



MED437
KING SAUD UNIVERSITY



قال تعالى : (وَلَقَدْ خَلَقْنَا الْإِنْسَانَ مِنْ صَلْصَالٍ مِنْ حَمَإٍ مَسْتَوِينَ)

EMBRYOLOGY 437



تمت المراجعة

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ب

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Important

Dr. notes

Explanation

OBJECTIVES :

By the end of the lecture, you should be able to:

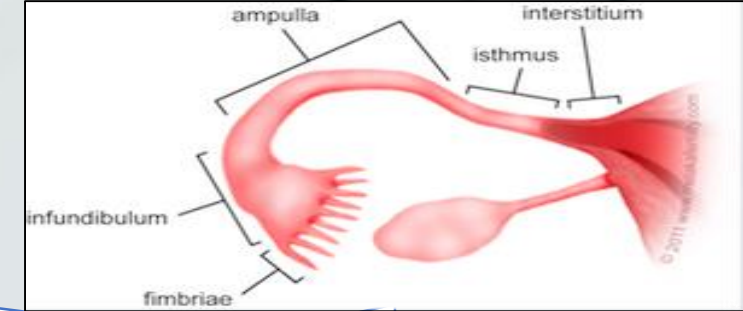
- Identify **fertilization** and its **site**.
- List the **phases** of fertilization.
- Describe the **results** of fertilization.
- Describe the **formation** of **blastocyst**.
- Identify **implantation** and its **site**.
- Describe the **mechanism** of **implantation**.
- Describe the **formation** of **primary chorionic villi** .
- List the **common sites** of **ectopic pregnancies** .

FERTILIZATION

• Definition:

it is the process during which a male gamete (**sperm**) unites with a female gamete (**oocyte**) to form a single cell (**ZYGOTE**).

1. It is a complex process.
2. It begins with a **contact** between **sperm & ovum**.
3. **Ends up** with **intermingling** of the **maternal and paternal chromosomes**.



• Site :

Where Does Fertilization Normally Occur?

longest and widest part of the tube.

Usually in the **ampulla** of uterine tube or fallopian tube (مترادفات)

may occur in any other part of tube.

Never occurs in the uterine cavity.

Chemical signal from oocyte attracts the sperms.
Peristaltic movement of the tube from medial to lateral.

• Phases :

1- Passage

of the sperm through the cells of the **corona radiata** by the effect of:

- a) **Hyaluronidase enzyme** secreted from the sperms.
- b) By movement of its tail.

2- Penetration

of the zona pellucida by **acrosine** (a substance secreted from **acrosomal cap**).

3- Fusion

of the plasma membranes of the oocyte and the sperm.

4- Completion

of the second meiotic division of the oocyte which was arrested at **metaphase**

6- formation

of the male pronucleus

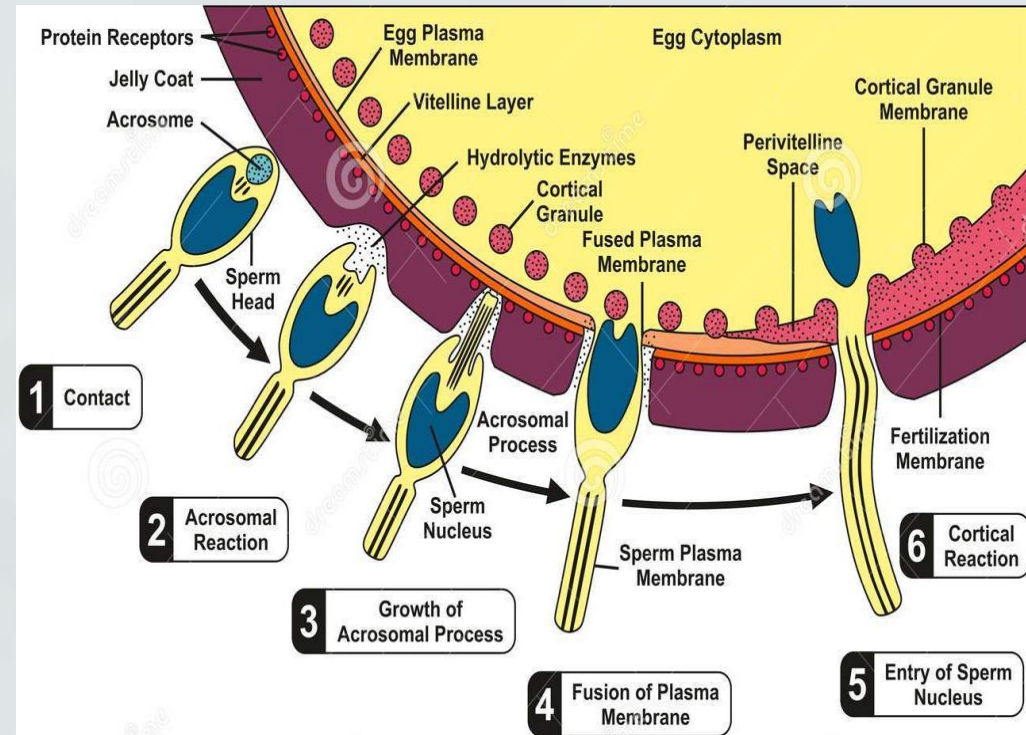
5- Formation

of the female pronucleus.

