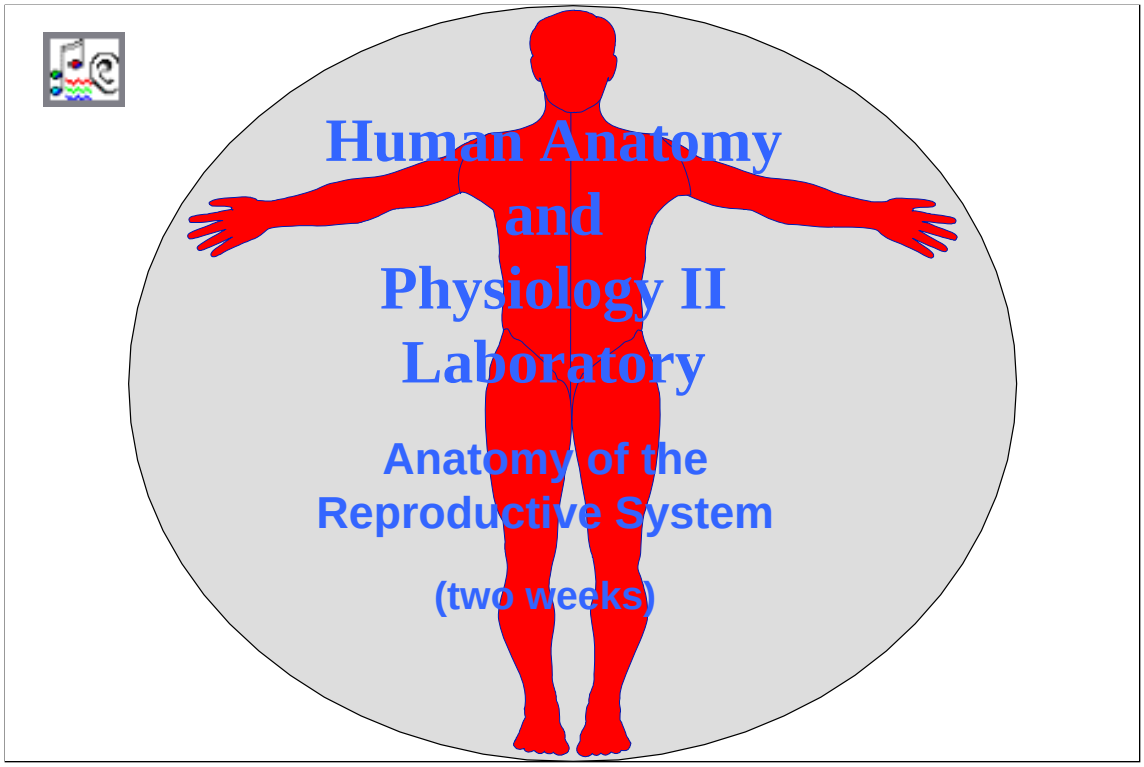


This lab involves two exercises in the lab manual entitled "*Anatomy of the Reproductive System*" and "*The Physiology of Reproduction*". In this lab you will look at reproductive system histology, and anatomy. Depending on your instructor, you may do this lab over two weeks, looking at the male reproductive system the first week and the female reproductive system the second week.

Complete the review sheets from the exercises and take the online quizzes on the reproductive systems, As an alternate your instructor may have you submit a drawing of reproductive histology from the Virtual Microscope or other histology site.

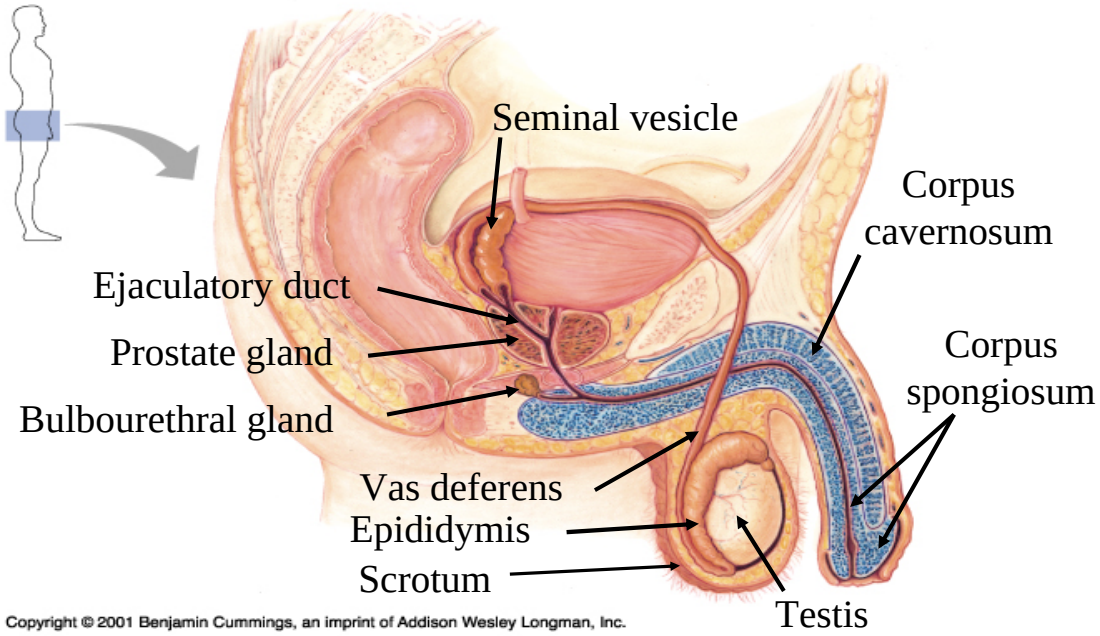
Use ADAM to study the reproductive anatomy.

