Pregnancy

Reproductive Block

Please check out this link before viewing the file to know if there are any additions/changes or corrections
Physiology Edit File

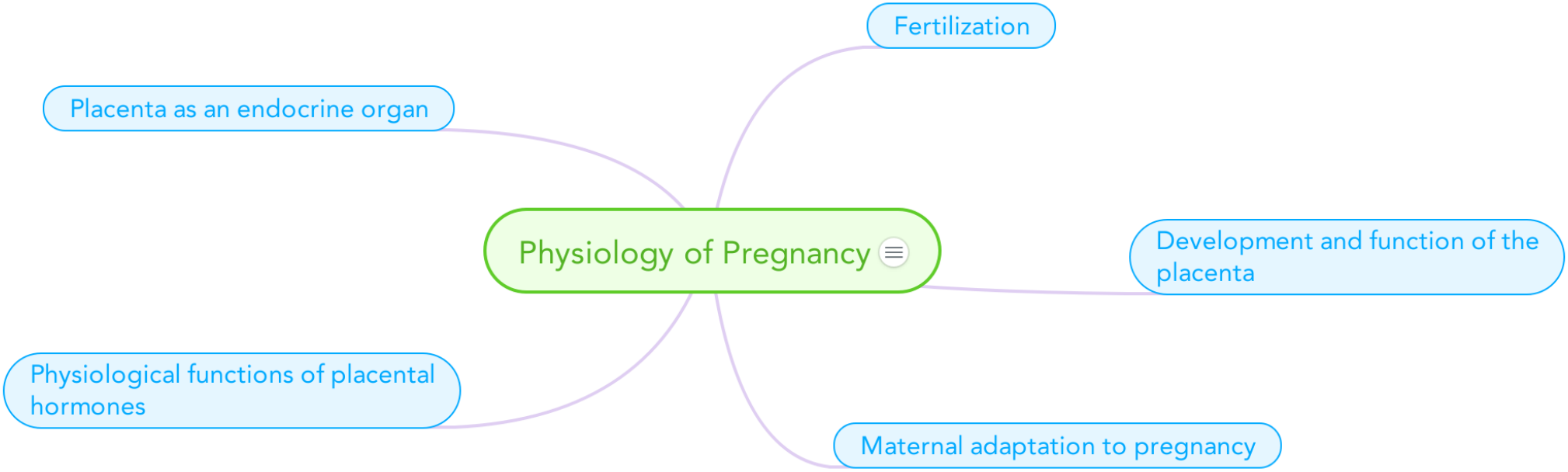
- Important
- Further explanation
- Males Lecture

Before start the lecture, we need to understand and perform these quotes in our life

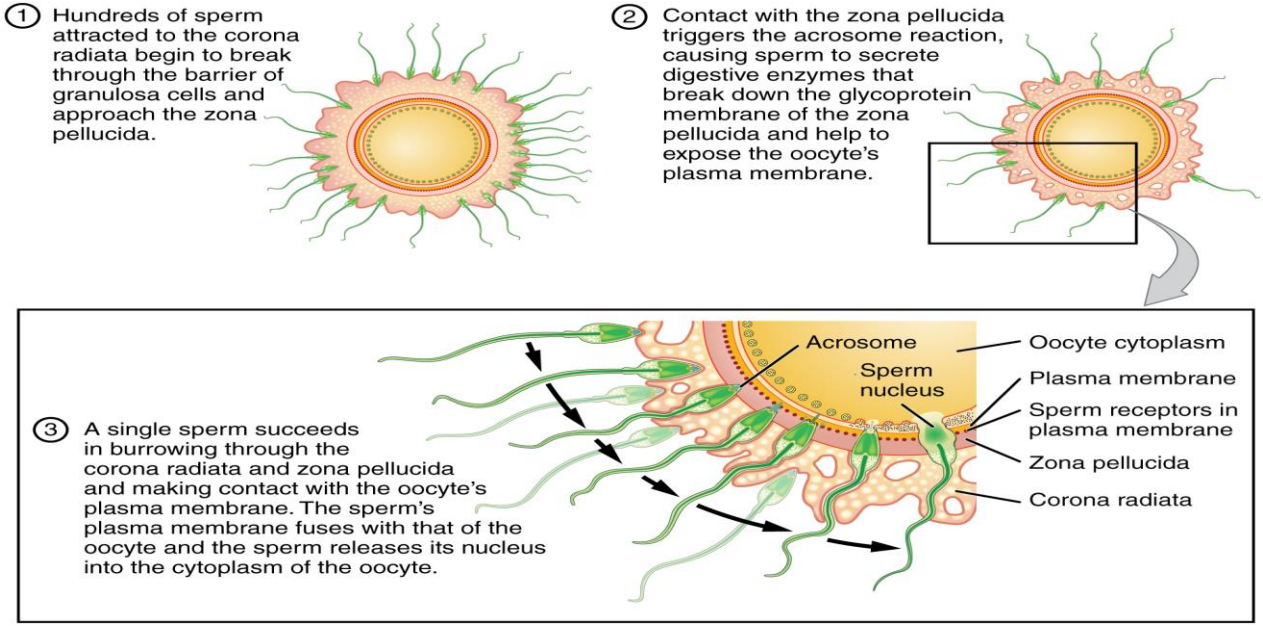
Before you were born She carried you under her heart. From the moment you arrived in this world until the moment she leave it, she will always carry you in her heart!

