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COURSE: EMBYROLOGY

LEVEL: 200

ASSIGNMENT

1) DISCUSS OVULATION

This is the release of a secondary oocyte from the ovarian follicle
In a few days before ovulation, under the influence of **FSH** and **LH**, the secondary follicle grows rapidly to a diameter of about 25 mm to become mature vesicular/ mature secondary or Graafian follicle
Coincident with final development of the vesicular follicle, there is an **abrupt increase in LH** that causes;

a) The primary oocyte to complete meiosis I

b) The follicle to enter the preovulatory 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

For the oocyte to be released, 2 events occur which are caused by LH surge:

a) it increases **collagenase activity**, resulting in **digestion of collagen fibers** (connective tissue) surrounding the follicle

b) Prostaglandin levels also increase in response to the LH surge and cause local muscular contractions in the ovarian wall

- Those contractions extrude the oocyte, which together with its surrounding follicular (granulosa) cells from the region of the cumulus oophorus,
- this causes **ovulation in which oocyte floats out of the ovary**
- Some of the cumulus oophorus cells then rearrange themselves around the zona pellucida to form the corona radiata

2) Differentiate between meiosis 1 and meiosis 2

Meiosis 1	Meiosis 2
There is formation of chiasma, crossing over occurs, and	There is no chiasma formation, no crossing over and synapsis

synapsis	occurrence
End products formation of two secondary gametocytes(23 duplicated chromosomes, 2N)	End product is formation of four gametes (23 single chromosomes, 1N)
Takes longer duration to complete	Takes a shorter duration to complete
At anaphase stage, during disjunction the centromeres do not split	At anaphase stage, during disjunction the centromeres split
Reduces the ploidy level from 2N to N (reduction)	Divides the remaining sets of chromosomes (division)

3) Discuss the stages of fertilization

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)

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

pellicida 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

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 twin and dizygotic twin

- a) Monozygotic twins have exactly identical DNA while dizygotic twins do not have identical DNA
- b) Monozygotic twin develop from a single fertilized egg that split while dizygotic twin develop from two different eggs fertilized by two different sperm cells.