

# HUMAN REPRODUCTION

## Learning objectives

- To describe the general structure and function of the male and female reproductive systems and the functions of their main parts
- To describe the role of meiosis in the production of sperm cells and egg cells (ova)
- To define the term 'secondary sexual characteristics'
- To describe the roles of oestrogen, progesterone and testosterone in human reproduction
- To describe the events of the menstrual cycle and the roles of oestrogen and progesterone
- To describe the menstrual cycle in detail, including hormonal control
- To describe one possible cause, prevention and treatment of endometriosis or fibroids
- To describe copulation and the four types of birth control
- To describe where fertilisation occurs
- To describe one cause in each case and the availability of corrective measures for male and female infertility
- To describe in-vitro fertilisation and implantation
- To describe implantation and the formation and function of the placenta
- To describe in detail the sequence of embryonic development up to the third month
- To describe the process of birth
- To describe milk production and breastfeeding, including the biological benefits of breastfeeding.

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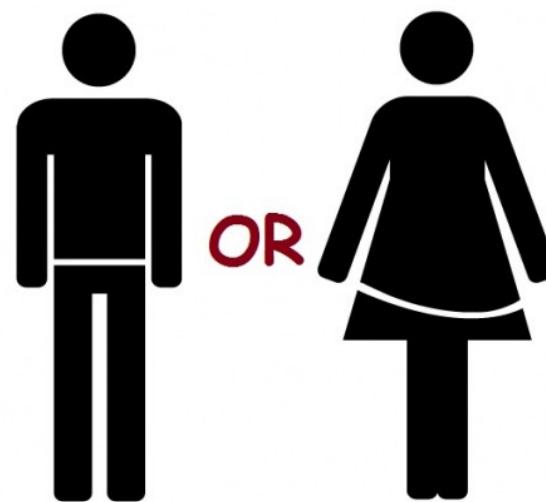
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# Introduction

**Both males and females have,**

1. A pair of structures to produce **gametes** (sex cells by Meiosis).
2. A series of **tubes** for Transport.
3. Several **Glands** that secrete hormones that control reproduction.



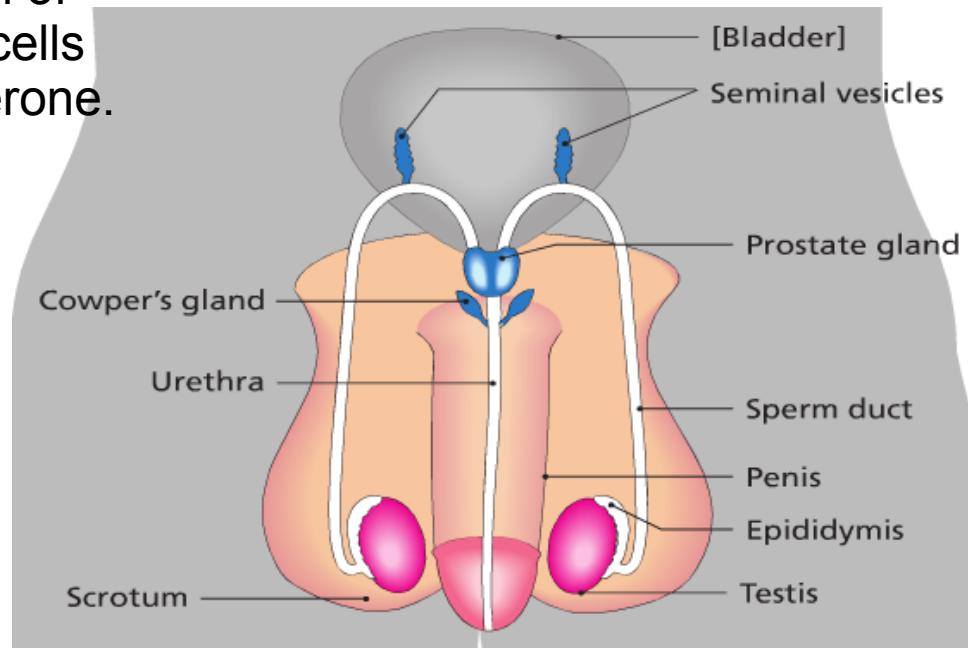
# Male Reproductive System

**Testes** - male gonads have 50 cm of tubules that produce sperm and cells inbetween these produce testosterone.

**Epididymis** - matures sperm and stores them for 6 weeks.

**Sperm Duct** - carries sperm to the urethra.

**Urethra** - carries semen and also urine out of the penis.



**Seminal vesicles, Prostate and Cowper's gland** - these glands produce seminal fluid that nourishes the sperm (fructose) and allows them to swim. The fluid and sperm together is called **semen**.