أتى رجلٌ رسولَ اللهِ صلَّى اللهُ عليه وسلَّم فقال :إني أشتَهي الجهادَ ولا أقدِرُ عليه، قال :هل بقِي مِن والدَيكَ أحَدٌ؟ قال :أُمِّي، قال :فأبلِ اللهَ في بِرِّها، فإذا فعَلتَ ذلك فأنتَ حاجٌّ ومعتمرٌ ومجاهدٌ، فإذا رَضِيَتْ عنكَ أمُّكَ فاتقِ اللهَ وبِرَّها .الأحاديث المختارة، .1689

Mindmap


Physiology of Pregnancy
Fertilization
Placenta as an endocrine organ
Development and function of the placenta
Physiological functions of placental hormones
Maternal adaptation to pregnancy

Fertilization



Males' LECTURE

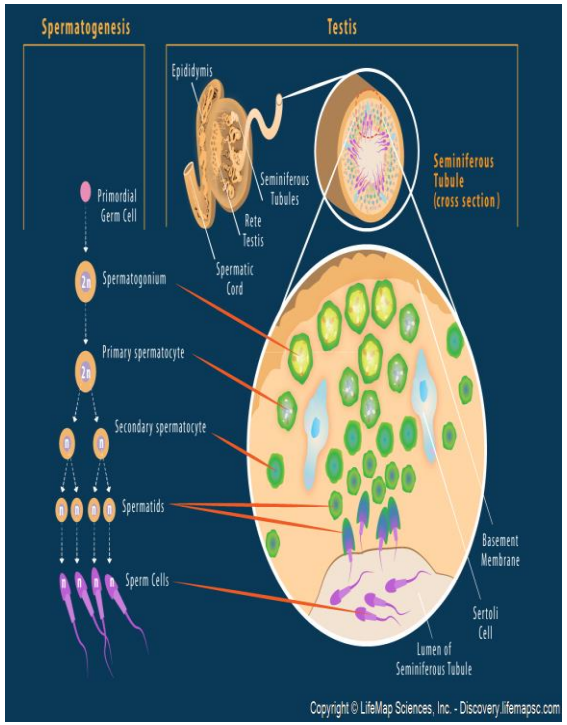
After ejaculation, sperms reach ***ampulla*** of fallopian tube within 30-60 min (PG and OT actions)

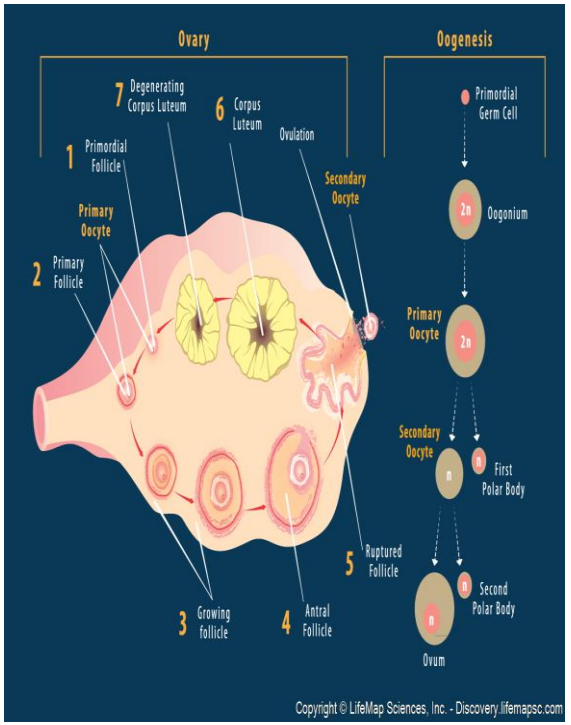
Fertilization, the union of male and female gametes.

