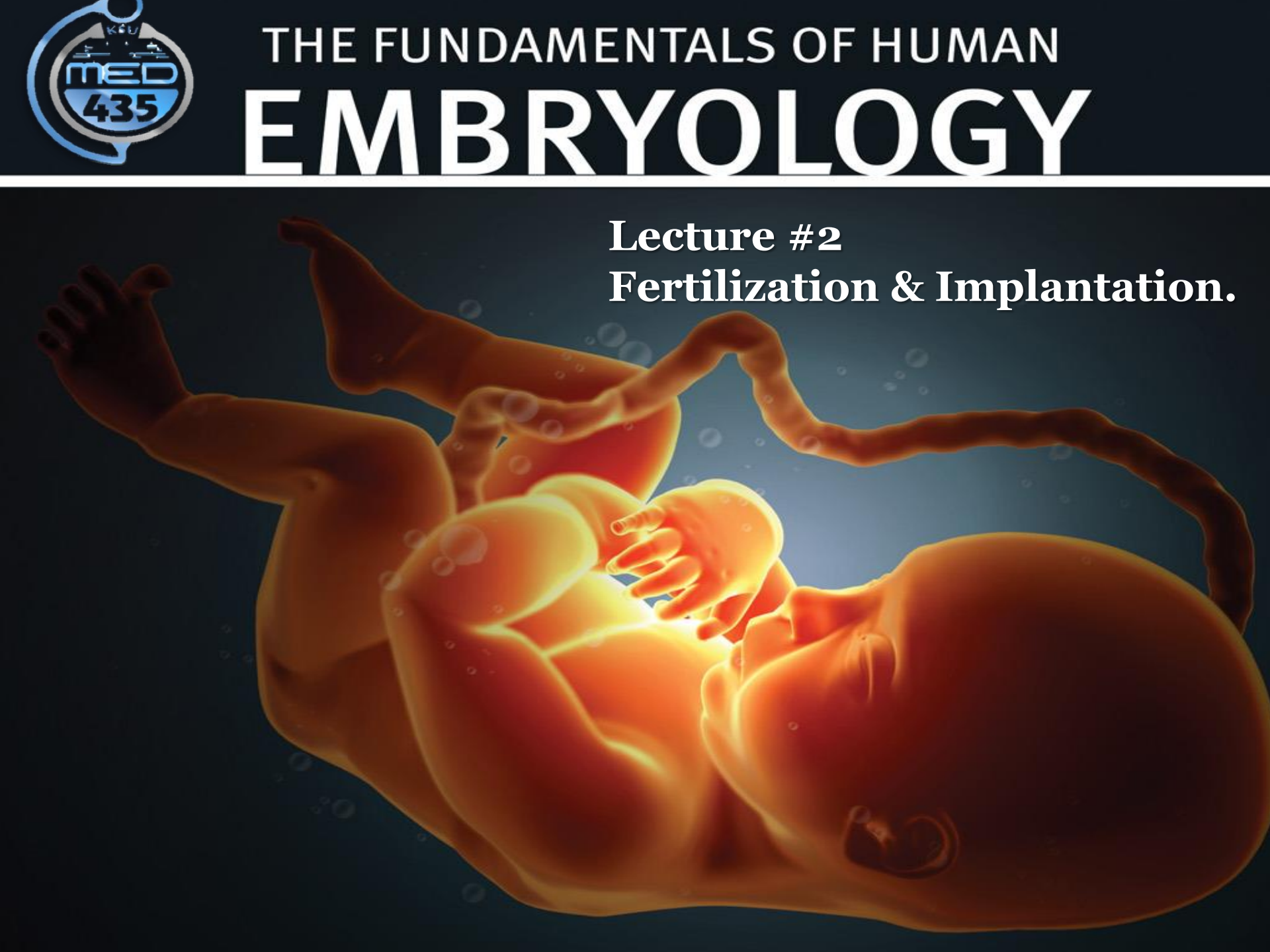
THE FUNDAMENTALS OF HUMAN EMBRYOLOGY



Lecture #2
Fertilization & Implantation.