## Hormones in the Male Reproductive System

**FSH** - Follicle Stimulating Hormone, causes meiosis in the testes.

**L.H.** - Lutinising Hormone, causes production of Testosterone in the testes.

**Testosterone** - is the main male hormone (Androgen). Causes the formation of male sex parts in the womb and then the secondary characteristics at puberty.

## Secondary Sexual Characteristics

**These are features that distinguish males from females, apart from the sex organs themselves.**

1. The growth of underarm, pubic, chest hair.
2. Larynx enlarges (deeper voice).
3. Muscle and bone development.
4. Growth spurt and shoulders widen.
5. More sebum(oil) in the skin, causing spots.



# Male Infertility

**Infertility is the inability to produce offspring.**

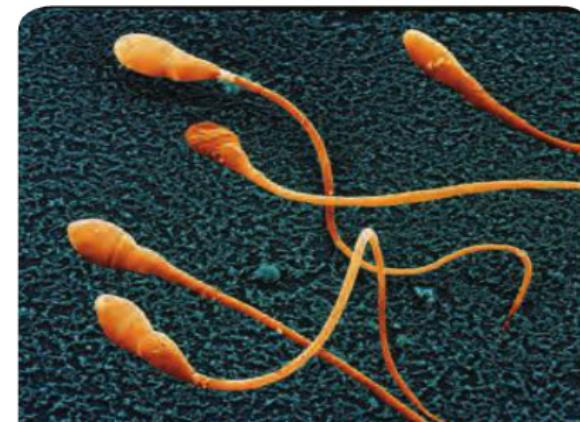
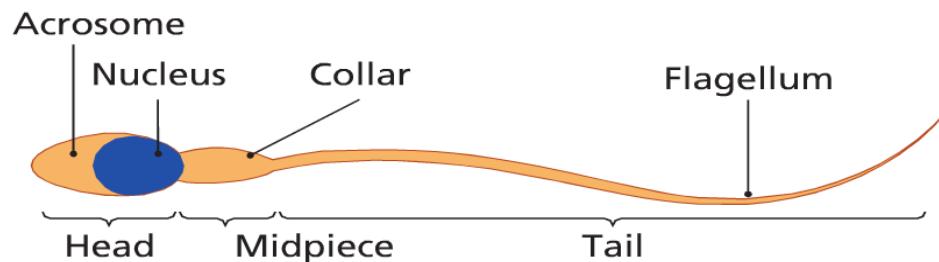
**Low sperm count** is the main reason for male infertility.

Is caused by drug use, alcohol, cigarette smoking and hormones.

**Treatment** - stop all the above and take hormone supplements.

Other reasons are,

- Low sperm motility (bad swimmers).
- Endocrine gland (hormone) failure.



The **acrosome** contains enzymes to eat into the egg.

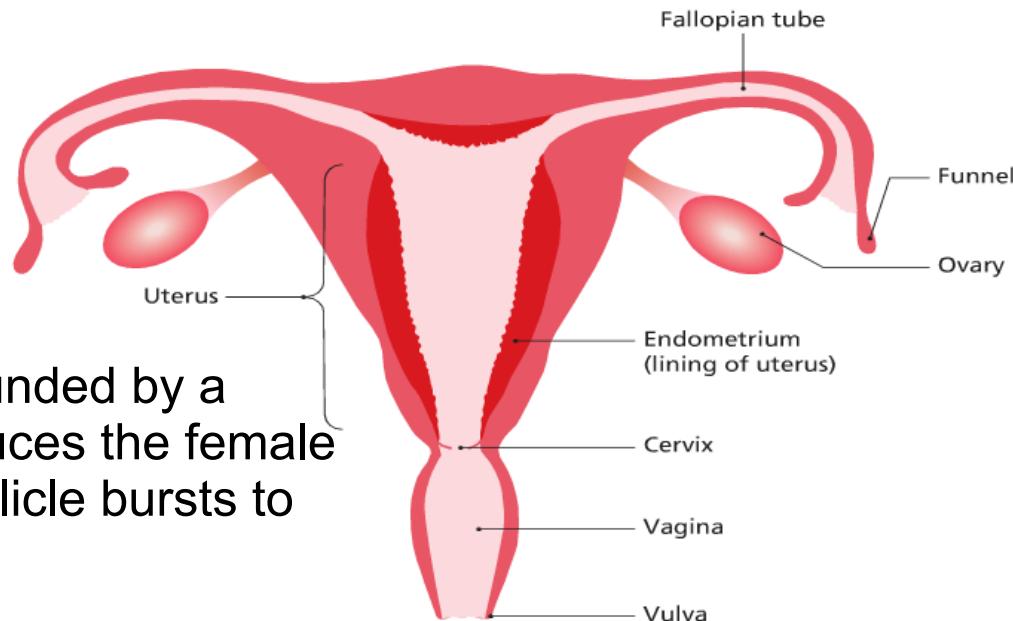
The **nucleus** contains the X or Y chromosome.

