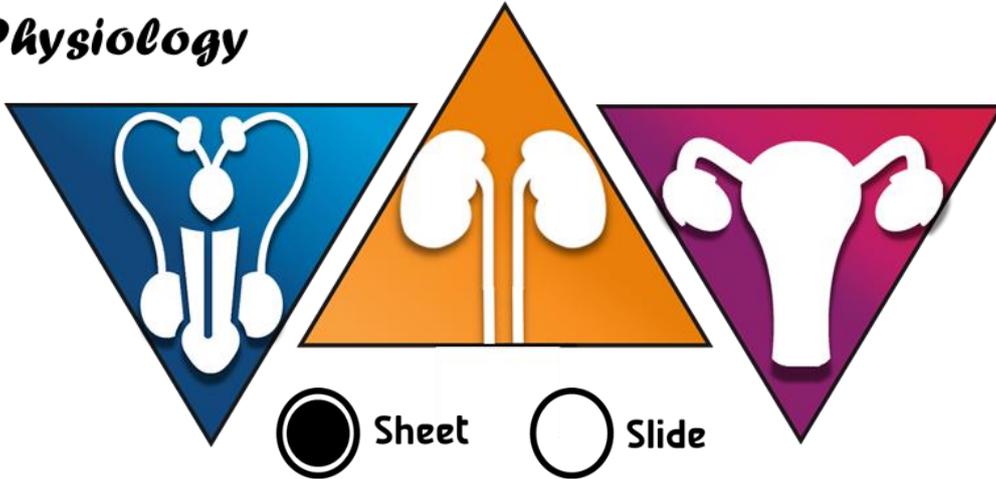




# Urogenital system

*Physiology*



**Number:**

1<sup>st</sup> Online Lecture

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## Puberty

We'll continue discussing the female reproductive system, starting with puberty, puberty means the onset of adult's sexual life, the usual age of puberty ranges from 12-13 years, many factors affecting the puberty, in addition to the age, genetic, nutritional, clinical and geographic factors determine the timing of puberty. Over the last 150 years, the age of puberty has declined by 2 to 3 months per decade, this pattern appear to correlate with improvements in nutrition and general health in America and in the whole world. Also Leptin appears to have permissive effect on the initiation of puberty providing the signal to the CNS that there are sufficient energy stores to support reproduction.

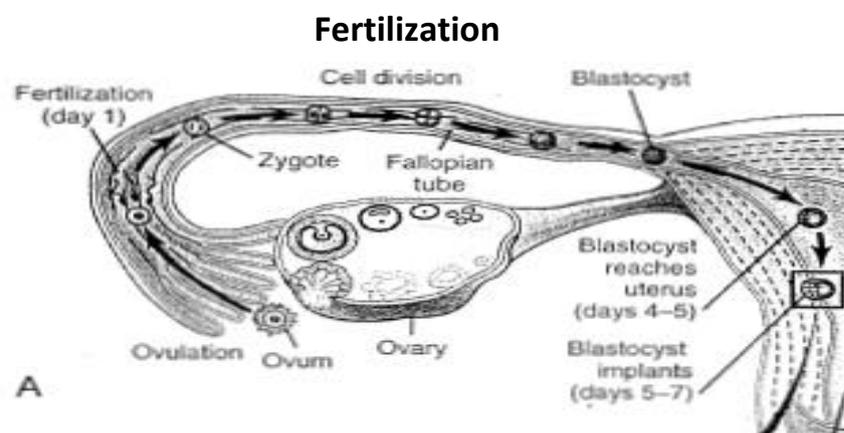
Also, Distance from the equator and lower altitudes are associated with early puberty. Obesity and heavy exercise (not normal exercise) delay puberty.

The pubertal growth spurt requires concerted action of sex steroids, GH and Insulin-like growth factors.