There is also a video showing cadaver dissection of the male reproductive system.

Click on the sound icon for the audio file (mp3 format) for each slide.

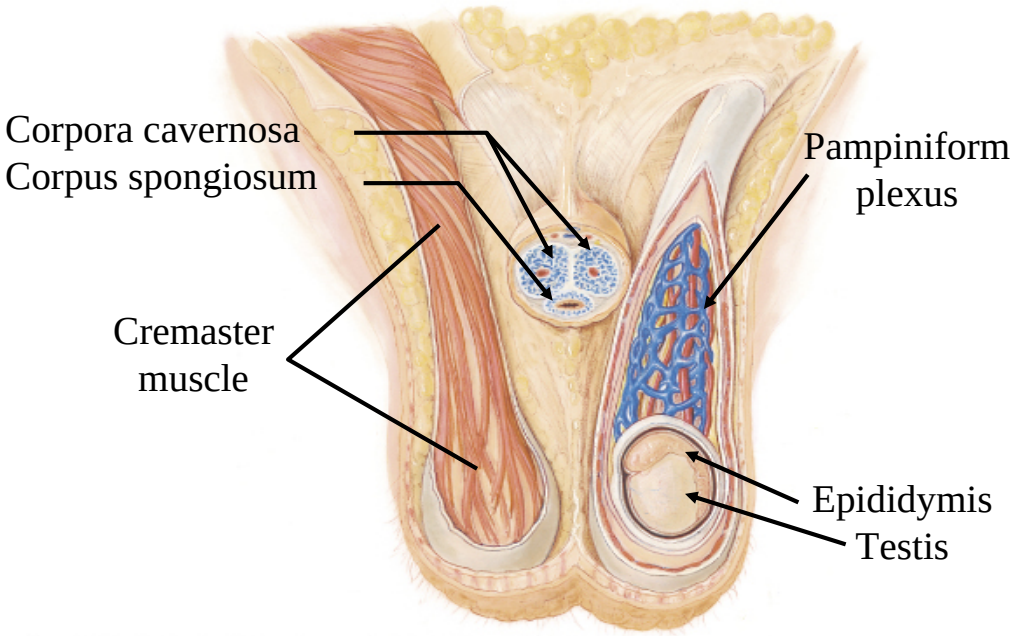
There is also a link to a dowloadable mp4 video which can be played on an iPod.