The **collar** has many mitochondria to power the tail.

## Female Reproductive System

**Ovaries** - female gonads that produce eggs and hormones. At puberty 20 eggs are made by meiosis each month. Only one survives usually.

The egg (ovum) is then surrounded by a **Graafian follicle**, which produces the female hormone, **Oestrogen**. This follicle bursts to release the egg at **ovulation**.



After ovulation the follicle fills with yellow liquid and is now called the **Corpus Leutum**. This produces the hormone **Progesterone**.

**Fallopian Tube** - known as the oviduct, it carries the egg to the womb.

**Uterus** (womb) - a muscular structure with a lining (**endometrium**) that provides nourishment for a developing embryo.

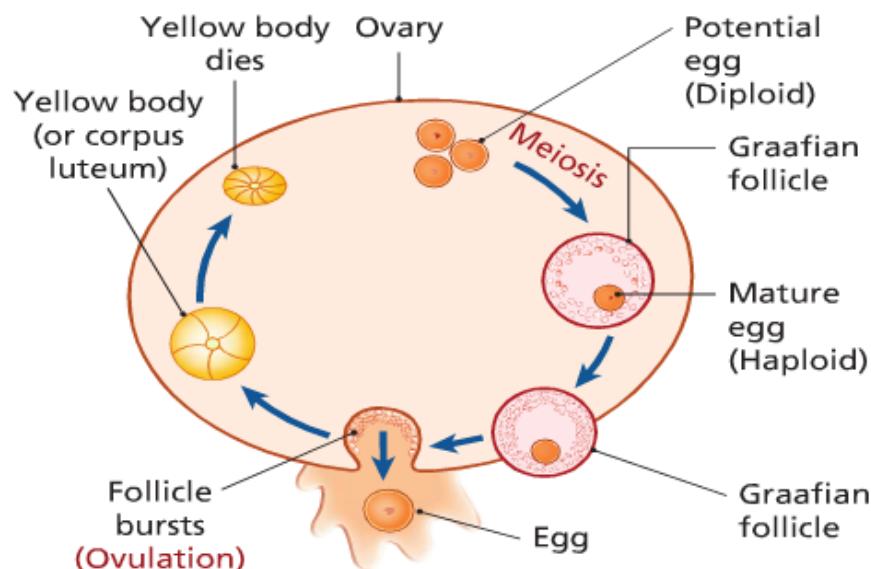
**Vagina** - a muscular tube that allows entry of sperm and the exit of a baby.

# The Menstrual Cycle

## Days 1-5

The old uterus lining breaks down and is released.

This is called Menstruation. Meiosis produces a new egg surrounded by a Graafian follicle.



## Day 14-28

The Graafian follicle becomes the Corpus Luteum, which releases Progesterone. This thickens the womb lining and stops more eggs being produced.

## Days 6-14

The Graafian follicle produces oestrogen, which thickens the womb lining and stops more eggs being produced.