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- 1) Sperm arrive in the vicinity of the ovum at random, sperm remain mobile for up to 4 days, their fertilizing capacity is about 2 days in the female reproductive system.
  - 2) Fertilization involves several steps. Recognition of the ovum by the sperm occurs first. The next step is regulation of the sperm entry into the ovum.
  - 3) The pellucida zone contains specific glycoproteins that serve as sperm receptors. They selectively prevent the fusion of inappropriate sperm cells. (eg. From different species) with the ovum.  
\* contact between the sperm and ovum triggers the acrosome reaction which is required for sperm penetration.
  - 4) To bind to and penetrate the Pellucida zone, the sperm must undergo **capacitation**; an irreversible process, that involves the following:  
An increase in sperm motility, the removal of surface proteins, loss of lipids and merging of the sperm with the ovum.
  - 5) Capacitation takes place along the female reproductive system and lasts from one hour tp several hours.

**The female sex response facilitates sperm transport through the female reproductive tract:**

- 1) uterine and cervical activity increases by the spinal reflexes during orgasm.
- 2) The cervix dilates during orgasm.
- 3) Oxytocin release at the time of orgasm increases uterine contractility.
- 4) The mucous of the cervical canal increases movement of sperms, under estrogen dominance and orgasm.
- 5) However, peristaltic activity and fluid flow in the oviducts assist transport.



Fertilization occurs at fallopian tube. The oviduct transport the germ cells in two opposite directions: 1-sperm ascend toward the ampulla 2- the zygote descends towards the uterus. -This movement in two opposite directions requires coordination between smooth muscle contraction, ciliary movement and fluid secretion. All of which are under hormonal and neural control.

Don't forget the peristaltic movement or activity for the movement of the zygote from the fertilization site towards the uterus for implantation.

After about 7 days, implantation of the blastocyst occurs in the uterus, and this implantation requires Interacion of the embryo with the uterine endometrium.

Until implantation, the embryo is enclosed in the zona pellucida.

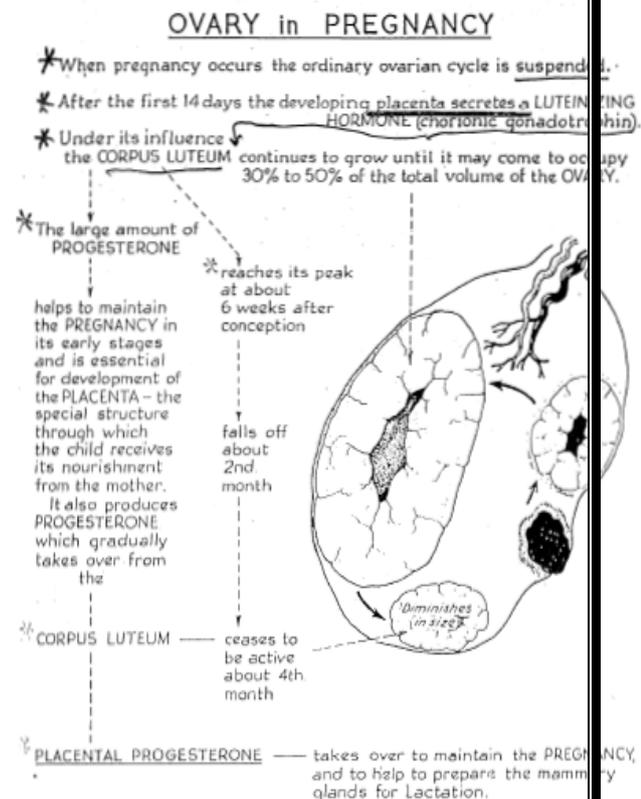
Retention of an intact zona is necessary for:

- 1) Embryo transport.
- 2) Protection against mechanical damage.

- 3) Protection against adhesion to the oviduct wall .
- 4) Prevention of immunological rejection by the mother is the peristaltic movement. When the zygote is big enough and reaches a certain site during its movement, it will cause the smooth muscles behind it to contract and the ones in front of it to relax (this is how the peristaltic movement happens).

### Ovary in pregnancy

- When pregnancy occurs, the ordinary ovarian and uterine cycles will stop.
- After 2 weeks of the fertilization occurs, the placenta develops, this formed placenta secretes special hormone called Luteinizing hormone or chorionic gonadotropin.
- Under the effect of this hormone, the corpus luteum continues to grow until it may come to occupy 30-50% of the total volume of the ovary, producing large amount of progesterone and estrogen.
- Corpus luteum reaches its peak at about 6 weeks after fertilization.
- It falls off about 2<sup>nd</sup> month.
- Ceases to be active about 4<sup>th</sup> month.
- Then the placenta takes over the function of the corpus luteum.