Male Reproductive Tract

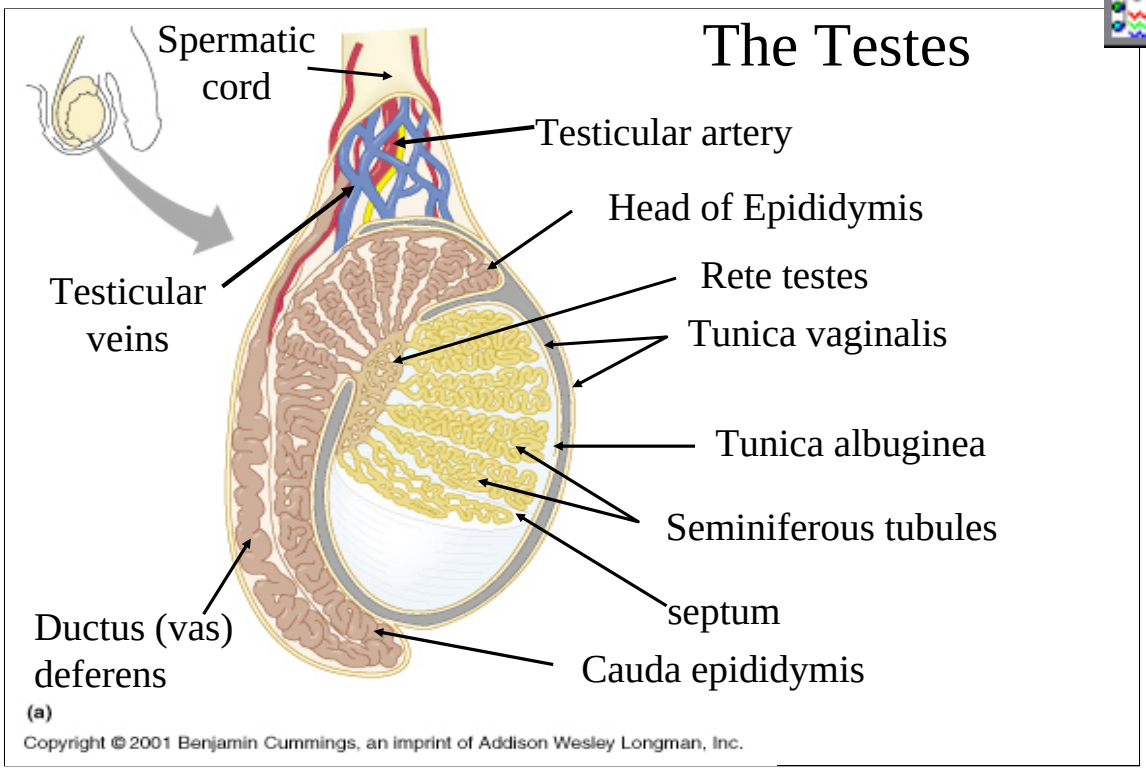


The **vas deferens** is a continuation of the **cauda epididymis** and is histologically very similar, including the **pseudostratified columnar epithelium** with **microvilli** and three layers of smooth muscle. The vas deferens continues into the body cavity through the **spermatic cord** until it joins with the duct of the **seminal vesicle** to form the **ejaculatory duct** which runs through the **prostate**. The prostate is composed of secretory epithelial glands which secrete a sperm-activating semen during ejaculation. Acid phosphatase is among the substances secreted. In patients with prostatic cancer, blood levels of acid phosphatase are used to check for metastasis. Fibromuscular tissue of the prostate propels the semen into the urethra and wraps around the **ejaculatory duct** to function in ejaculation. The seminal vesicles secrete an alkaline fluid containing sugars and other substances which makes up 65% of the semen. The **bulbourethral** (**Cowper's**) **glands** secrete mucus into the urethra prior to ejaculation.

The Spermatic Cord

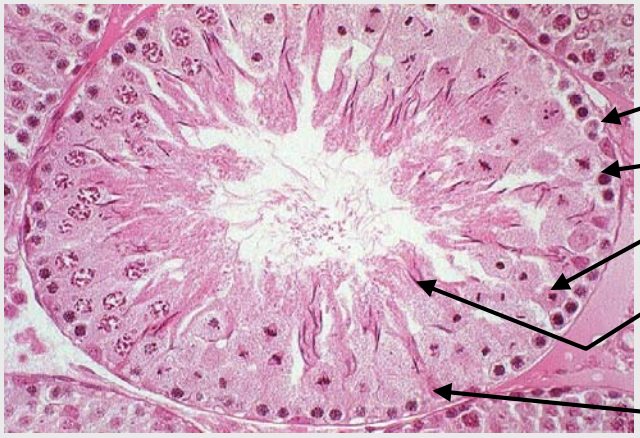


The spermatic cord has a heat control system resulting from a network of veins called the **pampiniform plexus**. These veins absorb heat from the incoming testicular artery and radiate it away from the testicle, helping to maintain the optimum temperature for spermatogenesis of 5 to 7 degrees below body temperature. The dartos muscle of the scrotum along with the cremaster muscle of the spermatic cord help to pull the testes closer to the body during cold weather.



Testicles are suspended in a skin-and-muscular sac known as the **scrotum** into which the testes descend before birth. The scrotum is lined with a thick **tunica vaginalis** and each testis is covered by a whitish **tunica albuginea** which forms septa which divide the testis into lobes. The process of sperm formation occurs in the **seminiferous tubules**. From the seminiferous tubules the sperm migrate through the **rete testes** to the highly coiled **epididymis**. The epididymis actually stretches to 4 to 6 m. and consists of a head, a body, and a tail (the **cauda epididymis**), which wraps around the testis. The epididymis leads to the **vas** (**ductus**) **deferens** which carries sperm to the urethra. Sperm mature during their passage through the epididymis acquiring motility and the ability to fertilize an oocyte.

Cells of the Seminiferous Tubule



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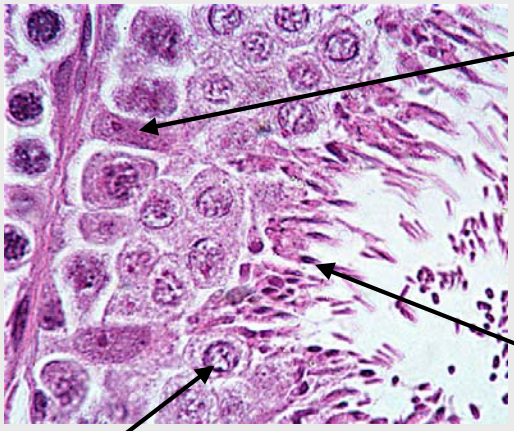
Sustentacular (Sertoli) Cells



Sustentacular (**Sertoli**) **cells** surround the developing spermatocytes and manage their environment and protect them. Note the elongated **spermatids** entering the tubule's lumen.