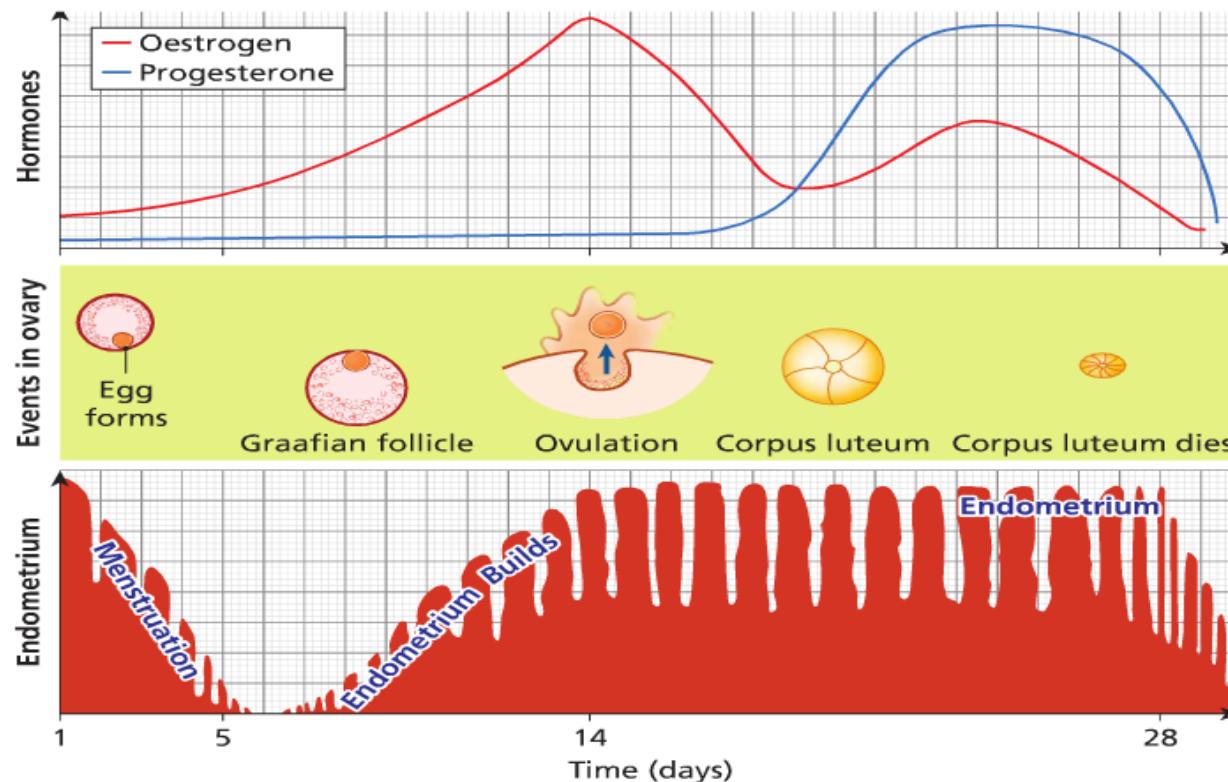
## Day 14

The Graafian follicle bursts and releases the egg, which moves into one of the Fallopian tubes. It survives for about 48 hours.

# The Menstrual Cycle - Continued

## Day 14-28

If fertilisation hasn't occurred then the Corpus Luteum breaks down by Day 22. This breaking down reduces the progesterone levels and so the uterus lining breaks down by Day 28.



## Hormones in the Female Reproductive System

**Oestrogen** - causes the womb lining to thicken for first 14 days.

**Progesterone** - Continues womb lining thickening for next 14 days.

Both **inhibit egg production** and are used in the contraceptive pill.

## Secondary Sexual Characteristics

These are features that distinguish males from females, apart from the sex organs themselves.

1. The growth of underarm and pubic hair.
2. Breasts enlarge and mature.
3. Body fat increases.
4. Pelvis widens for childbirth.
5. Growth spurt due to testosterone in adrenal glands.



## Female Infertility

**Infertility is the inability to produce offspring.**

**Failure to ovulate** - is the main reason for female infertility.

Is caused by endocrine gland failure. If FSH or LH is not produced or if there is too much then eggs may not be made or released.

**Treatment** - hormone supplements are injected.



## IVF (InVitro Fertilisation)

IVF is used if fallopian tubes are blocked, hormones don't allow ovulation or if males have a low sperm count. Females are given fertility drugs for the first 2 weeks and produce several eggs.

The eggs are removed and mixed with the sperm in a dish (in vitro). After 2 days any embryos are placed back into the womb. Usually a woman can have multiple births by this method.