### Chemicals secreted by the Blastocysts:

The doctor said that Blastocysts secretes many substances: hormones, enzymes, proteins and other chemicals. One of the hormones secreted is **hCG**

#### - hCG:

- Used as an indicator for pregnancy, it's tested after 2 weeks in plasma and urine to indicate the occurrence of pregnancy .
- One of the most important factors secreted by the trophoblast of blastocyst, both preimplantation and postimplantation.

- Besides rescuing the corpus luteum, hCG has the following functions:
  - Acts as an immunosuppressive agent.
  - Has growth-promoting activity.
  - Acts as an autocrine growth factor that promotes trophoblast growth and placental development.
  - hCG may have a role in the adhesion of the trophoblast to the epithelia of the endometrium.
  - has protease activity.
  - hCG levels are high in the area where the trophoblast faces the endometrium.
- Other important targets of hCG are the fetal adrenal gland and testis.

Many hormones, proteins, enzymes and all the female steroid hormones are secreted by the placenta:

- The most important hormone is the human chorionic gonadotropin (hCG).
- TSH.
- Human placental lactogen (hPL: hPL1 and hPL2), also known as Human chorionic somatomammotropins 1 and 2 (hCS1 and hCS2).
- Placental- variant growth hormone
- Prolactin

They play in the conversion of glucose to fatty acids and ketones, thus coordinating the fuel economy of the fetoplacental unit. The fetus and placenta use fatty acids and ketones as energy sources and store them as fuels in preparation for the early neonatal period.

Also, Human chorionic somatomammotropins 1 and 2 (hCS1 and hCS2) promote development of maternal mammary glands during pregnancy.

**Notes:**

\* Although the same cells produce hPL that produce hCG, hPL's pattern of secretion is different, indicating the possibility of control by different regulatory mechanisms.

\* There are some indications that increased levels of hCG and thyroxine accompany maternal morning sickness.

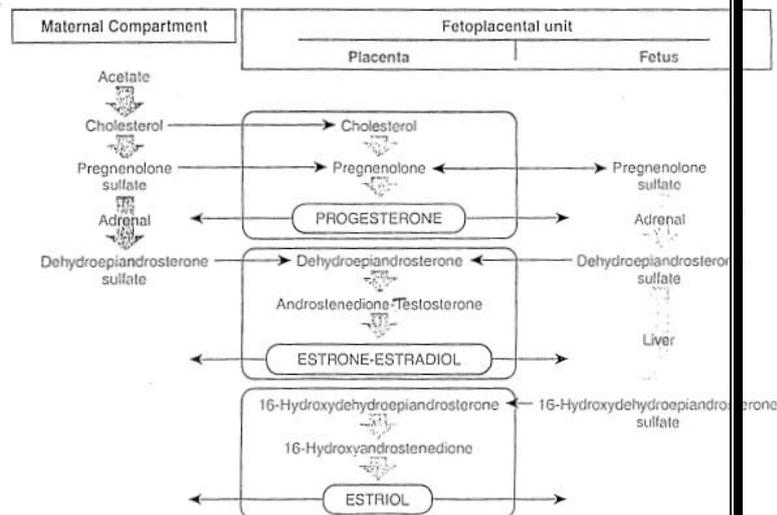
\* The highest level of hCG is between week 10 and 15.

\* Also the endometrium produces hormones, proteins, glycoproteins and peptides secreted by the endometrial glands **during pregnancy**.

### Placental unit and steroidogenesis

As you notice the placenta lies in between the maternal compartment and the fetal compartment:

- Female hormones are produced by the placenta, but substrates come mainly from the maternal compartment (as you see in the figure; cholesterol, pregnenolone)
- In the placenta, pregnenolone produces progesterone.
- Then progesterone will be distributed into the fetus and the mother.
- Also, estrone and estradiol (the most potent female hormones or estrogens) are also produced by the placenta, but the substrates (dehydroepiandrosterone sulfate) come from the maternal compartment as well as from the fetus, then estrone and estradiol will be distributed into the fetus and maternal compartment.
- Finally, the placenta produces estriol.



Wish you all the best  
your colleague: Lojayn Salah