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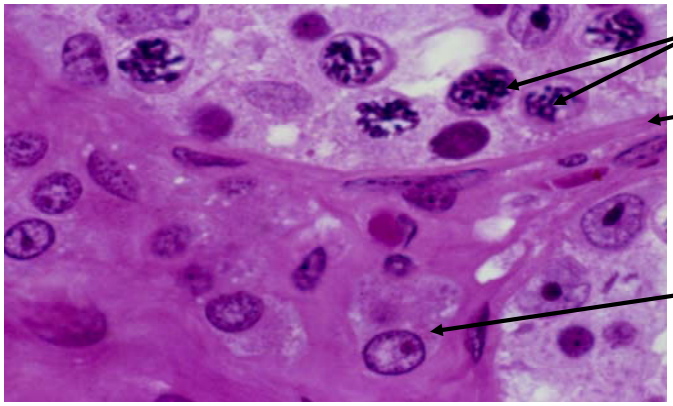
Interstitial Cells



Interstitial cells are found in between the seminiferous tubules, and produce **testosterone**.

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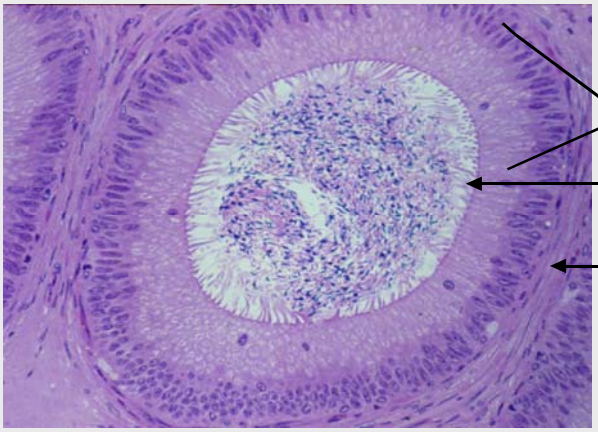
Epididymis Tubule h.p.



The lining of the epididymis is made of **pseudostratified columnar epithelial** cells, many of which possess **microvilli** (called **stereocilia**) which aid in secretion and absorption as the cells manage the sperm's environment. A thin layer (or two) of smooth muscle is also present.

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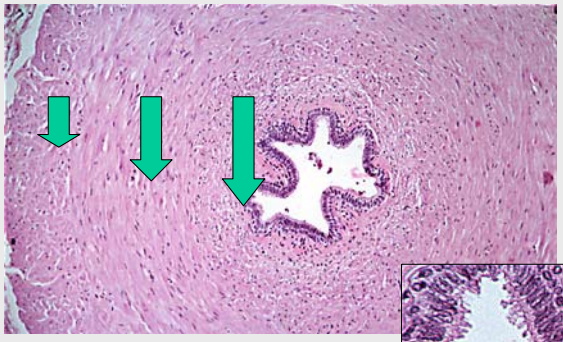
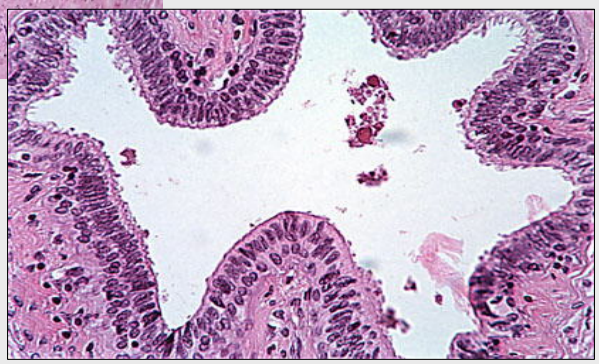
Vas Deferens, lp.