## Hormones in the Menstrual Cycle (Higher level only)

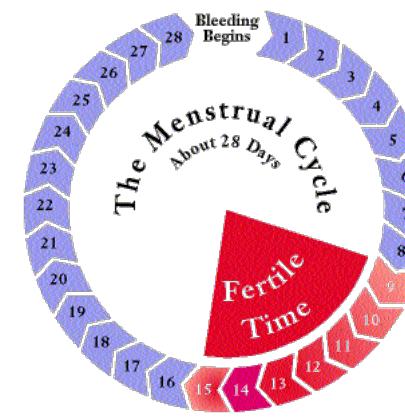
1. **FSH** - produced in pituitary gland, from day 1-5, and stimulates egg production.
2. **Oestrogen** - produced by Graafian follicle, day 5-14, builds up womb lining, inhibits FSH production (stops more egg production) and causes LH production.
3. **LH** - produced in pituitary gland, on day 14, causes ovulation, keeps womb lined and turns the Graafian follicle into the corpus luteum. The corpus luteum then makes the final hormone, Progesterone.
4. **Progesterone** - produced in pituitary gland, from day 14-28, inhibits FSH and LH and also stops any uterus contractions.

If pregnancy does not occur then the corpus luteum breaks down by day 22. By day 28 there are low levels of progesterone and oestrogen which causes contractions in the uterus, the lining breaks down and FSH is released again.

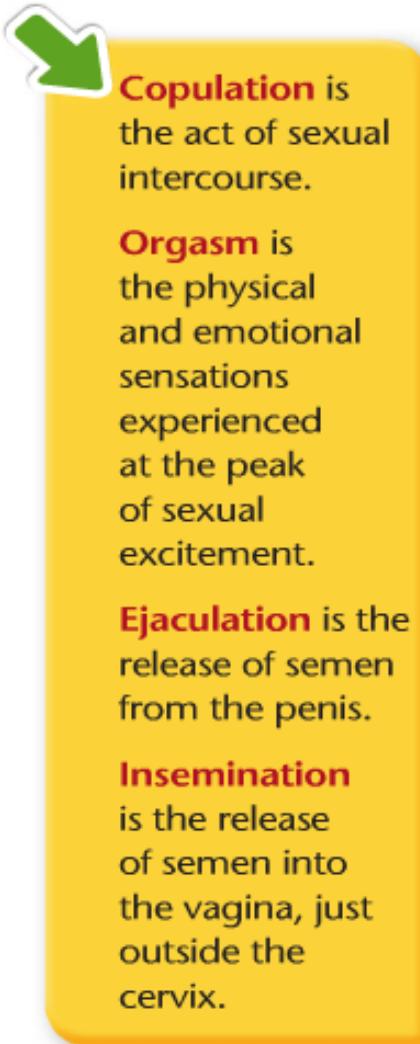
## Menstrual Cycle Disorder - Fibroids

Fibroids are benign cancer growths in the womb. They range from pea to grapefruit size. They can bleed and cause pain and also fertility problems.

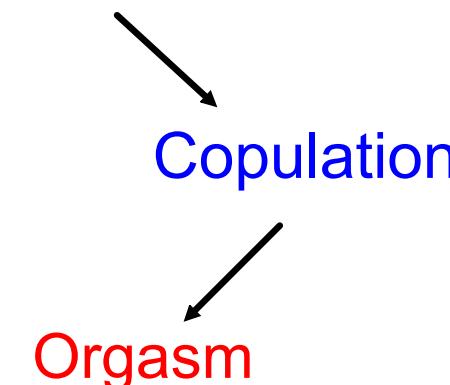
**Treatment** - remove by surgery or remove womb if too big.