7- Union

of the 2 pronuclei.

تجي اسئلة عن phases and results



CHROMOSOMES IN THE ZYGOTE

Zygote is genetically unique. (why?)

- Half of its chromosomes comes from the **father** and the other half comes from the **mother**.
- New combination is formed which is different from either of the parents.
- This mechanism forms **biparental inheritance** and leads to **variation** of the human species.

Sex of the Embryo

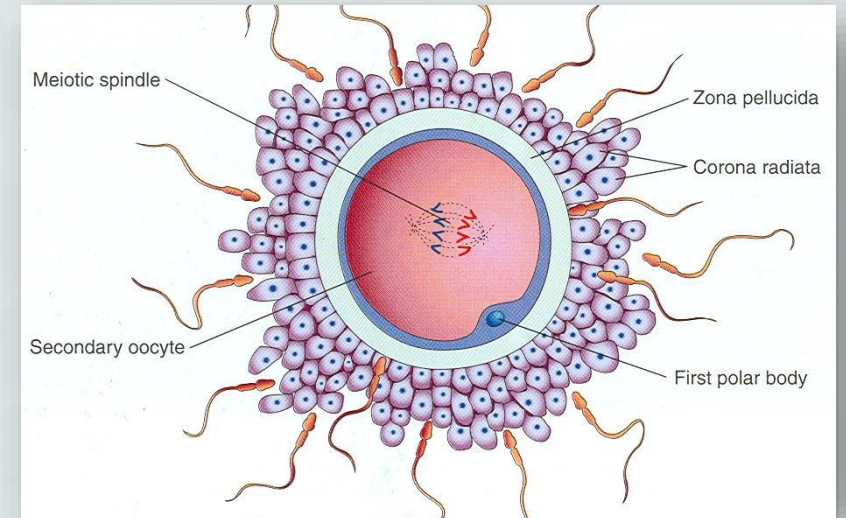
- Embryo's chromosomal sex is determined at the time of fertilization ,, (How?) by genetic studies.
- **Sex is determined** by the **type of sperm** (X or Y) that fertilizes the oocyte.
- So, it is the **father** whose gamete decides the sex.

Zonal reaction : it is a change in properties of zona pellucida that makes it **impermeable** to other sperms.(allows only one sperm to enter)

Zonal reaction : للحفاظ
متعلق بـ zona pellucida

Results of Fertilization

1. **Stimulates** the penetrated **oocyte to complete its 2nd meiotic division**.
2. **Restores** the normal **diploid** number of chromosomes.
3. **Determines** the **sex** of the embryo.
4. **Initiates cleavage** (cell division) of the zygote.



This single cell will undergo a multiple “mitotic” division to form (*Blastomeres*).
After **30 hours** of fertilization , the cleavage begins

Cleavage of Zygote

It is the repeated mitotic divisions of the zygote.

Normally occurs in the uterine tube.

Rapid (high speed) increase in the number of the cells.
that divided from the single cell (Zygote) to a sequence of 2 cells, then 4,8 and 16.... And so on.

These smaller embryonic cells are now called, Blastomeres.