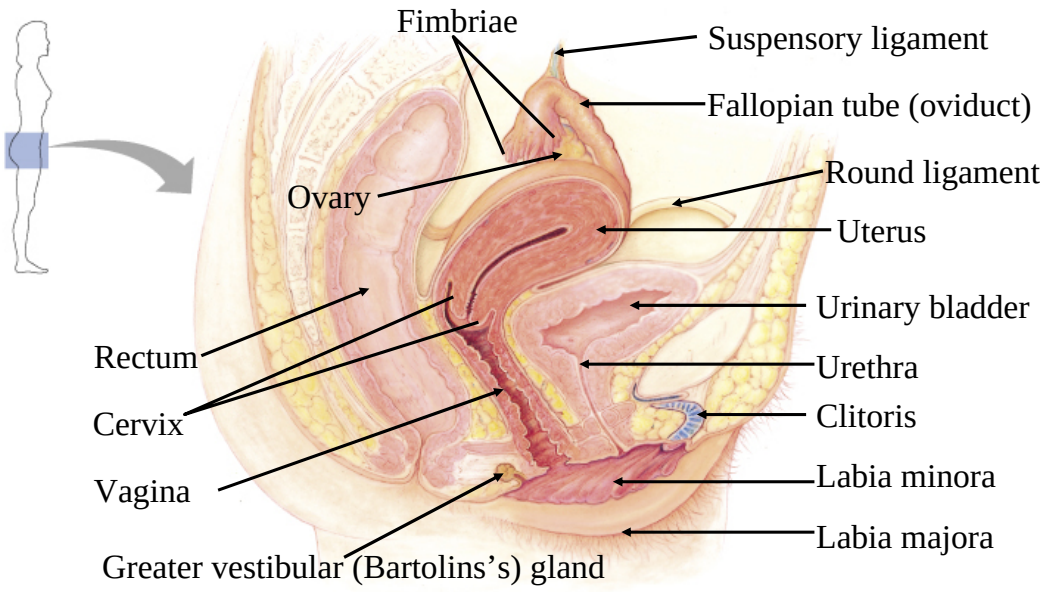


Three layers of smooth muscle:
outer-longitudinal,
middle-circular, and
inner-longitudinal



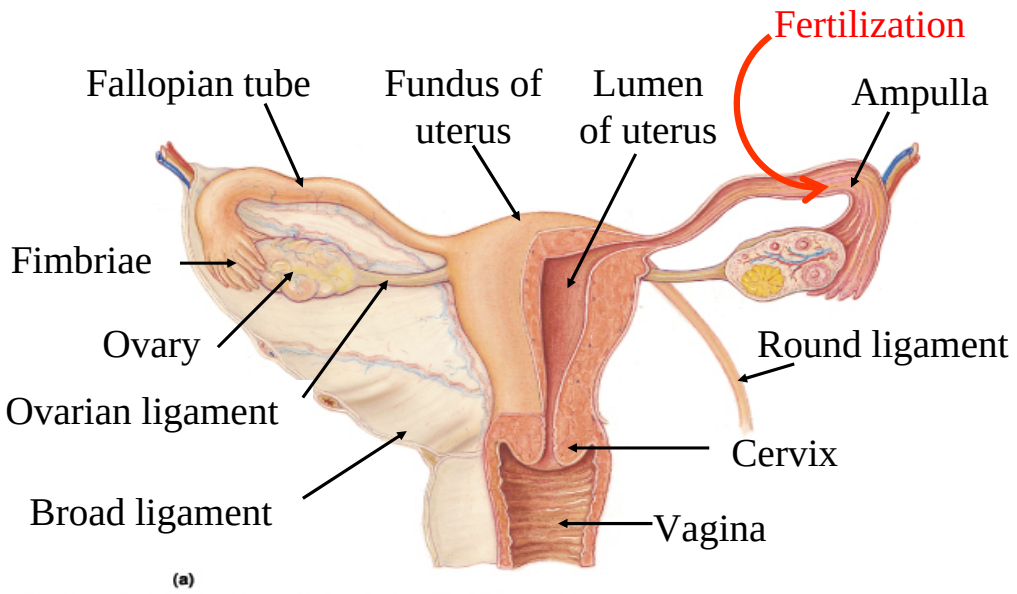
The **vas deferens** has three layers of smooth muscle which propels the sperm during emission and ejaculation. Pseudostratified columnar with stereocilia (microvilli) are present, similar to the lining of the epididymis.

Female Reproductive Tract



The **vagina** is a highly folded fibromuscular tube lined by **non-keratinized stratified squamous epithelium**. Vaginal mucosa contains no glands and is lubricated by mucus produced by the cervical glands. Vaginal mucosa undergoes changes during the menstrual cycle which somewhat mimics those of the endometrium. .**Uterus** - Once the **morula** (mass of dividing cells) is received from the oviduct all embryonic and fetal development occurs in the uterus. It is a melon shaped organ which has a **body**, a **fundus**, and a **cervix**. The cervix is a barrel-shaped portion separated from the body by the isthmus. The lumen or cervical canal has a constricted opening or **os** at each end. The cervical mucosa is from 2-3 mm thick and undergoes little change in thickness, nor is it sloughed off during menstruation. At mid-cycle there is a ten-fold increase in the amount of mucus produced by the cervical glands, and this mucus is less viscous and provides a more favorable environment for sperm migration than at other times when it inhibits the passage of sperm into the uterus. The external os is the site of transition from vaginal stratified squamous to cervical simple columnar epithelium. Cervical epithelial cells are constantly exfoliated into the vagina, and stained preparations (called Papanicolaou cervical smears after the scientists who developed the technique) are used to screen for pre-cancerous and cancerous lesions of the cervix.