Objectives:

By the end of this 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 blastocyts.**
- Identify **implantation** and **its site.**
- Describe the **mechanism of implantation.**
- Describe the **formation of primary chorionic villi.**
- List the sites of **ectopic pregnancy.**

Fertilization:

Definition : male gamete (sperm) + female gamete (oocyte) = (zygote)

☐ It is a **complex process** begins with a contact between sperm &ovum.

☐ Ends up with intermingling (mixing) of the maternal and paternal Chromosomes

* **Sperm** : can't live more than 48 hours.

* **Oocyte** : attracts the sperm with chemical signals.

 # Site of Fertilization:

Usually in the ampulla of uterine tube (the widest part of the tube) and may occur in any other part of tube(unlike the implantation that happen normally in one place).

*peristaltic movement of the tube from medial to lateral.

Never occurs in the uterine cavity

Phases of Fertilization:

when a chemical signal from oocytes attracts the sperm:

1- passage : sperm pass through corona radiata by the effect of : hyaluronidase enzyme + the movement of its tail

2- Penetration:
Of the Zona Pellucida by Acrosine enzymes(which is a substance secreted from Acrosomal cap) only one sperm to create a tract through the zona pellucida.
After entrance of one sperm zonal reaction takes place in the oocyte (zona pellucida layer)

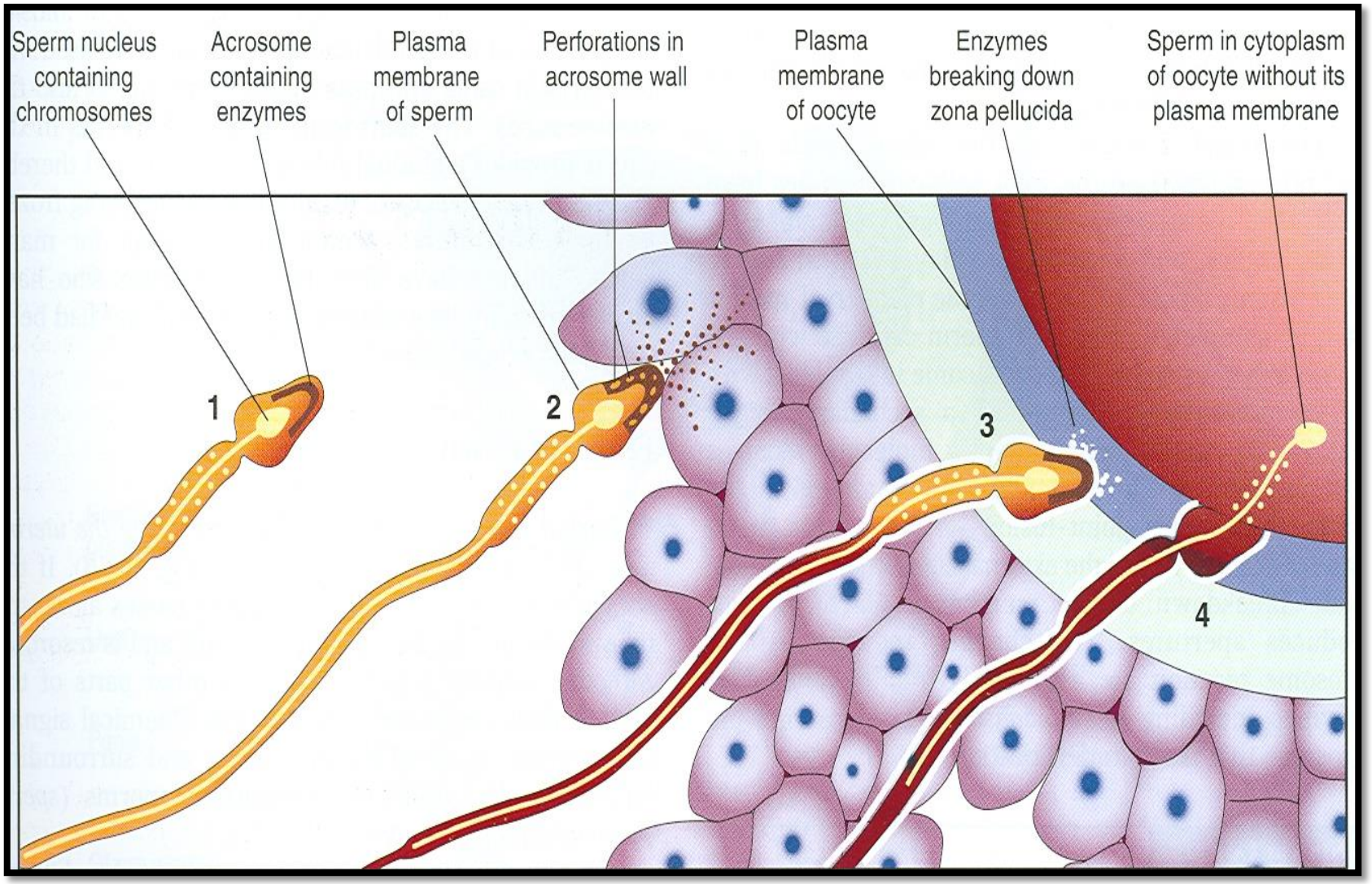
3- Fusion:
fusion of plasma membrane for both oocyte (ovum) and sperm .
Sperm content enters into the oocyte and undergoes morphological changes