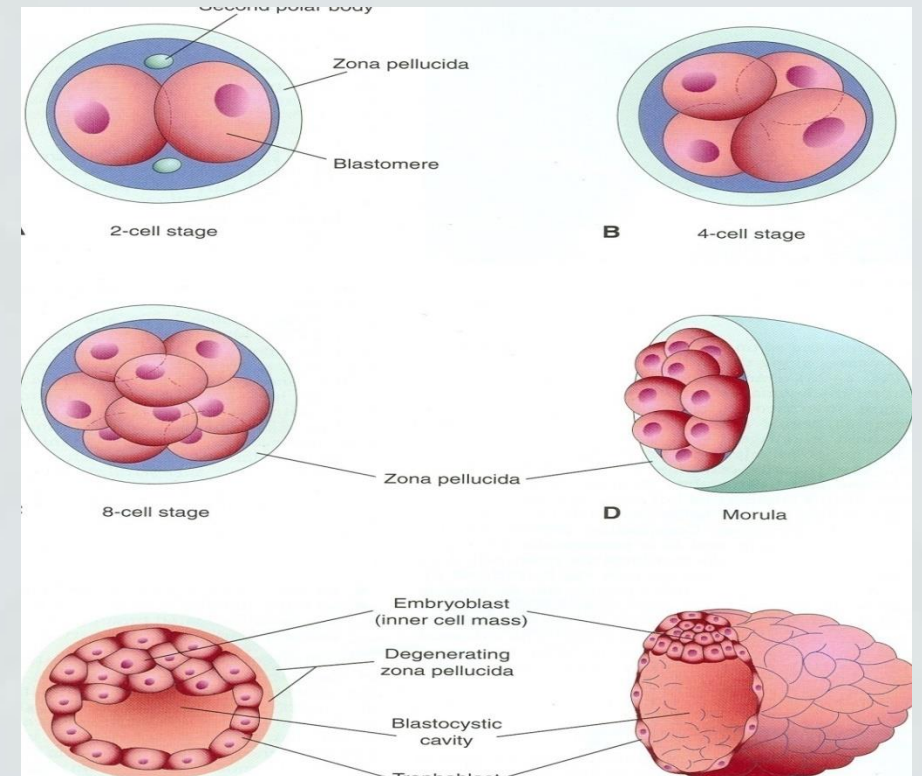
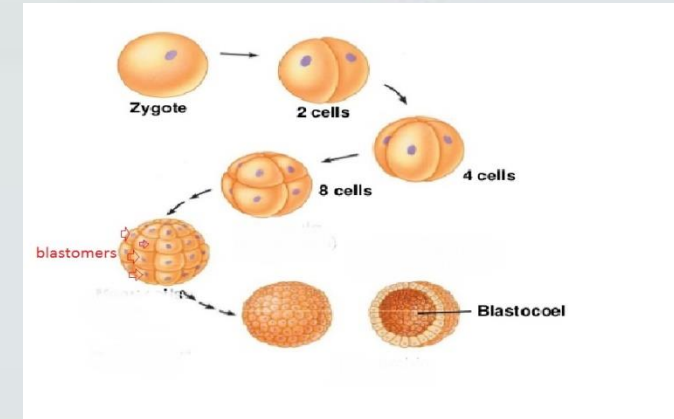
During cleavage (after 30 H) these cells will be surrounded by thick **zona pellucida**

Zygote lies within the thick **zona pellucida** during cleavage.

the zona pellucida is a translucent (شفاف) membrane under the microscope.

Zygote migrates in the uterine tube during cleavage from its lateral end to its medial end.

(until it reaches the uterine cavity).



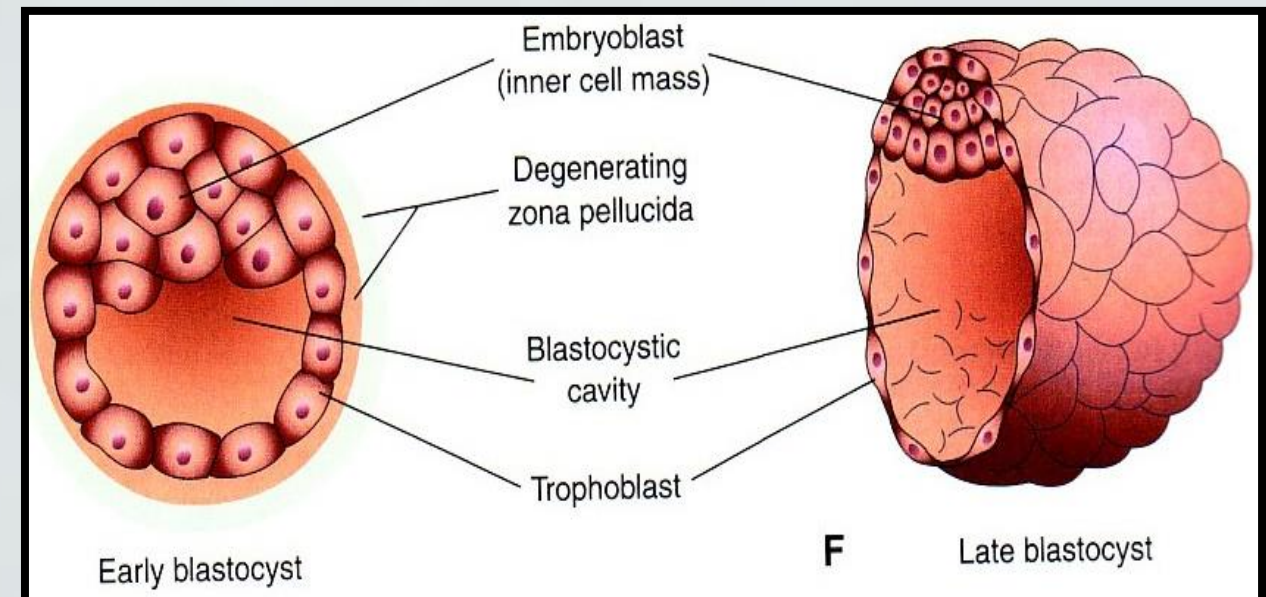
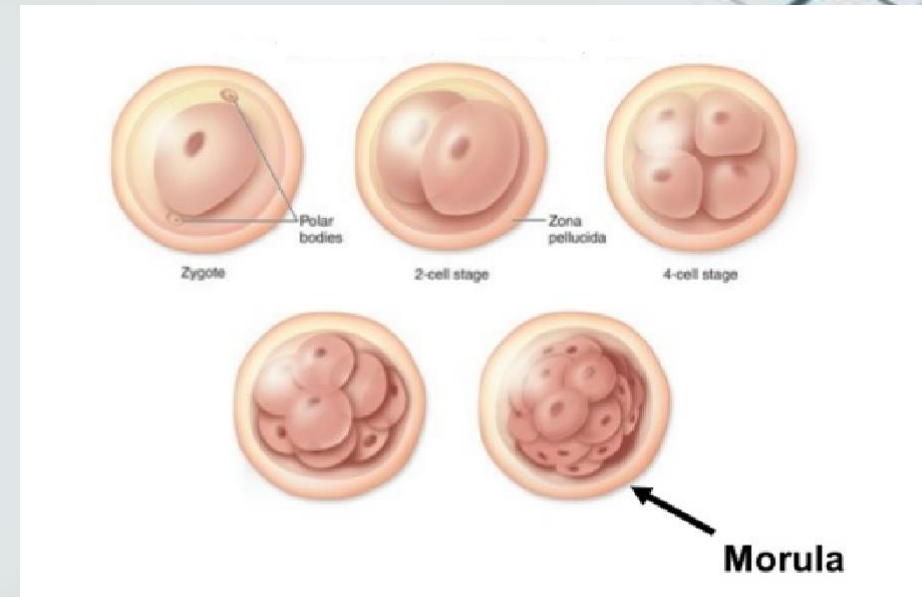
Morula