Normally occurs in the ampulla.

After the ovum get ovulated it goes to the ampulla waiting for the sperm to reach there, Normally the sperm takes 30-60 mins to reach the ampulla.

After the sperm reaches there it starts to penetrate the layers that surround the ovum mainly corona radiata and zona pellucida by its "hyaluronidase & proteolytic enzymes" Enzymes in the acrosome of the sperm.





Males' LECTURE

- **The 23 chromosomes of the male pronucleus and female pronucleus align themselves to re-form a complete complement of 46 chromosomes.**

- **-Delayed transport allows cell division to occur before the dividing ovum (Blastocyst ~100 cells) enters the uterus.**

- **-While the trophoblastic cords from the blastocyst are attaching to the uterus, blood capillaries grow into the cords from the vascular system of the newly forming embryo.**

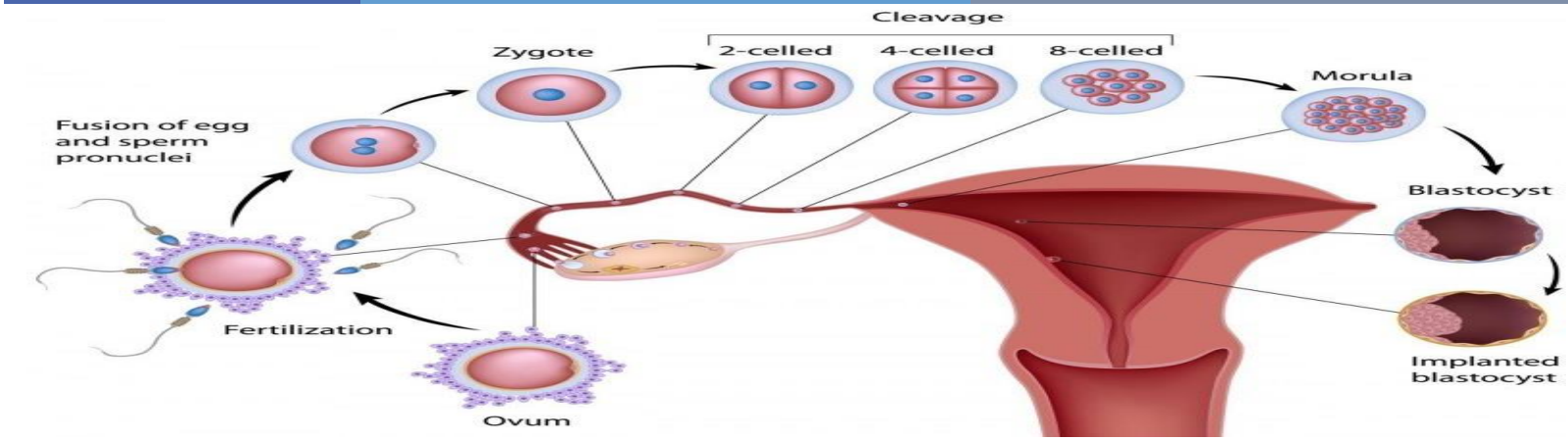
By following the diagrams "Oogenesis and spermatogenesis"
We find that

1) Each oocyte "ovum" divides to form mature ovum (female pronucleus 23 unpaired chr) + 2nd polar body
2) Each head of sperm swells (male pronucleus 23 unpaired chromosomes)
3) Fertilized ovum (zygote) contain 23 paired chromosomes. it means 2n so each ovum has 46 unpaired chromosomes.

RECALL !