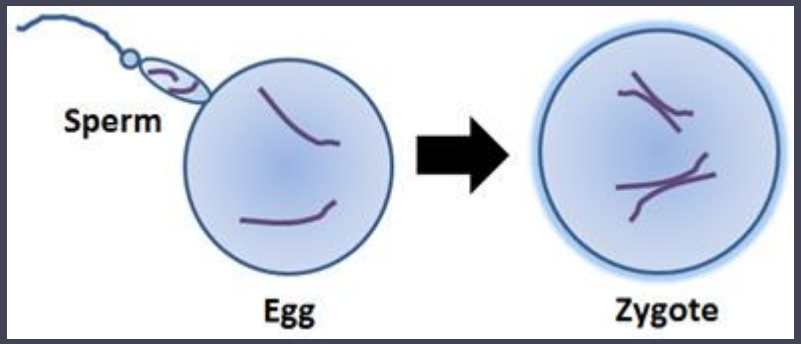
4- Completion:
the 2nd meiotic division of the oocyte is completed formation of the female pronucleus.

5- Formation:
the male pronucleus is formed . **Union** of the 2 pronuleii.

See the figure in the next slide..

Phases of Fertilization:





CHROMOSOMES

Zygote : is genetically unique

* 1\2 the chromosomes from the father and 1\2 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 .
* Sex is determined by the type of sperm (x or y) that fertilize the oocyte .

THE FATHER's gamete decides the sex.

Zonal reaction : it is a change in properties of zona pellucida that makes it impermeable to other sperms after fertilization.