Female Reproductive Organs



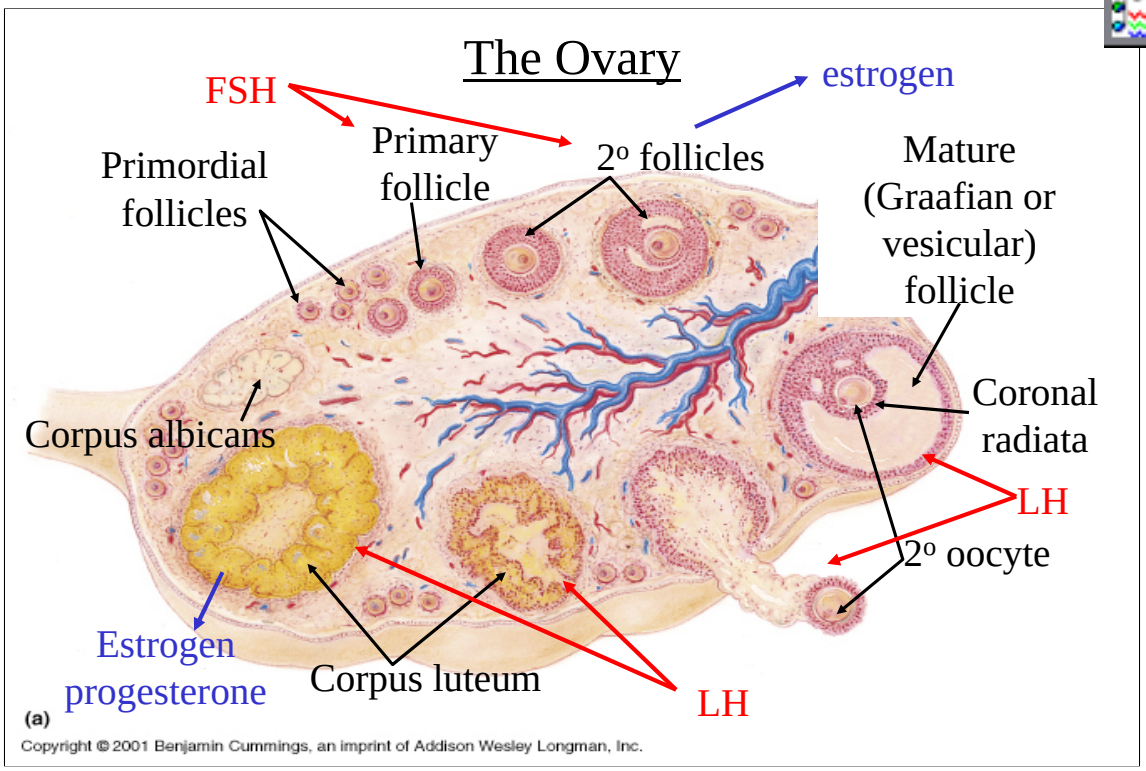
The secondary oocyte leaves the ovary and is taken into the **fallopian tube**. Finger-like extensions called **fimbriae** partially surround the ovary, and become more closely apposed around ovulation. Ciliary movement of the lining cells of the fallopian tube create a fluid movement which pulls the oocyte into the tube while sperm make their way through the os of the cervix and through the uterine cavity and up the fallopian tube . They meet and fertilization normally occurs in the ampulla. From there, the **zygote** (fertilized egg) moves down the fallopian tube, implanting in the endometrium within 7 to 10 days.

There is no audio file for this slide.

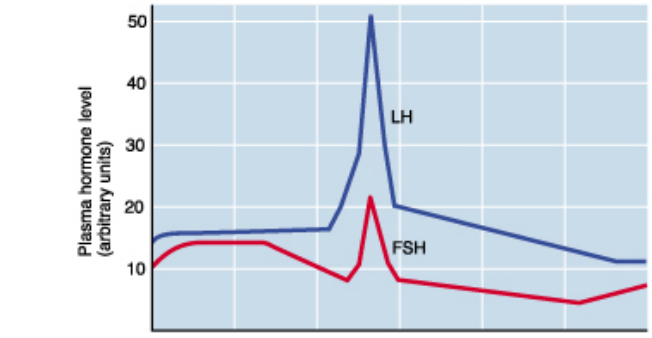
Normal Uterus

Normal uterus with fundus (1), lower uterine segment (2), cervix, vaginal cuff (3), right fallopian tube (4), right ovary (5), from a young woman.

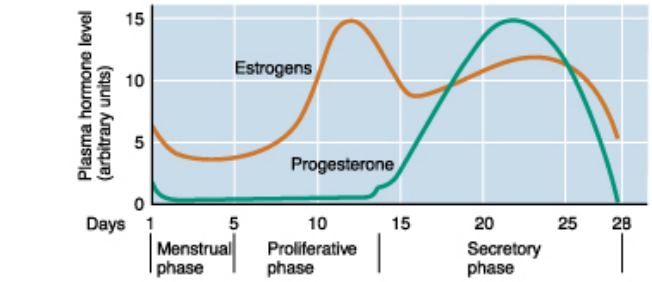
Also fimbriae (6), ovarian ligament (7), broad ligament (8).