- (n) means 23 chromosomes "haploid"
- So when we say (2n) means 2 x 23 = 46 chromosomes "diploid"

Cleavage



IMPORTANT

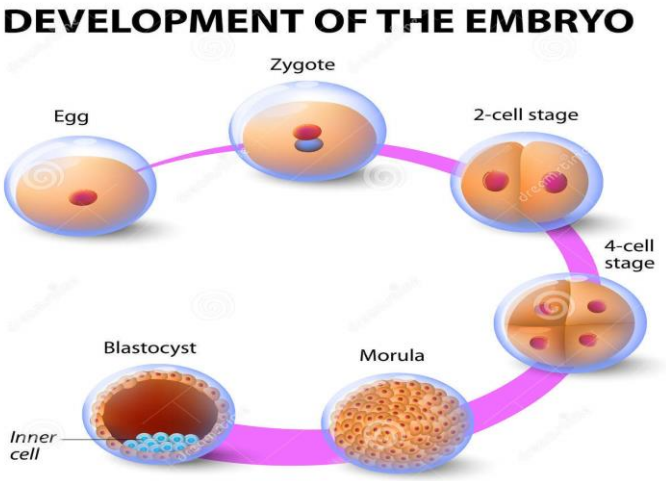
Following fertilization the zygote undergoes several <u>mitotic divisions</u> inside the zona pellucida (overall size does not change).

1st cleavage yields a 2 celled embryo, each cell is called a blastomere and is totipotent.

Divisions continue rapidly until the 32 cell stage.

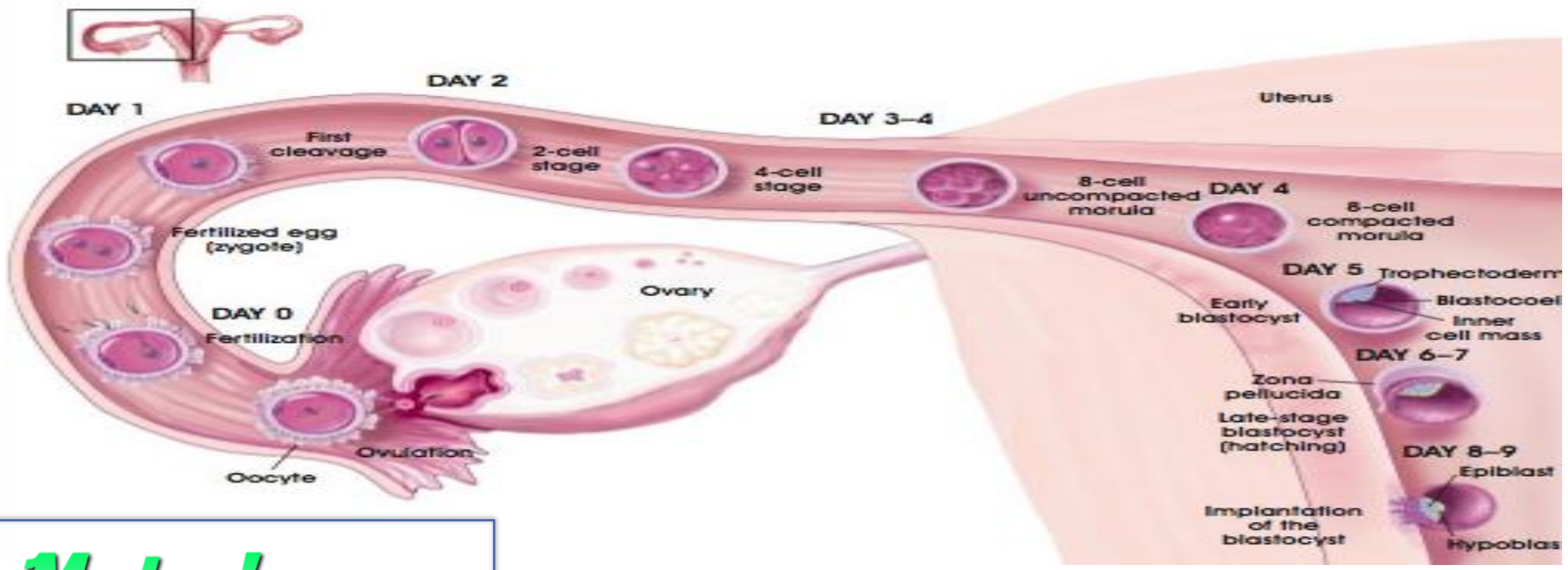
Zygote begins to divide as it travels through oviduct.

Implants into lining of uterus.



