

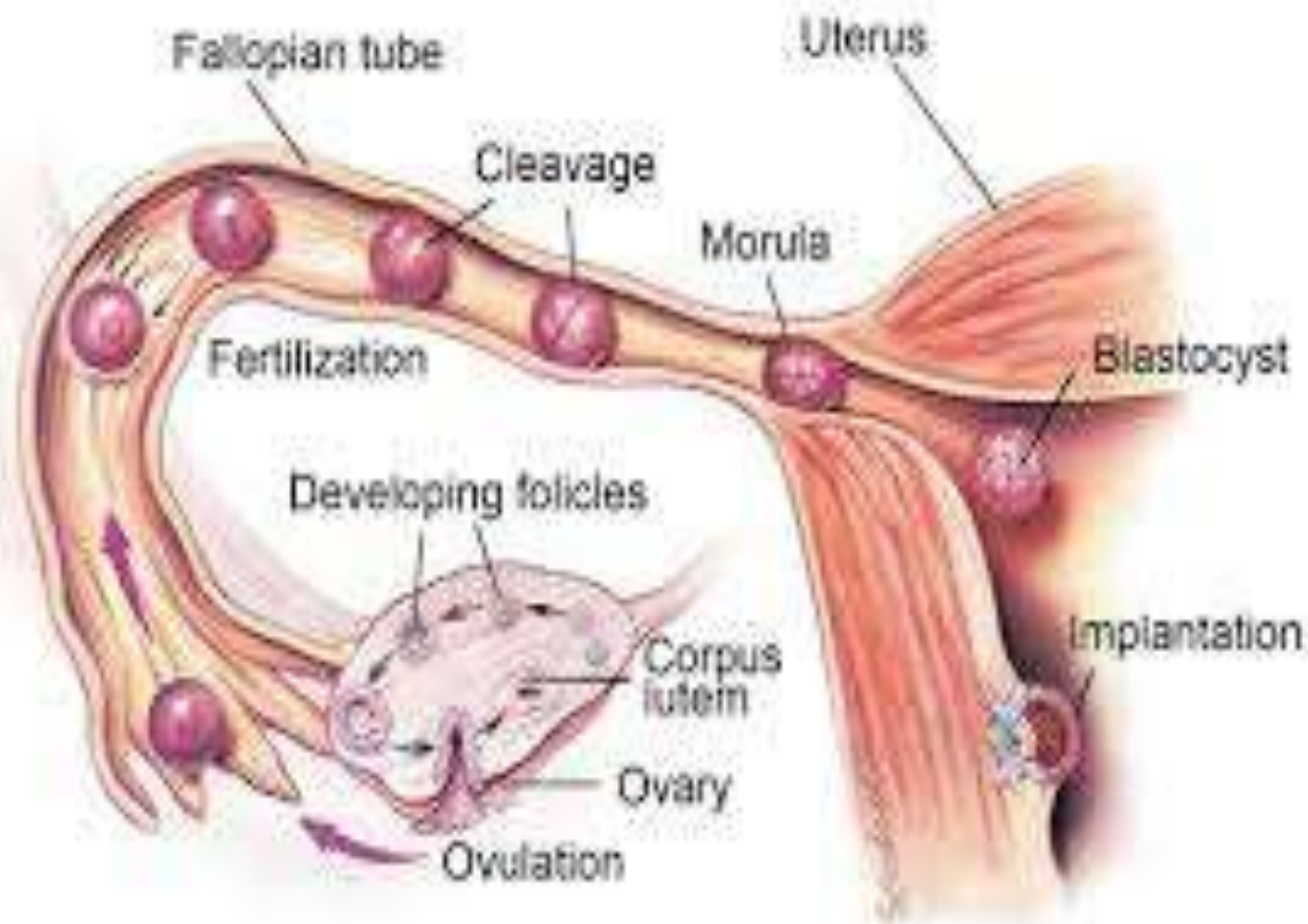
fertilization

- as ovarian follicle is growing, oogonium within it undergoes maturation, it enlarges to form a primary oocyte.
- primary oocyte undergoes the first meiotic division to shed off the first polar body & become a secondary oocyte.
- at ovulation second meiotic division is in progress & a spindle has formed for separation of second polar body .

- At this stage , ovum enters infundibulum of uterine tube & passes into ampulla.
- **fertilization** of ovum occurs in ampulla of uterine tube ,
- out of a few hundred capacitated sperms ,which surround ovum ,only one pierces zona pellucida & enters the ovum.
- As spermatozoon enters ovum ,2<sup>nd</sup> meiotic division is completed.& second polar body is extruded.

- The nucleus of ovum becomes **female pronucleus**.
- the head of spermatozoon separates from middle piece and tail, transform into **male pronucleus**.
- soon pronuclei lose their nuclear membranes, & 23 chromosomes of female & male pronucleus mixed up to form 23 pairs.

- these 46 chromosomes undergo changes like those in a typical mitotic division leading to formation of an embryo having two cells(no one celled stage of embryo).
- middle piece & tail soon separate from head of sperm & degenerate.



# Some biochemical changes during fertilization

- glycoprotein of zona pellucida is responsible for induction of **acrosomal reaction**, the release of acrosomal enzymes helps the sperm to penetrate the zona.
- when spermatozoon comes in contact with oocyte, plasma membranes of the two cells fuse. this, probably occur at **receptor sites** that are specific for a species.
- both head & tail of spermatozoon enters cytoplasm of the ovum.

- Alterations taking place in plasma membrane of oocyte & in zona pellucida ensure that no other spermatozoon can enter the oocyte.
- zona pellucida is altered due to release of lysosomal enzymes by plasma membrane of oocyte( **zona reaction**)
- as soon as spermatozoon enters ovum it finishes 2<sup>nd</sup> meiotic division & second polar body is formed.



- entry of sperm lead to metabolic changes within ovum that facilitate its development into an embryo.
- each chromosome in male & female pronuclei is made up of only one chromatid,replication of DNA takes place to form a second chromatid in each chromosome.
- in cell division that follows each chromosomes split into two , meanwhile a spindle is formed&one chromosome of each pair moves to each end of the spindle.
- This leads to formation of two cells ,each having 46 chromosomes.

# Result of fertilization

- the diploid chromosome number (46) is restored.
- determination of sex takes place
- fertilized ovum begins to divide into several cells ( i.e undergo cleavage)

- the daughter cells are still surrounded by zona pellucida
- each daughter cell is much smaller than ovum
- the cells become smaller & smaller until they acquire the size of most cells of the body.

# applied

- **TEST TUBE BABIES ( IVF)**
- i.e babies are produced by technique of ( in vitro –outside body) i.e IVF.
- this technique is increasingly being used now a days in infertile couples.
- gonadotropins are administered to woman to stimulate growth of follicles in ovary ,and ovum is removed just before ovulation.

- ovum removed is placed in a suitable medium ,spermatozoa are added to medium .fertilization and early development of embryo takes place in this medium.this process is carefully monitored .
- When embryo is 8- celled stage it is put inside uterus, successful implantation takes place in about 20% of such trials.

- indications when done---
- absence of ovulation
- obstruction of uterine tube
- inadequate motility of spermatozoa
- no. of spermatozoa may be inadequate ( usually 2-5 ml of semen ejaculated, each ml has million spermatozoa, if count of spermatozoa is less than 20 million /ml,)

- **sex determination-sex** of child is determined at time of fertilization ,it is now clear that one chromosome of each of 23 pairs is derived from mother & other from father.