Activity 1

A: ovary, B: oviduct, C: uterus, D: uterus *lining*, E: uterus *wall*, F: cervix, G: vagina

Activity 3

- (a) (i) the head gets smaller, compared to the size of the rest of the body
- (ii) the legs get longer, compared to the size of the rest of the body

Activity 4

Mouse 19 – 21 days, cat 64 days, horse 330 – 342 days, elephant 616 days.

Yes, the bigger the animal the longer the gestation period.