Totipotent means (of an immature or stem cell) capable of giving rise to any cell type or (of a blastomere) a complete embryo.

Transport of Fertilized Ovum

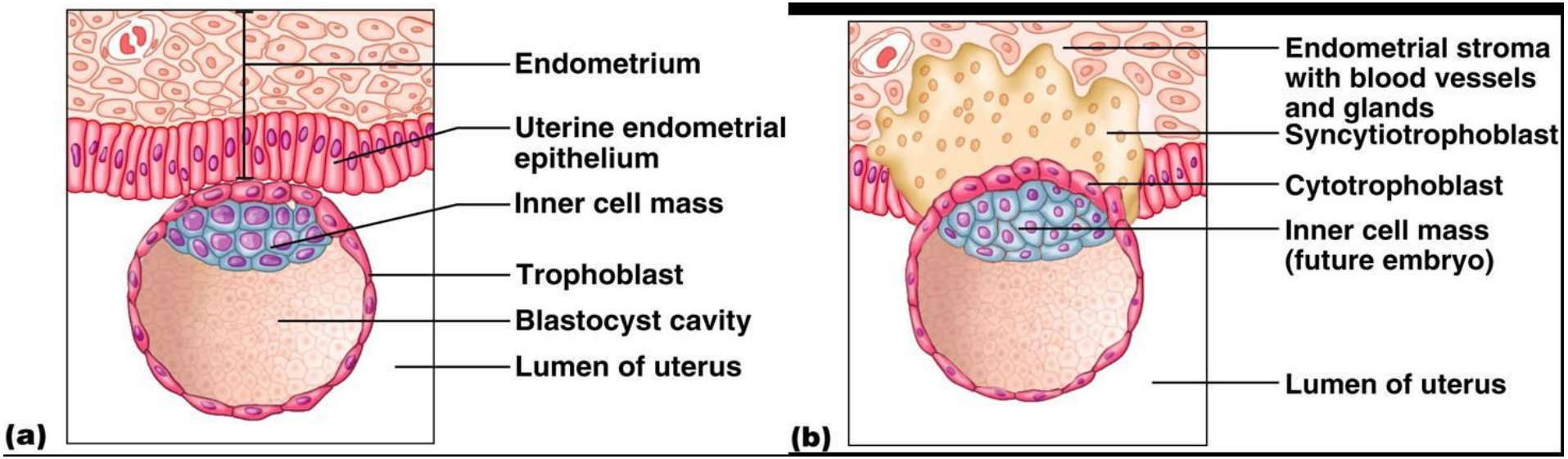


Males' LECTURE

If the ovum becomes fertilized by a sperm, a new sequence of events called *gestation* or *pregnancy* takes place, and the fertilized ovum eventually develops into a full-term fetus.

- After fertilization 3-5 days till zygote reach uterine cavity
- The transport of the zygote occurs because fluid current + action of cilia + weak contractions of the fallopian tube.
- Isthmus (last 2cm) relaxes under effect of progesterone.
- It takes 3-5 days until it reaches the uterine cavity to take enough time to devide.
- Blastocyst (100 cells) enters the uterus.

Implantation



Males' LECTURE

- **Implantation**

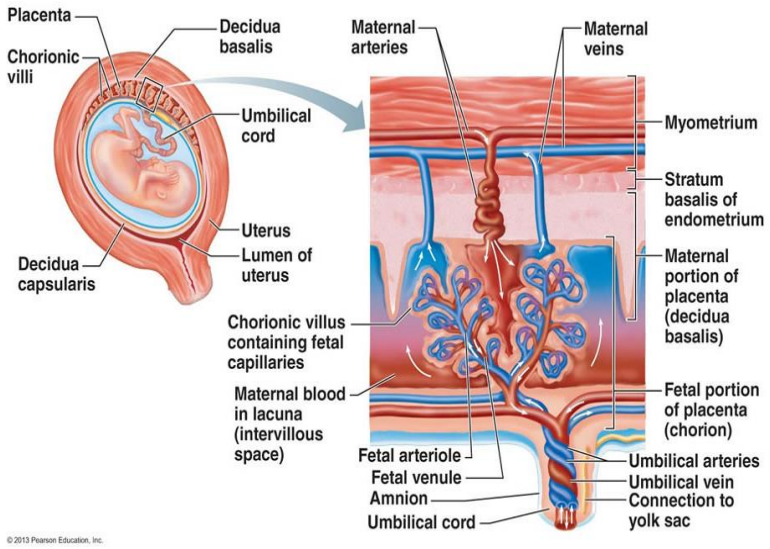
occurs on

about the fifth to seventh day after ovulation

When the free-floating blastocyst adheres to the endometrial lining, cords "projections" of trophoblastic cells begin to penetrate the endometrium and then blood capillaries grow in the cords.