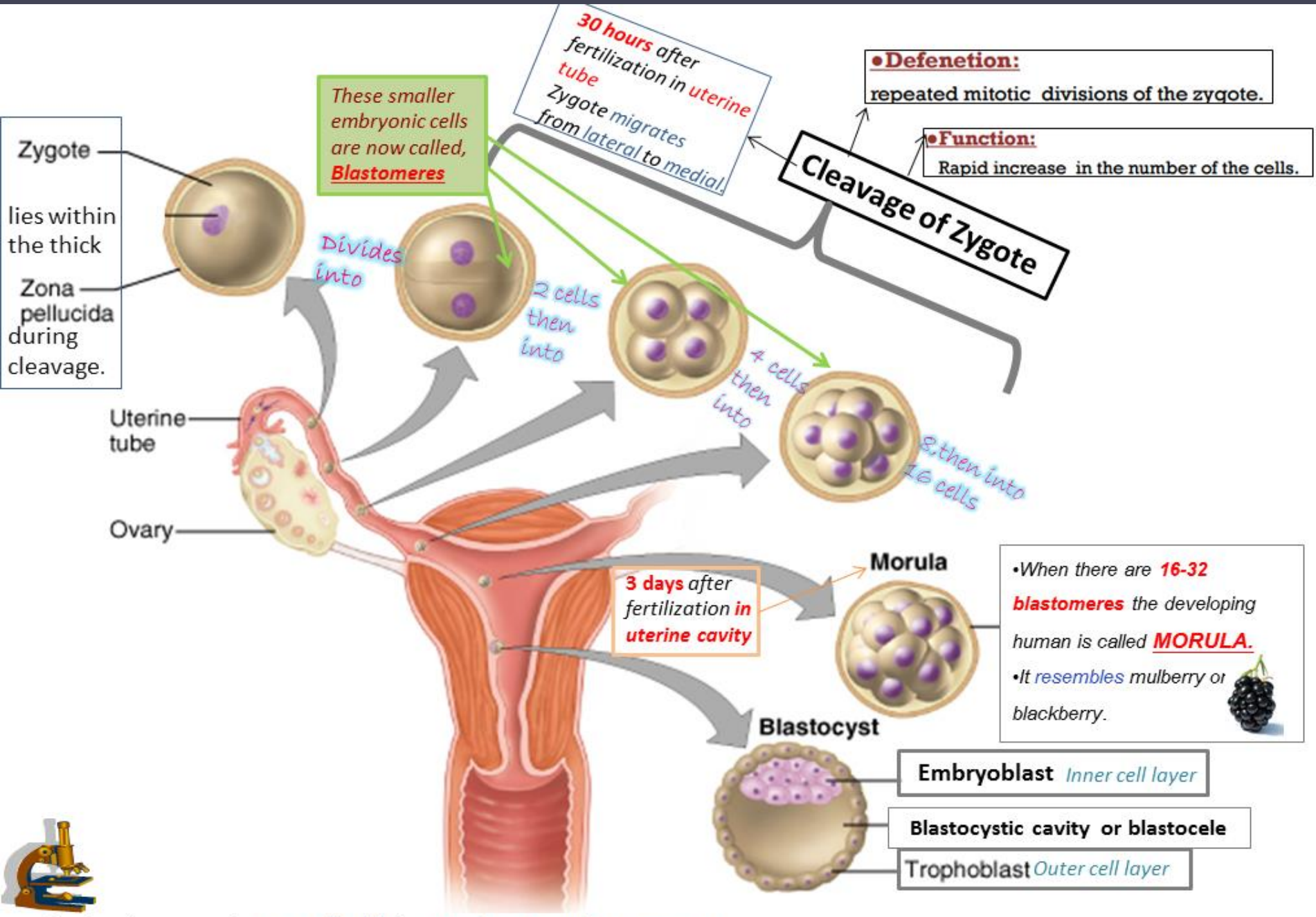
Results of Fertilization

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.



*Under the microscope, the zona pellucida is a translucent membrane((غشاء شفافي

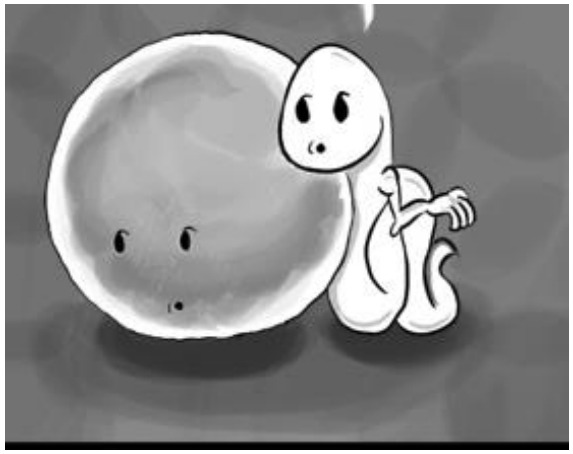
Definition: it is the process which the Blastocyst penetrates the superficial (compact) layer of the endometrium of the uterus.

