

Male reproductive system - A system adapted for creation of the male gamete, spermatozoa and sexual reproduction.

Vas deferens - Carries sperm towards the penis during ejaculation.

Testes - Produce s gametes (spermatozoa) and the hormone testosterone. Surrounded in a skin sac called the scrotum.

Penis - Organ adapted to transfer the sperm into the vagina during sexual intercourse.

Seminal vesicle - Secretes an alkaline, nutrient rich fluid onto the sperm in the vas deferens forming semen. The alkaline nature serves to neutralise any remaining acidic urine in the urethra and acidic conditions in the vagina.

Prostate gland - Secretes an alkaline fluid containing zinc ions onto sperm in the vas deferens.

Urethra - Carries semen and urine out of the body.

Epididymis and seminiferous tubules - Spermatozoa are made in the seminiferous tubules and stored in the epididymis to mature and become mobile.

Spermatogenesis - This occurs in the seminiferous tubules of the testes. A cross section is shown below.

Sertoli cells
provide nutrients
to the developing
Spermatazoa.

The diploid (2n)

germinal epithelium divides by mitosis to form

spermatogonia (2n) that also divide by mitosis resulting in cells that increase in size-

Primary spermatocytes (2n)

Primary spermatocytes(2n) divide by **meiosis** to form haploid (n)

secondary spermatocytes after the first division and eventually

spermatids (n) after the second meiotic division.

Spermatazoa mature and tails form adjacent to the lumen of the tubule.

Interstitial cells (Leydig cells) in-between seminiferous tubules secrete testosterone to stimulate spermatogenesis.

Female reproductive system

Fallopian tube/
oviduct - tube
lined with ciliated
epithelium
which push the
secondary oocyte
from the ovary to
the uterus.

Uterus - A
specialist organ
where the embryo
implants into
the blood rich
endometrial layer and
grows to term. If there
is no fertilisation, this
layer is shed during
menstruation.

Ovary - Produces gametes up to secondary oocyte stage.
Also produces hormones progesterone and oestrogen.

Cervix - Ring of muscle at the neck of the uterus.

Vagina - A muscular walled structure. Sperm is deposited here during sexual reproduction and the foetus passes through here during birth.

Oogenesis - Takes place in an ovary up to secondary oocyte stage. Diploid germinal epithelium cells (2n) divide by mitosis to make oogonia that will increase in size forming primary oocytes (2n).

Primary oocytes (2n) present at birth are stopped in prophase of meiosis I.

Germinal epithelium cells divide to form diploid follicle cells making primary follicles.

Secondary oocytes (n) and a small polar body (n) are formed when the primary oocyte completes meiosis I.

The secondary follicle containing the haploid secondary oocyte matures into a graafian follicle.

One graafian follicle migrates to the surface of the ovary and bursts releasing the secondary oocyte. This is ovulation.

Meiosis II begins but stops at metaphase II until fertilisation.

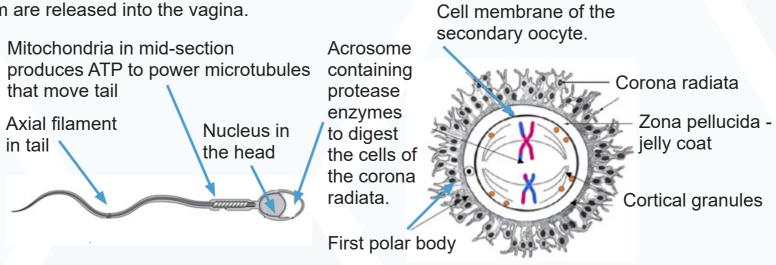
The graafian follicle becomes the corpus luteum after ovulation. If fertilisation occurs it will produce hormones, otherwise it degenerates.



Fertilisation - In sexual reproduction sperm are released into the vagina.

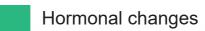
Capacitation and the acrosome reaction

- 1. Sperm swim to the fallopian tube.
- 2. Capacitation increases the permeability of the membrane in front of the acrosome.
- 3. The acrosome releases proteases that digest the corona radiata.
- 4. The acrosome membrane ruptures releasing hydrolase enzymes which digest the zona pellucida on contact.
- 5. The membranes of the sperm and secondary oocyte fuse and the genetic material of the sperm enters the secondary oocyte.



The cortical reaction

- 6. Cortical granules fuse with the cell membrane and alter the zona pellucida to form the fertilisation membrane; this prevents polyspermy.
- Meiosis II completes creating a second polar body.
- 8. Sperm and ovum nuclei fuse. A zygotic nucleus is formed.





Implantation

Immediately following fertilisation, mitotic divisions of the newly formed zygote occur - this is called cleavage. A hollow ball of cells called the blastocyst is produced and this implants into the endometrial lining of the uterus.