21 days after fertilization blood start to be pumped by fetal heart into the capillaries
Maternal blood sinuses develop around the trophoblastic cords
More and more trophoblast projections develop (placental villi).

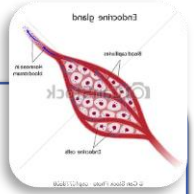
Placenta



Placental functions

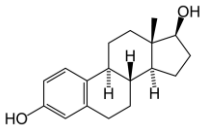
- Respiration
- Nutrition
- Excretion

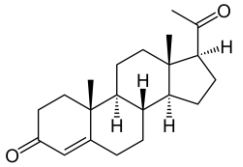
Endocrine



Protection

Placenta as an Endocrine Organ





Estrogen

Steroid hormone

- Secreted by syncytial trophoblast cells
- Towards the end of pregnancy it reaches 30× (max at the end of pregnancy)

Derived from weak androgen (DHEA)

released from maternal & fetal adrenals cortex

Progesterone

- Steroid hormone
- Secreted by syncytial trophoblast cells
- Towards the end of pregnancy it reaches 10×
- Derived from cholesterol

Functions in the mother

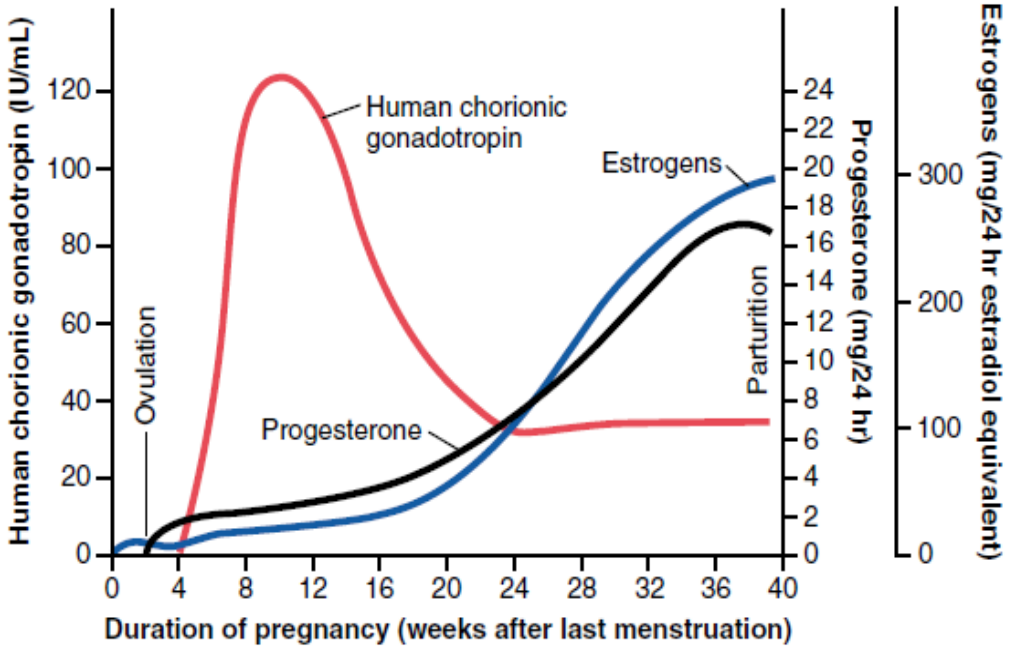
- Enlargement of uterus, breast & external genitalia
- Relaxation of pelvic ligaments in preparation for labor (thats why estrogen increases)
- Activation of the uterus (gap junctions)

Functions in the mother

- Provides nutrition to developing embryo (uterine secretory phase)
- Development of decidual cells
- Inhibits the contractility of the uterus

Human Chorionic Gonadotropin hCG Level (Pregnancy Test)

- ✓ Glycoprotein Hormone
- ✓ Produced by the embryo following implantation
- ✓ Secreted by Syncytiotrophoblast cells
- ✓ Most important function is to maintain corpus luteum (↑estrogen & progesterone) till 13-17 weeks of gestation
- ✓ Exerts interstitial (Leyding) cell-stimulating effect on testes of the male fetus (growth of male sex organs)
- ✓ hCG is detected in pregnancy tests



Other Hormones

Human Chorionic Somatomamotropin (HCS) or Human placental lactogen (hPL)

Protein hormone

Secreted by placenta around 5th gestational week.