# The Stages of Copulation

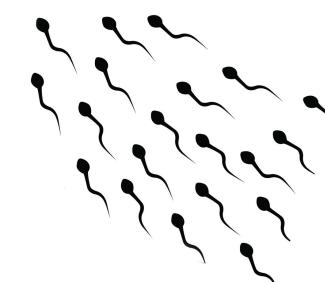


Sexual Arousal

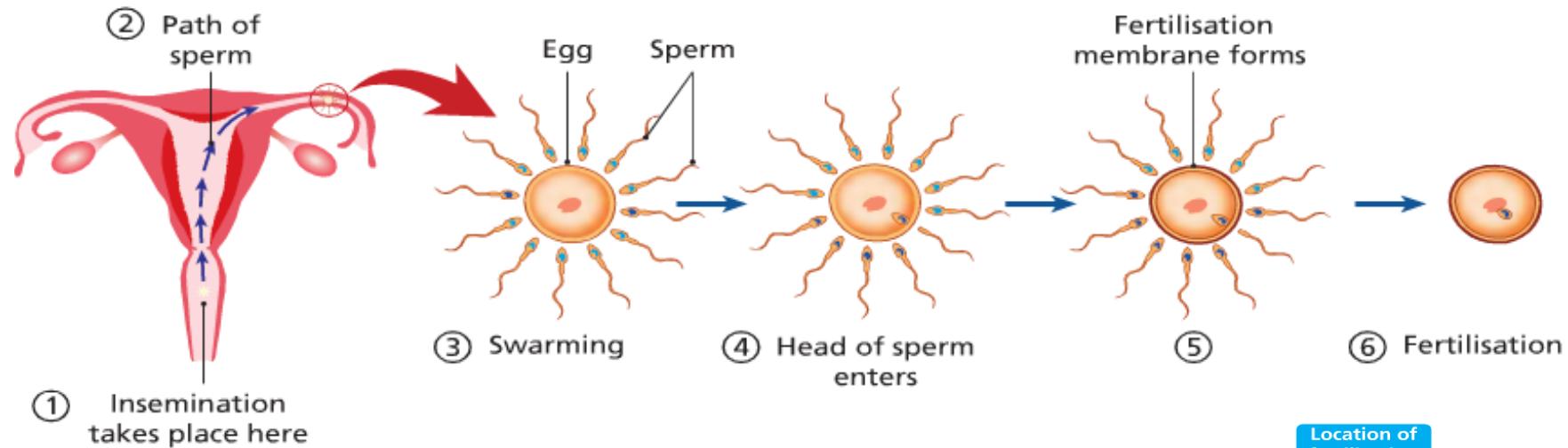


Sperm can be moved into the fallopian tubes by contractions 5 minutes after insemination. They use a chemical smell to find the egg (chemotaxis).

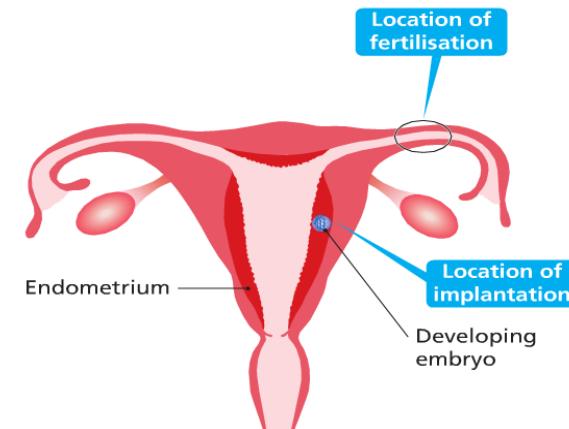
Many sperm will be attacked by white blood cells, go the wrong way or find the vagina too acidic.



# Fertilisation



Sperm survive for up to **4 days** in the female.  
 The egg lasts about **2 days**.  
 Fertilisation happens in the **fallopian tube**  
 and can happen if intercourse occurs  
 between Day 7-18.



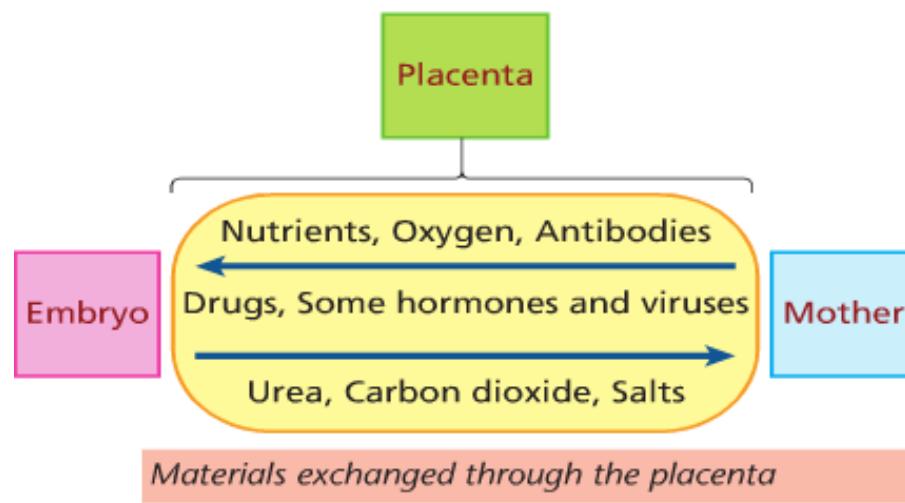
**Implantation** happens 6-9 days after fertilisation. This is where the embryo attaches to the uterus lining. An amniotic membrane forms around the embryo and the amniotic fluid protects the embryo.