IMPLANTATIO N

SITE: posterior wall of the body of the uterus near the fundus

TIME: Begins at 6th day after fertilization

Completed by the 11th or 12th day



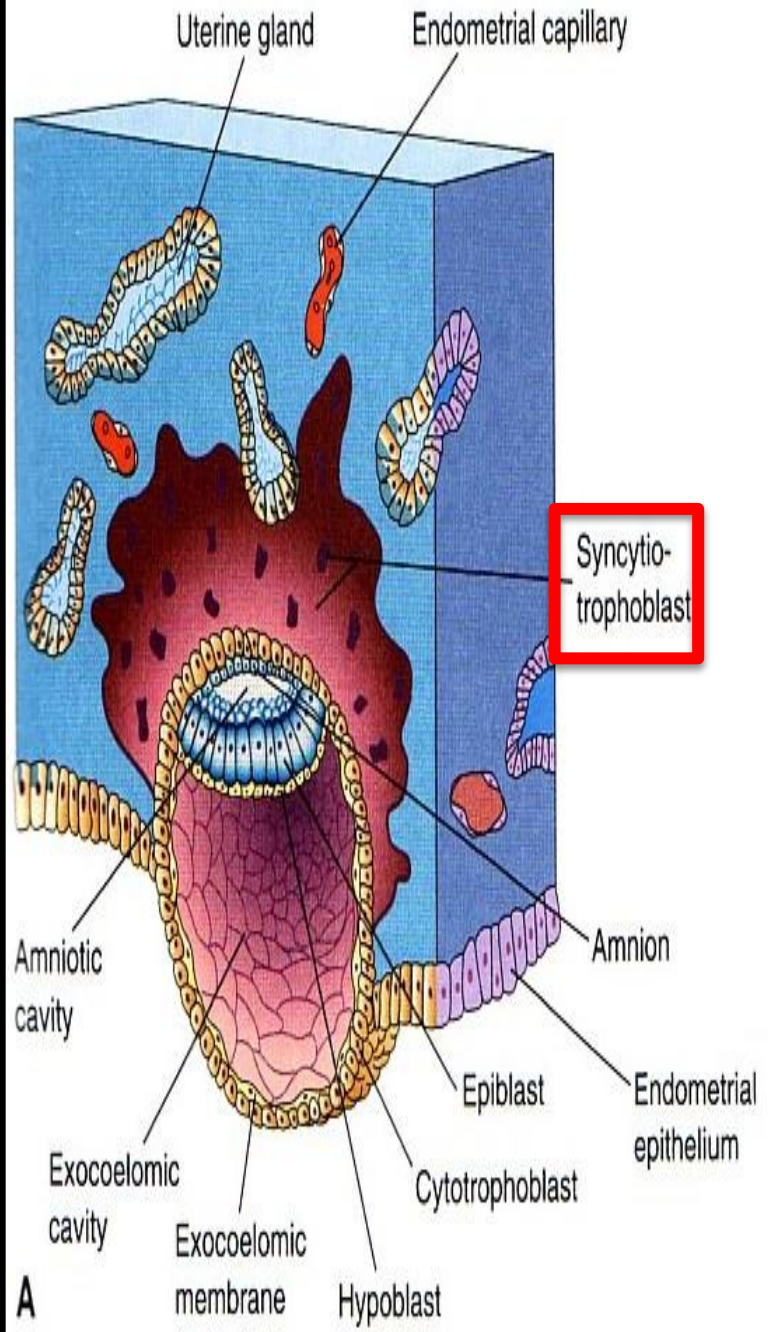
4th day	Morula reaches uterine cavity and remains for 1 or 2 days fluid passes from the uterine cavity to morula . Now the morula called Blastocyst it's cavity called blastocystic cavity divided into Empryoblast & Trophoblast
5th day	Zona pellucida degenerates & disappears allows the blastocyst to increase in size & penetrates to endometrium. The Empryoblast projects into the blastocystic cavity while Trophoblast formed the wall of the blastocyst
6th day	- Blastocyst begins implantation & adheres to the endometrium. - Penetration results from proteolytic enzymes e.g.(cox-2) produced by the trophoblast.
7th day	Trophoblast differentiated into 2 layers: -Cytotrophblast: inner layer, mitotically active. –Syncytiotrophoblast : outer multinucleated mass with indistinct cell boundary
8th day	Blastocyst is superficially embedded in the compact layer of the endometrium.
10th or 11th	Blood Filled Lacunae appear in the Syncytiotrophoblast which communicate forming a network
11th or 12th	Blood of maternal capillaries reaches the lacunae so Uteroplacental circulation is established

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

Implantation can be **detected** by:

1- Ultrasonography.

2- hCG (human chorionic gonadotrophin) which is secreted by the Syncytiotrophoblast about the **end of 2nd week**.



Early Pregnancy Factor:

– Is an immunosuppressant protein.