When there are 16 to 32 blastomeres the developing human is called **MORULA**.

The **Morula** reaches the uterine cavity at this stage.

Spherical **Morula** is formed about the **3rd** day after fertilization.

It resembles mulberry or blackberry.



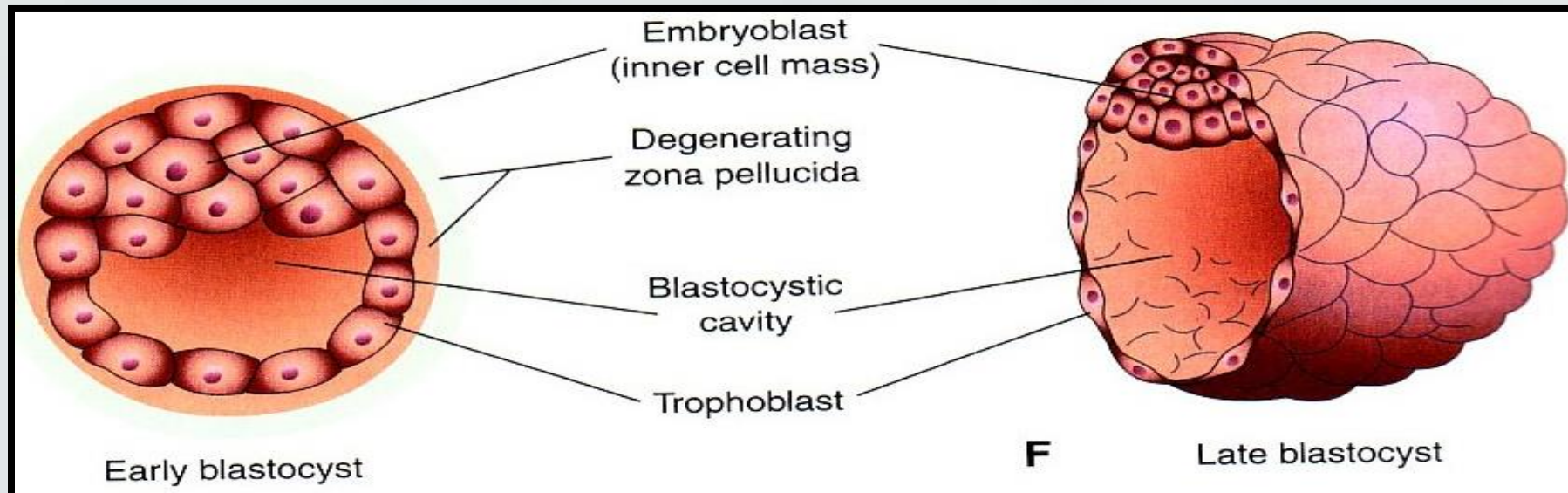
The Mechanism

The Morula reaches the uterine cavity by the 4th day after fertilization.

It remains **free** within the uterine cavity for one or two days.

Fluid passes from uterine cavity to the Morula.

Now the Morula is called ***Blastocyst***, its cavity is called blastocystic cavity or blastocele, and its cells divided into **Embryoblast & Trophoblast**.