# The Placenta

## Functions of the placenta

### Exchange

The placenta allows gases, nutrients, waste, antibodies, drugs and some hormones and micro-organisms to be exchanged between the blood of the mother and of the embryo. This exchange happens mainly by diffusion.



### *Prevents bloods from mixing*

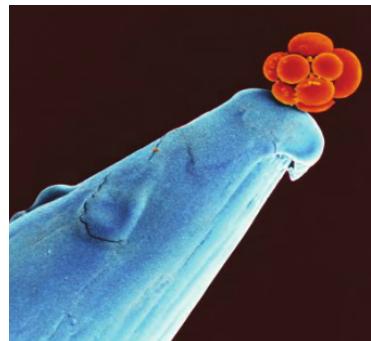
The blood supplies of the mother and embryo do **not** mix. The separation of the two blood supplies is essential for two reasons.

1. The blood groups might not be compatible, which would lead to damage to red blood cells.
2. The blood pressure of the mother's system would cause damage to the embryo.

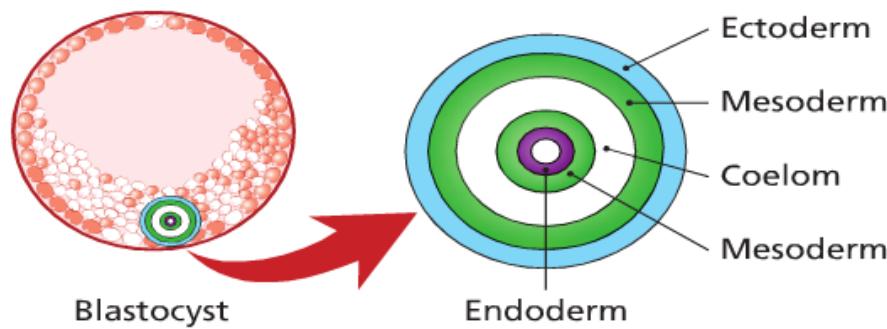
### *Hormone production*

The placenta also produces the hormone progesterone

# Zygote Development



- Day 1 - Fertilisation occurs.
- Day 3 - Zygote develops by mitosis into a **morula**.
- Day 5 - Becomes a hollow ball called a **Blastocyst**.  
This now moves into the uterus.
- Day 10 - 3 Germ layers are formed.

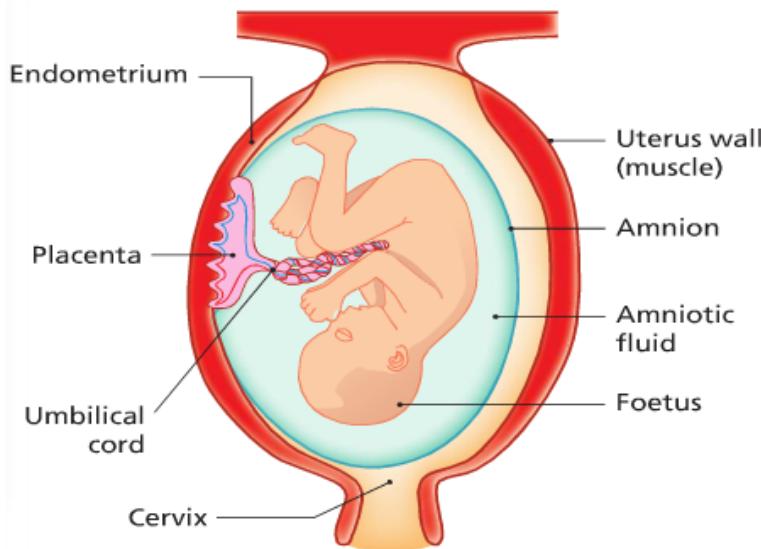


Embryonic development	
Germ layer	Organ or system produced
Ectoderm	Skin, nails, hair, nervous system
Mesoderm	Muscles, skeleton, excretory system, respiratory system, circulatory system, reproductive system
Endoderm	Inner lining of digestive, respiratory and excretory systems; liver and pancreas

## Growth up to 8 Weeks



**Gestation** is the length of time spent in the uterus from fertilisation to birth.



After 4 weeks the heart forms and starts to beat. The brain and umbilical cord form.