Functions in the mother

- Breast development
- Weak growth hormone's action
- Inhibits insulin sensitivity =↓ glucose utilization
- Promotes release of fatty acids

This hormone has weak actions similar to those of growth hormone. It causes the formation of protein tissues, increase lipolysis, decrease maternal insulin sensitivity

Relaxin

- Polypeptide
- Secreted by corpus luteum and placenta

Functions in the mother

- Relaxation of symphysis pubic ligament (weak)
- Softens the cervix at delivery (important for giving birth)

To memorize:

From the name relaxin, it relaxes the ligaments in the pelvis and softens and widens the cervix. For helping in the delivery of a new born baby.

Physiological Adaption in Pregnancy

Changes in Different organs

Increase in uterine size (50 gm to 1100 gm)
The breasts double in size
The vagina enlarges
Development of edema and acne
Masculine or acromegalic features
Weight gain 10-12 kg (last 2 trimesters)
Increase appetite
Removal of food by fetus
Hormonal effect

Changes in maternal endocrine system

Anterior pituitary gland enlargement (50%)
- Release of ACTH, TSH and PL
- FSH and LH almost totally suppressed

Adrenal gland
- Increase glucocorticoids secretion (mobilize AA)
- Increase aldosterone (retain fluid)

Thyroid gland enlargement (50%)
- Increase thyroxine production (hCG)

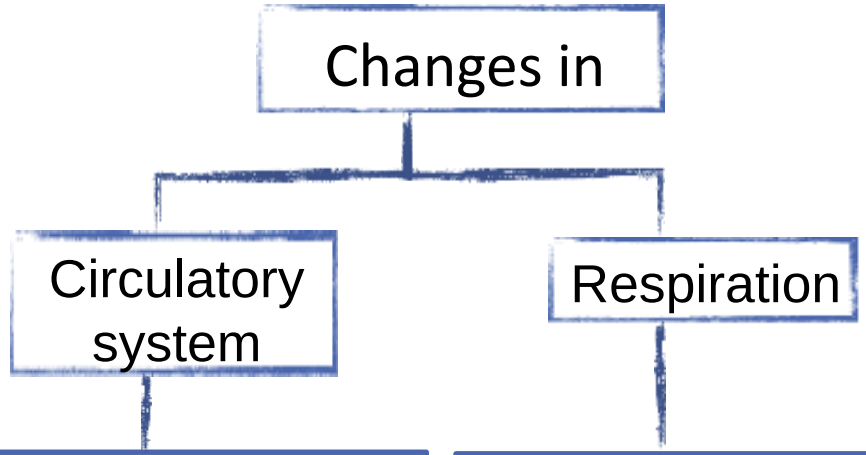
Parathyroid gland enlargement
Increase PTH secretion (maintain normal Ca+2)

Changes in Metabolism

Increase basal metabolic rate (15%)
Increase in daily requirements for
- Iron, Phosphates, Calcium, Vitamins - vitamin D (Ca+2 absorption)

The renal tubules reabsorpative capacity for Na+, Cl, and water is increased as much as 50%
The renal blood flow and GFR increase up to 50%
Normal pregnant woman accumulates only about 5 pounds of extra water and salt.

Physiological Adaption in Pregnancy



- Increase in COP (30-40%) by 27th weeks
- Increase in blood flow through the placenta
- Increase in maternal blood volume (30%) due to:

A)Increase aldosterone and estrogen (↑ECF)
B)increase activity of the bone marrow (↑RBCs)

- Increase in O2 consumption (20%)
- Increase basal metabolic rate (BMR)
- Increase in body size
- Increase in respiratory rate (RR)
- Progesterone ↑ sensitivity of RC to CO2
- Increase in minute ventilation by 50% and a decrease in arterial PCo2 to several millimeters.