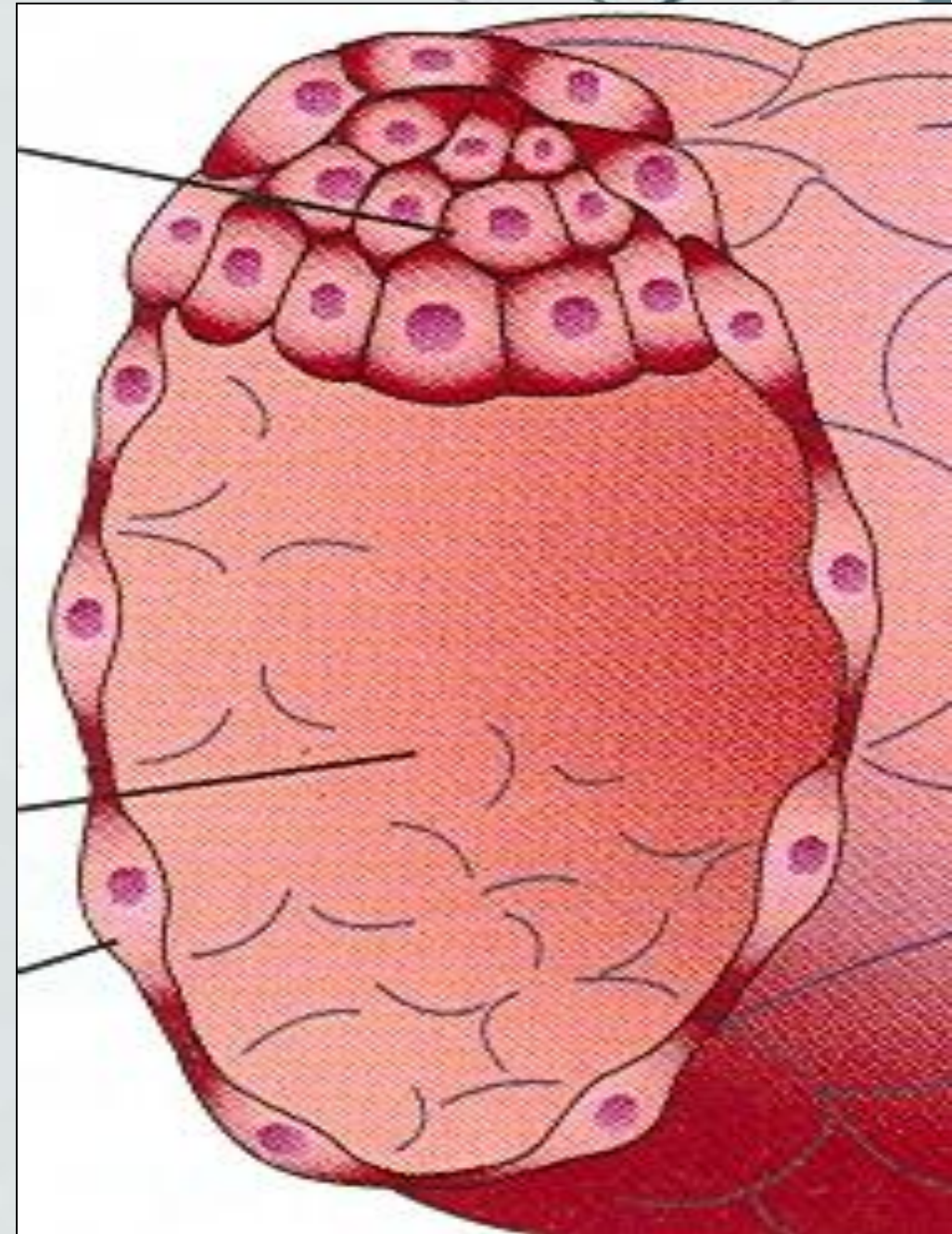
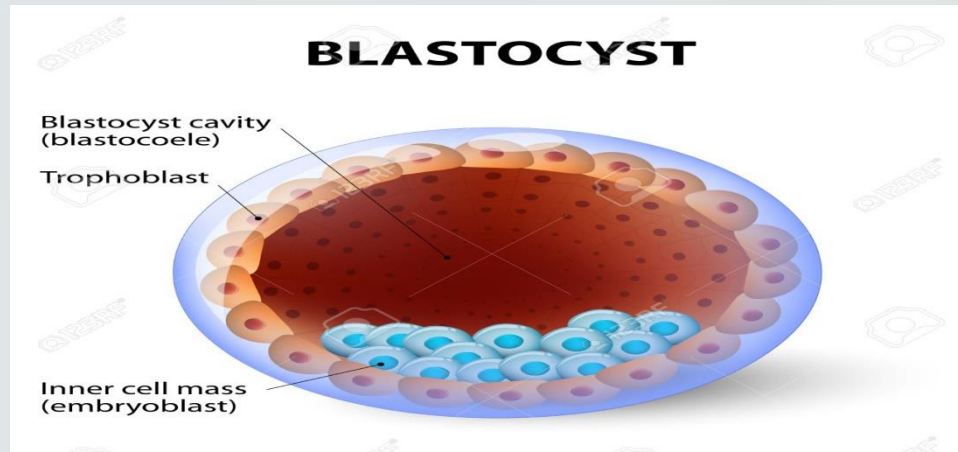
BLASTOCYST

A **cavity** appears within the morula dividing its cells into 2 groups:

1-Outer cell layer called **trophoblast**.

