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**COURSE: EMBRYOLOGY**

**1.**  **Ovulation** is the release of a mature oocyte from the ovarian follicle. It is triggered by a surge of **LH production**, which is coincident with the final development of the vesicular follicle. The LH surge along with estrogen appears to cause a cystic swelling or bulging on the surface of the ovary. A small avascular spot, the **stigma**, soon appear on this swelling. For the oocyte to be released, 2 events occur which are caused by LH surge;

1. Increase in collagenase activity, resulting in digestion of collagen fibres (connective tissues) surrounding the follicle.
2. Prostaglandin levels also increases in response to the LH surge and cause local muscular contractions in the ovarian wall

The stigma soon ruptures, expelling the secondary oocyte with the follicular fluid. The expelled secondary oocyte is surrounded by the **zona pellucida** and one or more layers of follicular cells from the **cumulus oophorus**, which are rearranged around the zona pellucida of the expelled secondary oocyte to give rise to **corona radiata.**

**2. Differences between meiosis 1 and meiosis 2**

1. In meiosis 1, homologous chromosomes separate, while in meiosis 2, sister chromatids separate
2. Meiosis 2 produces 4 haploid daughter cells, whereas meiosis 1 produces 2 diploid daughter cells
3. Genetic recombination (crossing over) only occurs in meiosis 1
4. In meiosis 1 at the anaphase 1, the centromeres don’t split whereas in meiosis 2 at the anaphase 2, the centromeres split

3. **Fertilization** is the union of the gametes (sperm & oocyte). The usual fertilization site is in the **ampulla of the uterine tube**. The fertilization process takes approximately 24hrs. The sequences of fertilization include;

1. **Passage of the sperm through the corona radiata:** For the sperm to pass through the corona radiata, they must have been capacitated (removal of the glycoprotein coat & seminal proteins from the plasma membrane that overlies the acrosomal region of the spermatozoa).
2. **Penetration of the zona pellicuda:** Passage of a sperm through the zona pellucida is the important phase in the initiation of fertilization. Binding sites (receptors) are present in the zona pellucida , which the acrosome of the sperm binds with and the acrosome releases a proteolytic enzyme, **acrosin** which dissolves or loosens the zona pellucida, thereby forming a path for the sperm to enter the oocyte. Once the sperm penetrates the zona pellucida, a **zona reaction**, a change in the properties of the zona pellucida, occurs that makes it impermeable to other sperms. Cortical granule sends signals zona pellucida to close binding sites(inactivation of binding sites) to prevent polyspermy.
3. **Fusion of cell membranes of the oocytes and sperm:** The plasma or cell membranes of the oocyte and sperm fuse and break down in the area of fusion. The head and tail of the sperm enter the cytoplasm of the oocyte, but the sperm’s cell membrane (plasma membrane) and mitochondria remain behind.
4. **Completion of second meiotic division of the oocyte and formation of the female pro-nucleus:** Penetration of the oocyte by a sperm activates the oocyte into completing the second meiotic division and forming a mature oocyte. The nucleus of the mature oocyte becomes the female pro-nucleus.
5. **Formation of the male pro-nucleus:**  Within the cytoplasm of the oocyte, the nucleus of the sperm enlarges to form the male pro-nucleus, and the tail of the sperm degenerates.
6. **Formation of the zygote:** Male & female pro-nuclei fuse together to form an **ootid**. The ootid becomes the **zygote**. The zygote is genetically unique because half of its chromosomes came from the mother and half from the father. The zygote conatins a new combination of chromosomes that is different from those in the cells of either of the parents.

**4.** Differences between monozygotic twins and dizygotic twins

1. Monozygotic twins originate from a single zygote or fertilized egg whereas dizygotic twins originate from two zygotes or fertilized eggs.
2. Most monozygotic twins share one placenta (fused placenta) and chorionic sac (the chorionic sacs are fused), whereas most dizygotic twins have their own separate placentas and two separate chorionic sacs.
3. Monozygotic twins occur as a result from the fertilization of one zygote, when the original zygote divides about 7-12 days into pregnancy. They are of the same sex, genetically identical, and very similar in physical appearance whereas dizygotic twins occur as a result from the fertilization of two oocytes, they develop from two zygotes and may be of the same sex or different sexes, genetically un-identical and very different physical appearance.
4. Monozygotic twins are called identical twins whereas dizygotic twins are called fraternal twins.