By week 5 the internal organs and limbs form. By 6 weeks the eyes, mouth, nose and ears are visible.

By week 8 the tail has shortened and most organs are formed. Now called a **foetus**.



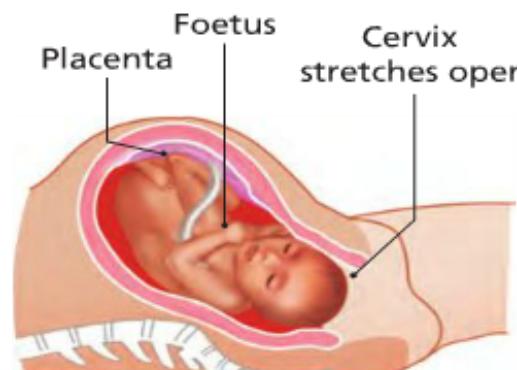
Oxytocin is often called the 'love hormone'. It is produced when people are in love or emotionally attracted (such as when a mother is with her baby). It increases trust and attachment, improves levels of optimism and self-esteem, reduces inflammation (and may help in healing), improves digestion, reduces stress and increases generosity.

# Stages of Birth

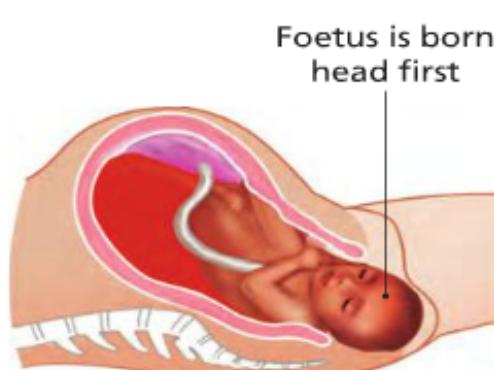
## Hormones associated with birth

Throughout pregnancy the hormone **progesterone** is produced in greater and greater amounts.

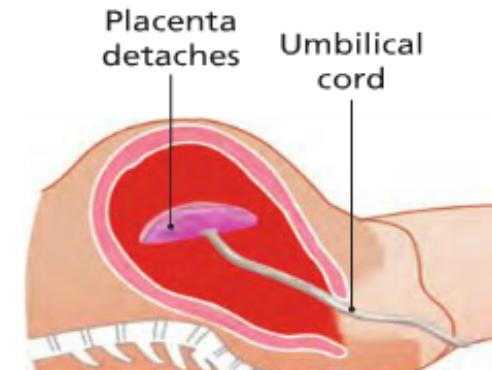
- For the first 10–12 weeks progesterone is made by the corpus luteum in the ovary of the mother.
- After 12 weeks it is made by the placenta, which means the placenta acts as an endocrine gland.
- Immediately before birth the placenta stops producing progesterone. The walls of the uterus begin to contract when levels of progesterone are low.
- At the same time, the pituitary gland of the mother produces a hormone called **oxytocin**. Oxytocin causes stronger contractions of the uterus muscle, resulting in the onset of labour. Labour begins when the uterus starts to contract involuntarily.



The birth begins



The baby is born



The afterbirth is expelled

# Breastfeeding

**Colostrum** - a thick yellow fluid that comes before milk.  
Has many minerals, proteins and antibodies.

**Prolactin** - Stimulates milk production and this continues until the baby stops feeding.

## Benefits of Breastfeeding

- The milk contains the ideal balance of **nutrients** needed by the baby.
- Contains **antibodies** from the mother for most common diseases.
- Safer as it is **sterile** is no infection from cleaning bottles etc.
- Causes the **uterus** to contract and helps mother recover quickly.
- May also help reduce the chance of breast **cancer** in the mother.



# Birth Control



**Birth control** refers to methods taken to limit the number of children that are born.

**Contraception** is the deliberate prevention of fertilisation or pregnancy.

## Natural Contraception

Basically avoiding sex during ovulation by measuring body temperature and mucous.

## Artificial Contraception

There are various methods - Mechanical, Chemical and Surgery.

1. Condoms, Diaphragms and Cap block the sperm.
2. Spermicides to kill sperm and hormones to block ovulation.
3. Tying tubes (sperm duct or fallopian tubes).