2-Inner cell layer (mass) called **Embryoblast** attached to one of the poles of the blastocyst.

The cavity is called **blastocystic cavity** or blastocele.



IMPLANTATION

Definition:

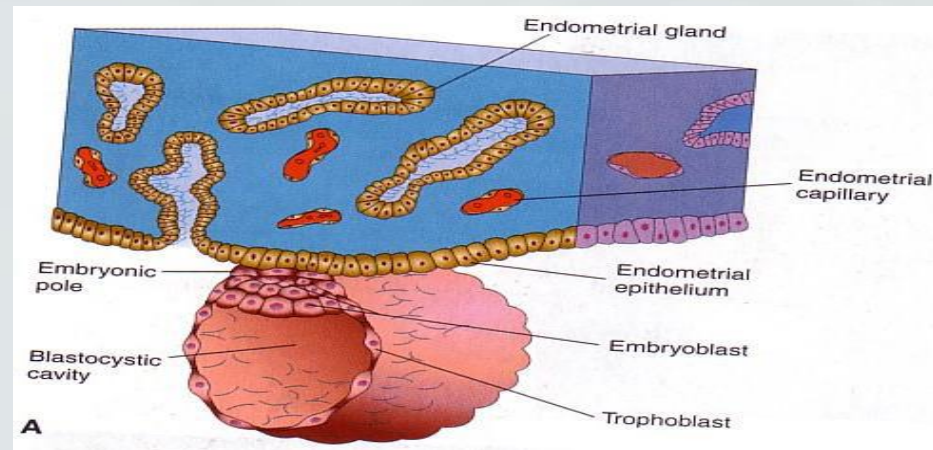
It is the process by which the **Blastocyst** penetrates the **superficial** (compact) layer of the endometrium of the uterus.

Site:

The normal site of **implantation** is the ***POSTERIOR WALL OF THE BODY OF THE UTERUS NEAR THE FUNDUS.***

Time:

- It **begins** about the **6th day** after fertilization.
- It is **completed** by the **11th** or **12th** day.



SUMMARY :

5th Day the Zona pellucida degenerates, To allow the blastocyst to increase in size and penetrate the endometrium

6th Day Blastocyst begins implantation & adheres to the endometrium and beginning of penetration. Trophoblast cells at the embryonic pole of the blastocyst begin to penetrate the epithelium of the endometrium (uterine mucosa)
Penetration results from proteolytic enzymes (eg.COX-2) produced by the trophoblast. (in females lecture)

7th Day Trophoblast differentiated into 2 layers:
1-Cytotrophblast, inner layer, mitotically active.
2-Syncytiotrophblast (outer multinucleated mass, with indistinct cell boundary
* Invasion of endometrium continues with the syncytiotrophblasts

8th Day the blastocyst is superficially embedded in the compact layer of the endometrium.

10th or 11th Day
•Blood-filled Lacunae appear in the Syncytiotrophblast which communicate forming a lacunar network
•Syncytiotrophblast erodes the endothelial lining of the maternal capillaries which known as sinusoids.

11th or 12th Day blood of maternal capillaries reaches the lacunae so Uteroplacental circulation is established

13th to 15th Day Proliferation of Cytotrophblast cells produce extension inside the Syncytiotrophblast to form the primary chorionic villi.

Extra Notes: Chorionic villi are villi that sprout from the chorion to provide maximum contact area with maternal blood.

Secondary chorionic villi are identified by having connective tissue

Tertiary chorionic villi are identified by having capillaries

- ❖ Endometrial cells undergo a process called apoptosis, (programmed cell death) to facilitate invasion of endometrium by the Syncytiotrophoblast.
- ❖ **Syncytiotrophoblast** engulf these degenerated cells for nutrition of the embryo.