The **oogonia** have already matured before birth and women are born with a limited number of **primary oocytes** which have already begun, and are suspended in, prophase of the first meiotic division. Each month a small number of these primary oocytes continue meiosis I, usually from alternating ovaries, and usually only one becomes a **secondary oocyte**. (Fertility drugs are FSH derivatives and stimulate many follicles, which increases the probability that some will develop into secondary oocytes to be fertilized) It is the secondary oocyte which is ovulated. Surrounding each early primary oocyte is a **primordial follicle**. These follicles develop along with the oocytes, first becoming primary follicles and continuing as **growing or secondary follicles**, and ultimately becoming a **mature** (a.k.a. **Graafian or vesicular**) **follicle** which contains the secondary oocyte, which is then ovulated. After ovulation the follicle becomes a **corpus luteum** under the control of **LH**. If no fertilization occurs the corpus luteum will break down and produce a **corpus albicans**.

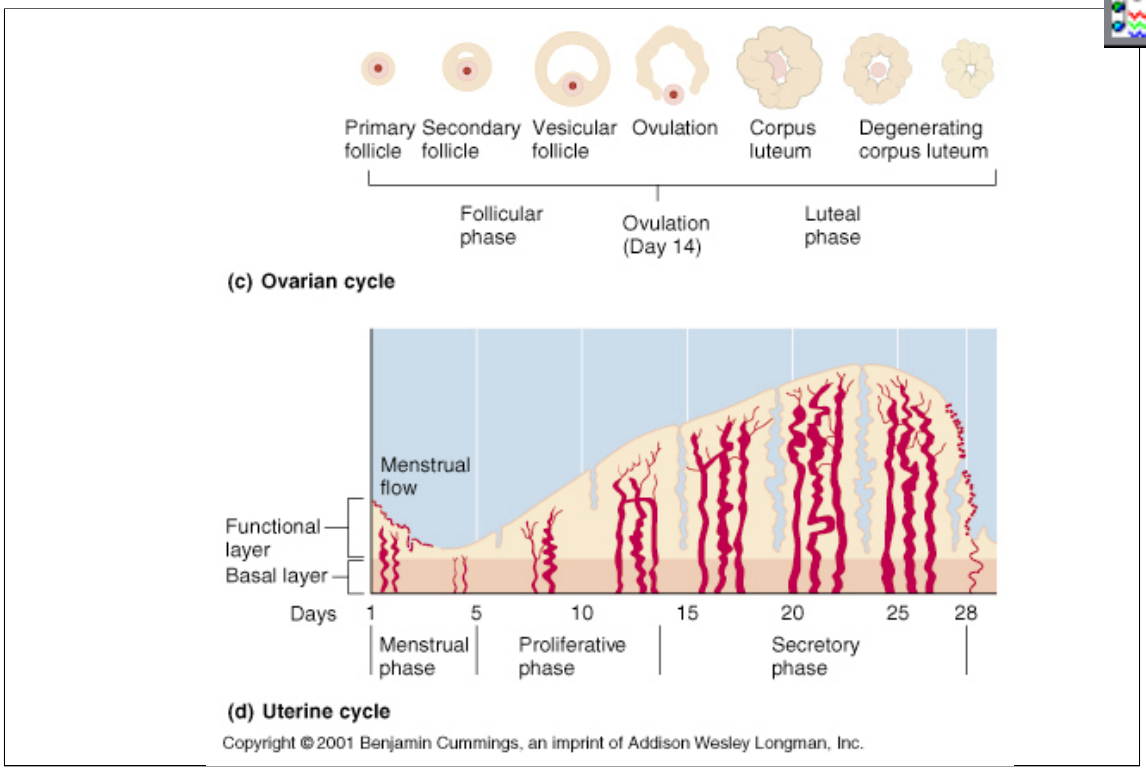


(a) Fluctuation of gonadotropin levels



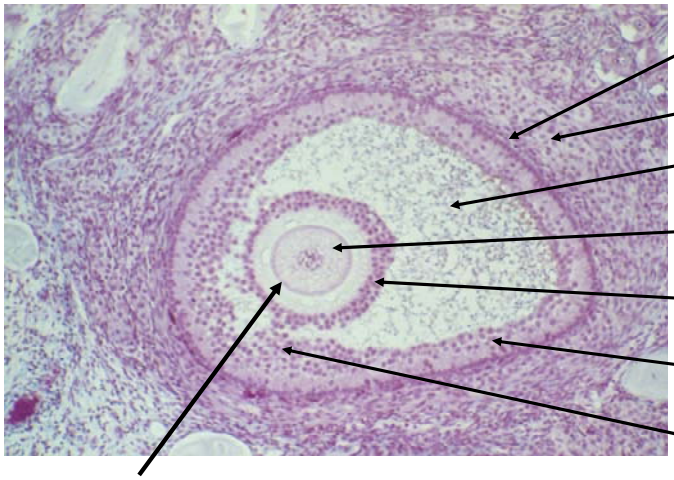
(b) Fluctuation of ovarian hormone levels

Gonadotropins control **oogenesis** under the regulation of the hypothalamus. The cycle begins about day 4 with **Follicle Stimulating Hormone (FSH)** stimulating the development of some of the primordial follicles to become primary follicles with accompanying development of the oocyte.