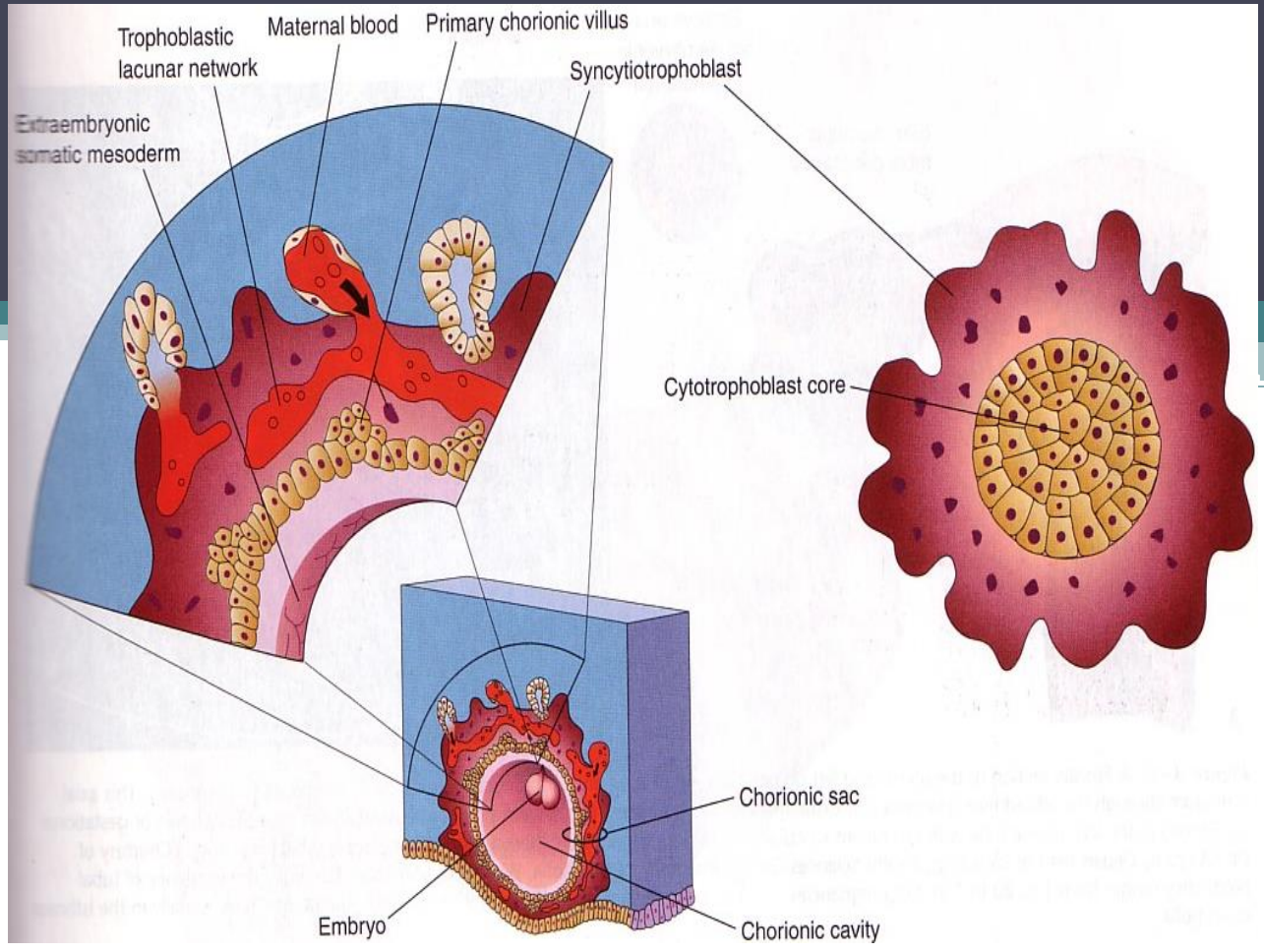
– **Secreted** by trophoblast cells.

– **Appears** in maternal serum within 24--48 hrs., after fertilization.

–It is the basis for EPT (Early pregnancy test) in the first 10 days of development.