❖ **Implantation** can be detected by:

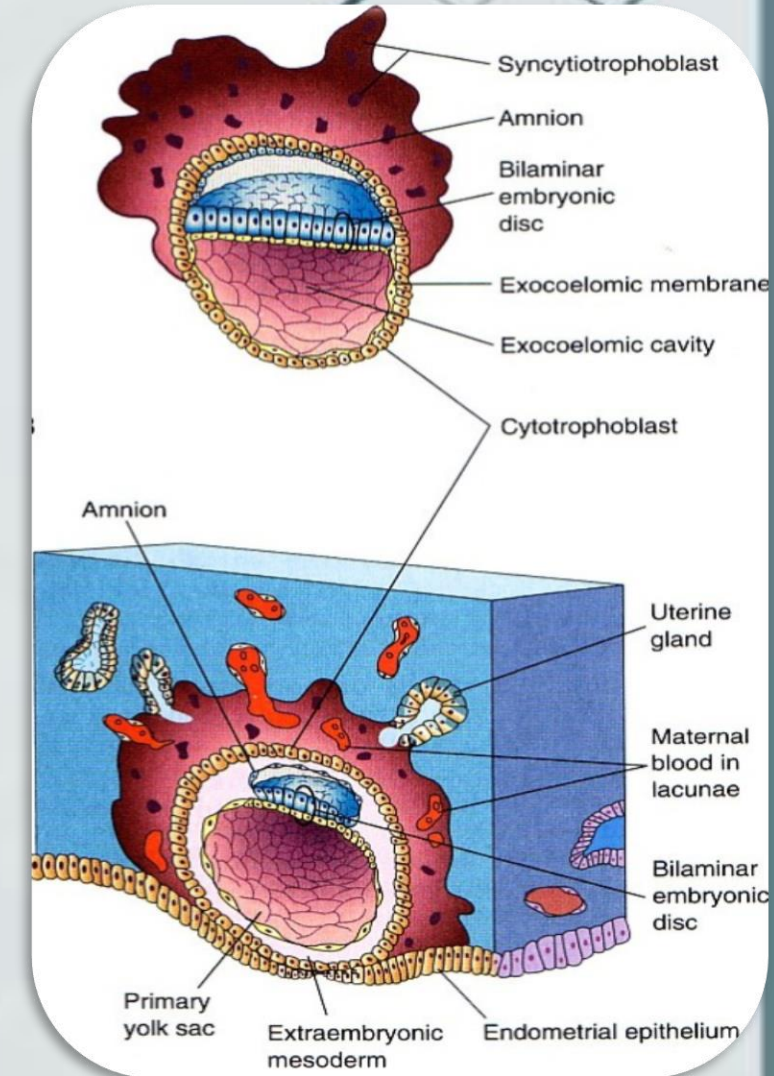
1- **Ultrasonography**.

2- **Pregnancy test hCG** : (human chorionic gonadotrophin) a hormone which is **secreted by the Syncytiotrophoblast** about the **end** of 2nd week

(HCG can be measured in both the blood and urine to determine if a woman is pregnant).

Early Pregnancy Factor: (EPF)

- ❖ Is an **immunosuppressant** (مخمد للمناعة) **protein**.
- ❖ It is **Secreted** by trophoblast cells.
- ❖ It **Appears in maternal serum** within 24--48 hrs., after fertilization.
 - Serum: blood plasma minus clotting proteins.
- ❖ **Its function** is to prevent the immune system from attacking the new embryo. It is the basis for **EPT** (Early pregnancy test) in the **first 10 days of development**.



Ectopic Implantation (Pregnancy) (الحمل خارج الرحم)

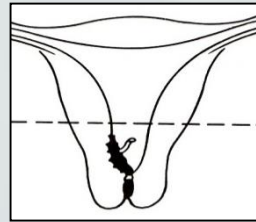
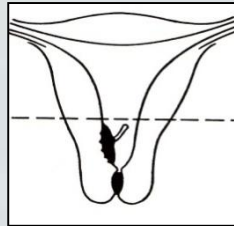
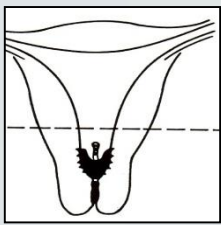
•It means implantation outside the uterine cavity.

1. 95 to 97% of ectopic pregnancies occurs in the uterine tube.

•Most are in the ampulla & isthmus.

2. Placenta previa: (تستلزم ولادة قيصرية)

•Implantation occurs in the lower uterine segment.