FSH continues to exert influence over these follicles causing them to secrete **estrogen**. Estrogen has two effects at this point. The low levels of estrogen which occur at first exert negative feedback through the hypothalamus to suppress FSH secretion. Estrogen also causes the **proliferative phase** of endometrial development.

Mature (Vesicular) Follicle



A mature (Graafian or vesicular) follicle contains a secondary oocyte which has resulted from Meiosis I. This occurs under stimulus of LH.

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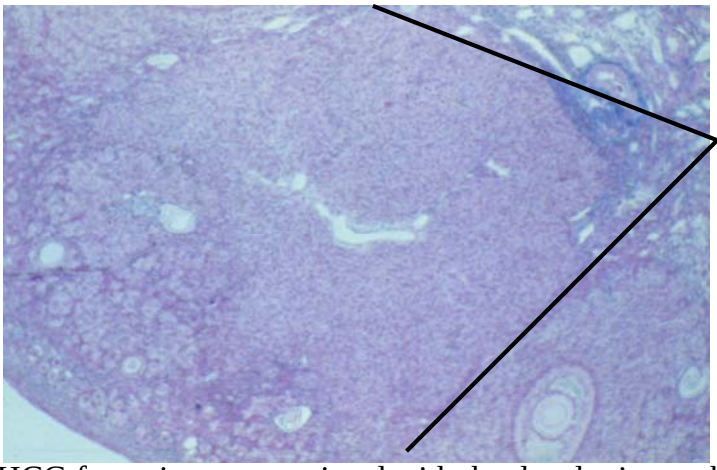
Corpus Luteum of Pregnancy



LH from the anterior pituitary maintains the corpus luteum causing it to grow and secrete estrogen and progesterone. If pregnancy ensues the corpus luteum is maintained by HCG from tissues associated with the developing embryo and grows to 2 or 3 cm.

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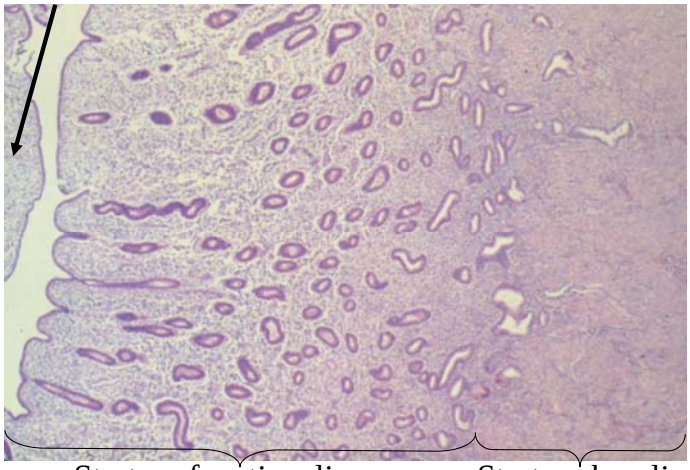
Uterus, Menstrual Phase

Exfoliating tissue



Breakdown of the corpus luterum in the absence of LH causes loss of estrogen and progesterone to maintain the endometrium.

Stratum functionalis

Stratum basalis

Here you can see the deep epithelium which develops as the stratum functionalis of the endometrium. You can also see some of this tissue exfoliating during menstruation.

There is no audio file for this slide.

Lab Protocol

1) Complete the Review Sheets for the two exercises.
2) Take the quiz on the reproductive system.
3) Use ADAM to identify structures of the reproductive system. (See next 2 slides)
4) View the cadaver video on the male reproductive system.

ADAM Interactive Anatomy

Male Reproductive System:

Dissectible Anatomy, Male, Anterior, Window centered on pelvic region, Layer indicator 180, Testis and associated structures.

Dissectible Anatomy, Male, Medial View, Window centered on pelvic region, Layer indicator 49, Penis, testis, and associated structures.

Atlas Anatomy, System, Reproductive, Male Superficial Perineal Space 1.

ADAM Interactive Anatomy

Female Reproductive System:

Dissectible Anatomy, Female, Anterior, Window centered on pelvic region, Layer Indicator 3, external genitalia.

Dissectible Anatomy, Female, Anterior, Window centered on pelvic region, Layer Indicator 226, internal genitalia.

Dissectible Anatomy, Female, Medial View, Window centered on pelvic region, Layer Indicator 48, internal genitalia.

Atlas Anatomy, System, Reproductive, Female Pelvic Diaphragm

Atlas Anatomy, System, Reproductive, Fascia in Female Pelvis (Med.)
Atlas Anatomy, System, Reproductive, Female Pelvic Organs (Ant)