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DEPARTMENT: MEDICINE AND SURGERY

COURSE: EMBRYOLOGY

1.Discuss ovulation: Ovulation is the release of a secondary oocyte from the ovarian follicle.Few days before ovulation,under the influence of FSH and LH, the secondary follicle grows rapidly to a diameter of about 25mm to become mature vesicular/ mature secondary or Graafian follicle

-Coincident with final development *o*f the vesicular follicle, there is an abrupt increase in LH that causes;

1. the primary oocyte to complete meiosis I
2. and the follicle to enter the pre-ovulatory mature vesicular stage

Meiosis II is also initiated, but the secondary oocyte is arrested in metaphase approximately 3 hours before ovulation

In the meantime, the surface of the ovary begins to bulge locally, and at the apex, an avascular spot, the stigma, appears

2.Differentiate between meosis 1 and meosis 2

Meosis I	Meosis II
i.The 4 stages of meosis I are prophase I, metaphase I, anaphase I and telophase I.	The 4 stages of meosis II are prophase II, metaphase II, anaphase II and telophase II.
ii.In prophase I, synapsis, crossing over and chiasma formation occurs.	In prophase II, nuclear envelops dissolve, spindle fibers reform and synapsis is absent.
iii.During metaphase I, there is an alignment of 46 homologous duplicated chromosomes at the metaphase plate.	Here, there is an alignment of 23 duplicated chromosomes at the metaphase plate.
iv.During the anaphase I, there is a seperation of 46 homologous chromosomes fron each other and centromers do not split.	Here, there is seperation of 23 duplicated chromosomes to form 23 single chromosomes and centromers split.
v.In telophase I, there is formation of two secondary gametocytes (23 duplicated chromosomes, 2N)	In telophase II, formation of four gametes (23 single chromosimes,1N) occurs.

3.Discuss the stages involved in fertilization

Fertilization

- This is the union of the sperm and oocyte

- The usual site of fertilization is the ampulla of the uterine tube
- The fertilization process takes approximately 24 hours
- It is a sequence of coordinated events which include the following stages:

I Passage of a sperm through the corona radiata:

- For sperms to pass through the corona radiata, they must have been capacitated (removal of the glycoprotein coat and seminal plasma proteins from the plasma membrane that overlies the acrosomal region of the spermatozoa)

Note:

Only capacitated sperms can pass freely through the corona radiata

II. Penetration of the zona pellucida:

- The zona is a glycoprotein shell surrounding the egg that facilitates and maintains sperm binding and induces the acrosome reaction
- The intact acrosome of the sperm binds with a zona glycoprotein (ZP3/ zona protein 3) on the zona pellucida
- Release of acrosomal enzymes (acrosin) allows sperm to penetrate the zona pellucida, thereby coming in contact with the plasma membrane of the oocyte
- As soon as the head of a sperm comes in contact with the oocyte surface, the permeability of the zona pellucida changes
- When a sperm comes in contact with the oocyte surface, lysosomal enzymes are released from cortical granules lining the plasma membrane of the oocyte.

In turn, these enzymes alter properties of the zona pellucida to:

- ✓ prevent sperm penetration and
- ✓ inactivate binding sites for spermatozoa on the zona pellucida surface
- only one sperm seems to be able to penetrate the oocyte

III. Fusion of plasma membranes of the oocyte and sperm

- The plasma or cell membranes of the oocyte and sperm fuse and break down at the area of fusion
- The head and tail of the sperm enter the cytoplasm of the oocyte, but the sperm's plasma membrane remains behind

IV. Completion of the second meiotic division of oocyte and formation of female pronucleus

- Penetration of the oocyte by a sperm activates the oocyte into completing the second meiotic division and forming a mature oocyte and a second polar body
- The nucleus of the mature ovum/oocyte is now called the female pronucleus

V. Formation of the male pronucleus

- Within the cytoplasm of the oocyte, the nucleus of the sperm enlarges to form the male pronucleus and the tail of the sperm degenerates

Note

Since all sperm mitochondria degenerate, all mitochondria within the zygote are of maternal origin (i.e., all mitochondrial DNA is of maternal origin)

- Morphologically, the male and female pronuclei are indistinguishable
- The oocyte now contains 2 pronuclei, each having haploid number of chromosomes(23)
- The oocyte containing two haploid pronuclei is called an ootid

VI. The 2 pronuclei fuse into a single diploid aggregation of chromosomes, the ootid becomes a zygote

The chromosomes in the zygote become arranged on a cleavage spindle in preparation for cleavage of the zygote.

4.Differentiate between monozygotic twins and dizygotic twins

Monozygotic twins	Dizygotic twins
Are often called conjoined twins	Not seen as conjoined twins
Resemblance is similar	Resemlance is just like any other two siblings
Genetically identical	Genetically not identical
Twins are of the same sex	Twins may be of the same or different sexes
Form from single zygote	Form from two zygotes
Incidence is more common	Incidence is less common
Mostly diamniotic, monochorionic, with single placenta	Mostly have two amnions, two chorionsand two placentas.