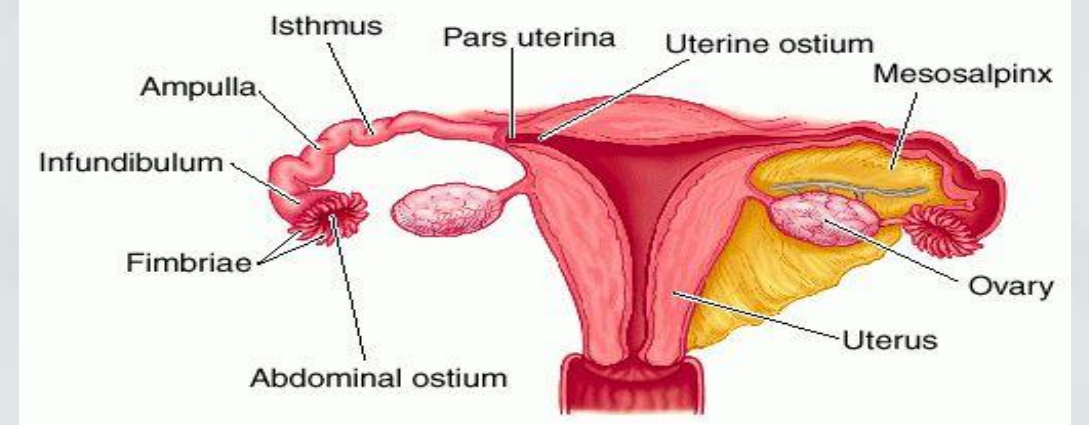
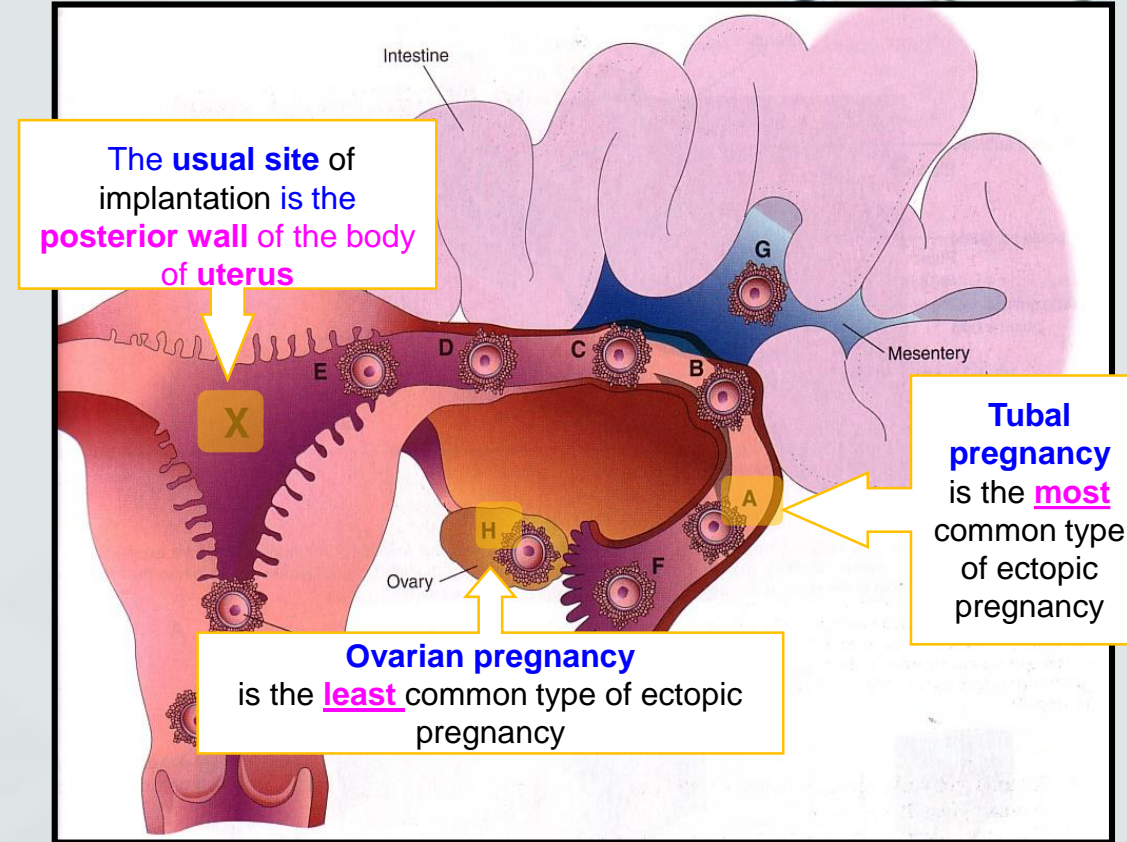
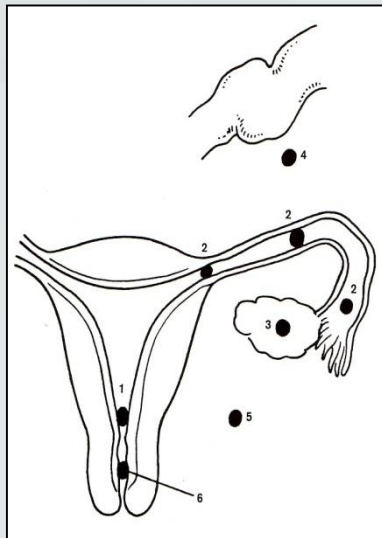
Placenta previa centralis

Placenta previa lateralis

Placenta previa marginalis

sites of Ectopic Pregnancy:

- 1- Placenta Previa.
- 2- Tubal.
- 3- Ovarian.
- 4- Abdominal.
- 5- Pelvic.
- 6- Cervical.





Video may be helpful for your understanding:

[Human Physiology - Fertilization and Implantation](#)

Online quiz:

[Fertilization and Implantation online quiz](#)





Embryology⁴³⁷

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