Males' LECTURE

× There are three reasons why low PO2 is sufficient to deliver O2 to the fetal tissues:

1-Hemoglobin of the fetus (Higher)

2-Fetal hemoglobin concentration (Higher)

3-The *Bohr effect* (high PH in fetal blood (alkaline) and low PH in maternal blood (acidic)), that facilitate the diffusion of O2 to fetal.

Males' LECTURE

- In later pregnancy, the permeability increases because of thinning of the membrane diffusion layers and because the surface area expands many times over.

- **The fetal hemoglobin concentration is about 50% greater than that of the mother**

Summary

*** Fertilization:**
Fertilizing sperm >> penetrates Corona Radiata >> Binds to ZP3 receptor >> activates releasing of Hydrolytic enzymes onto Zona Pellucida >> the sperm nucleus enters ovum cytoplasm >> releasing of Ca+ stored in Cortical Granules >> deactivation of ZP3 receptor >> Block POLYSPERMY .

* sperms reach ampulla of fallopian tube within 30-60 min .

* The ovum still in the secondary oocyte stage of development .

* The PCO2 of the fetal blood is higher than that of the maternal blood , To help the fetus gets rid of Co 2 to the mother .

* Estrogen and Progesterone are steroid hormone and secreted by trophoblast cells .

* Zygote begins to divide as it travels through oviduct, delayed transport allows cell division

* Increase basal metabolic rate , Increase in daily requirements for (Ca, Vit D , K , Fe , PO) & The renal blood flow and GFR .(Metabolism and kidney function during pregnancy)

*Functions of the placenta are Respiration , Nutrition , Excretion , Endocrine , Protection .

* Increase aldosterone level, preparing the pregnant for losing fluid during labor

MCQs

1) The Functions of Human placental lactogen (hPL) ?

A. Maintain corpus luteum
B. Inhibits insulin sensitivit
C. Provides nutrition to developing embryo

2) Implantation occurs in:

A. 2 Days after fertilization .
B.1 Week after fertilization
C. 1 Month after fertilization .

3) Why maternal blood volume increase ?

A. Increase aldosterone and estrogen (↑ ECF)
B. Increase activity of the bone marrow (↑ RBCs)
C. Both

4) Divisions continue rapidly until:

A.The 16 cell stage .
B. The 32 cell stage .
C. The 8 stage .

5) Isthmus (last 2cm) relaxes under effect of:

A. Prolactin
B. progesterone
C. Human placental lactogen (HPL)

6) How long take the travelling of the Zygote from ampulla to uterus ?

A. 3-5 Days.
B.2 Days.
C.7 Days

Answers: 1-B 2-B 3-C 4-B 5-B 6-A

SAQS

Q1:Explain the process of fertilization (including the location, duration, and enzymes) and what happens afterwards?

Ans: the definition of fertilization is the union of male and female gametes.
An ovum goes from the ovary to the ampulla where fertilization usually occurs. The egg waits for the sperm to arrive at the ampulla for about 45 minutes.
After the sperm reaches the ovum it starts to penetrate the layers that surround the ovum mainly corona radiata and zona pellucida by its hyaluronidase & proteolytic enzymes.
After fertilization, it takes about 4 days till the zygote reaches uterine cavity for implantation.

Q2: provide an example of a physiological adaptation in pregnancy that occurs in the uterus, breast, vagina, the circulatory and respiratory system?

Ans: Uterine increase in size, breasts double in size, vagina enlarges, circulatory system increase in blood flow through the placenta, respiratory system increase in O2 consumption.

Q3: How does relaxin hormone help in giving birth (include the hormone type and where it gets secreted from)?

Ans: Relaxin is a polypeptide hormone secreted by corpus luteum and placenta. It relaxes the symphysis pubic ligament and softens the cervix, which aids in the delivery of the newborn baby.

Q4: Elaborate on the changes in hCG, estrogen, and progesterone during pregnancy?

Ans: At the beginning of pregnancy estrogen and progesterone are low, and hCG later on starts to show (about 4th week).
4 weeks into the pregnancy hCG increases rapidly, stays high till 13-17 weeks, to increase progesterone and estrogen. Estrogen and Progesterone have a steady increase till birth. They play an important rule in pregnancy, estrogen helps in preparation for labor, and progesterone in providing nutrition to developing embryo.

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Thank you for checking our work

Best Wishes..