Formation of The Primary Chorionic villi :

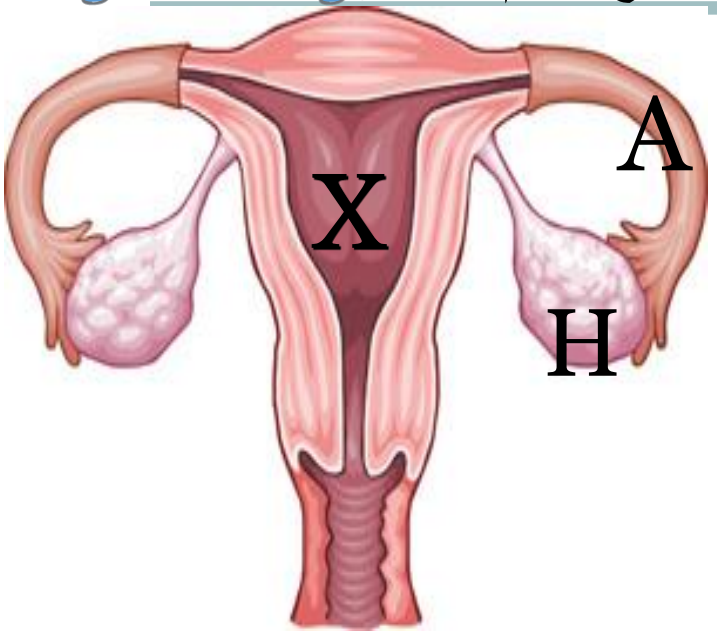
By the 13th day *Proliferation* of **Cytotrophblast cells** produce **extension** inside the **Syncytiotrophoblast** to form the **primary chorionic villi.**



Ectopic Implantation (Pregnancy)

الحمل خارج الرحم

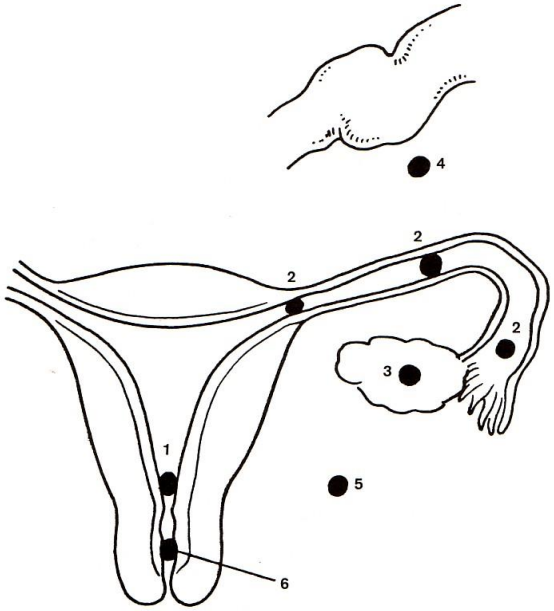
- It means implantation outside the uterine cavity.
- The usual site (normal site) of implantation is the posterior wall of the body of uterus (X).
- Tubal pregnancy is the most common type of ectopic pregnancy (A).
- Ovarian pregnancy is the least common type of ectopic pregnancy (H).



• 95 to 97% of ectopic pregnancies occurs in the uterine tube.
• Most are in the ampulla & isthmus.
• Placenta previa : Implantation occurs in the lower uterine segment.

Ectopic Pregnancy:

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

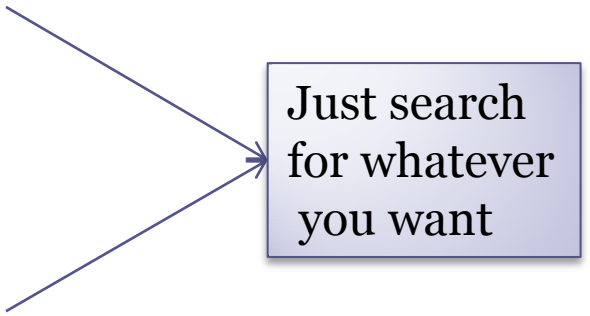


Youtube videos:

Embrology - Day 0 7 Fertilization, Zygote, Blastocyst
https://www.youtube.com/watch?v=EwTZ1fypivg

Khanacademy
https://www.youtube.com/channel/UCJayvjGvKEblkA3KYK1BQQw

Armando Hasudungan
https://www.youtube.com/channel/UCesNt4_Z-Pm41RzpAClfVcg



Zonal reaction is :

a-Dissolve of zona pellucida .

b- changing properties of zona pellucida that makes it impermeable to other sperms .

c- properties of zona pellucida that makes it permeable to other sperms .

d- chemical reaction leads to enlarge the zygote .

Answer: B

Embryology heroes :

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