Cleavage 4-celled 2-celled

The placenta forms from the outer blastocyst cells

(trophoblast cells) that extend into the endometrium linking the foetus to the mother's tissues to collect nutrients.

The blastocyst secretes HCG (human gonadotrophic hormone) which maintains the corpus luteum. The corpus luteum produces progesterone which:

2. Inhibits the production of **FSH** and **LH**. Maintains the endometrium.

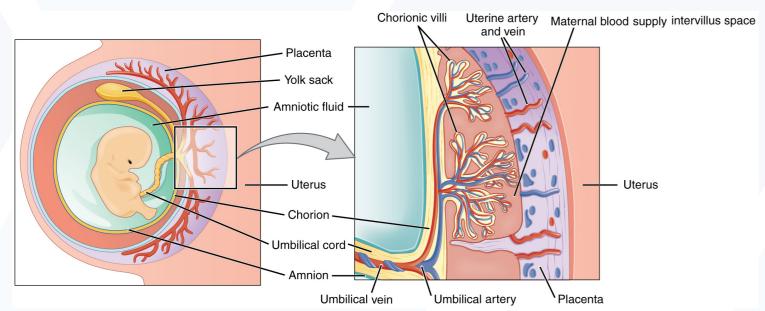
Supresses contraction of the uterine wal



This has the effect of preventing menstruation and the formation of a new follicle.

When formed, the placenta takes over producing HCG and after 16 weeks it takes over the production of progesterone, it also produced **oestrogen** that stimulates the growth of the uterus and the mammary glands.

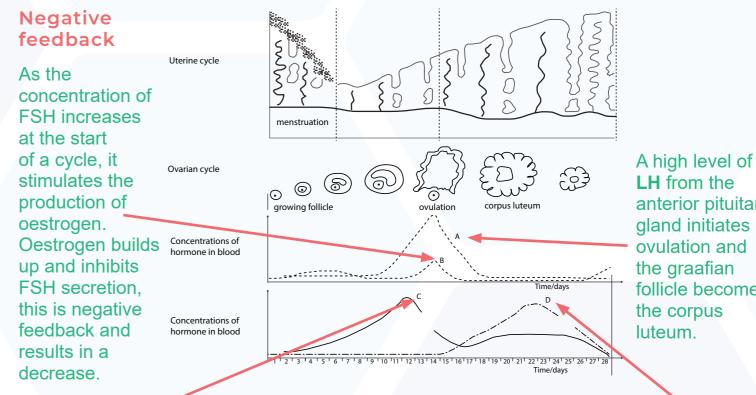
Pregnancy - The placenta links the mother to the foetus in pregnancy for the exchange of oxygen, carbon dioxide, nutrients and waste products.



	Structure	Function
	Chorionic villi	Extend into the maternal blood and have microvilli to increase surface area, thin walls for easy diffusion and blood flows in a counter current direction to the maternal blood to maintain diffusion gradients along the whole blood vessel. Cells also fuse together preventing the mother's white blood cells from entering the foetal blood. Antibodies can pass through though conveying some immunity.
	Intervillous spaces	Contain maternal blood and bathe chorionic villi. This means mothers blood and foetal blood do not mix and changes in maternal blood pressure do not damage delicate foetal capillaries.
	Umbilical arteries	Carries deoxygenated blood and waste materials away from the foetus to the chorionic villi where gas exchange and excretion occurs.
	Umbilical veins	Carries oxygenated blood and nutrients to the foetus.
	Amniotic fluid	Acts as a shock absorber protecting the foetus from bumps.

The menstrual cycle - A series of hormonal and physiological changes involving the brain, ovaries and uterus. Controlled by the hormones:

• LH (lutenising hormone) • FSH (Follicle stimulating hormone) • Oestrogen • Progesterone.



The level of **oestrogen**, secreted by

the developing follicle, increases in the blood which triggers the repair

FSH production and stimulates LH

of the endometrium; this inhibits

production.

The corpus luteum produces **progesterone** that further develops the endometrium.

With no implantation falling **FSH and LH** levels cause the corpus luteum to degenerate. This means progesterone levels fall, the endometrium breaks down and is lost during menstruation.

anterior pituitary follicle becomes



Birth - After 39 weeks of development, hormonal changes stimulate birth of the foetus.

- 1. **Progesterone and oestrogen** decrease. As these were inhibiting oxytocin and prolactin these hormones can again be produced.
- 2. The posterior pituitary gland secretes **oxytocin** that simulates uterine contractions. Positive feedback occurs where the uterine contractions in turn stimulate more oxytocin to be produced.
- 3. The anterior pituitary gland secretes **prolactin** stimulating the production of milk by the mammary glands.