TIME FOR A QUICK REVIEW

Lesson I
OVERVIEW

1. **Oogenesis** – A long process starting in fetal life and ending when the last gamete is available.
2. **Post-natal phase** – Growth (increase in oocyte size) and maturation (acquisition of meiotic and developmental competence).
3. **Ovulation** – Follicular luteinization and release of the mature gamete for fertilization.
4. **Reproductive Cycle** – Active from puberty to menopause; in primates and humans, it stops due to ovarian reserve depletion.
5. **Oocyte Origin** – Derived from primordial germ cells (PGCs), which proliferate mitotically during fetal life.
6. **Meiosis and Arrest** – Oocytes enter meiosis but arrest at the diplotene stage until a resumption signal is received.
7. **Reproductive Biotechnologies** – ART has led to successes, but in vitro oocyte growth remains a challenge.
8. **Fertility Preservation** – Ovarian transplantation or in vitro folliculogenesis to preserve fertility, especially for cancer patients.
9. **IVM/IVF Efficiency** – High in some species (mice, sheep), but low in others (dogs, pigs, humans).
10. **Developmental Competence** – Not all mature oocytes support embryonic development; cytoplasmic quality is crucial.

Lesson II
POST-NATAL OOGENESIS – structural modification of the cytoplasm

1. **Post-natal oogenesis** – Involves two phases: growth and maturation.
2. **Oocyte growth phase** – Structural and biochemical modifications occur in the cytoplasm and nucleus.
3. **Cell size increase** – Oocyte diameter expands sixfold, while volume increases 200 times.
4. **Mitochondria** – Increase in number, relocate to the periphery, and enhance metabolic activity.
5. **Golgi apparatus** – Transforms from a compact structure to an active form with vacuoles and lipid vesicles.
6. **Zona Pellucida (ZP)** – A glycoprotein envelope formed late in post-natal oogenesis, growing up to 10-12 µm thick.
7. **ZP functions** – Protects the oocyte, regulates molecular diffusion, and facilitates sperm recognition.
8. **Gap junctions** – Enable metabolic exchange between somatic cells and the oocyte, ensuring its survival.
9. **LH signaling** – The oocyte lacks LH receptors; cumulus cells mediate LH signaling to trigger meiosis.
10. **Cortical granules (CG)** – Lysosome-like organelles migrate to the oocyte membrane and regulate ZP structure.
11. **CG exocytosis** – Blocks polyspermy but is less efficient under IVF conditions due to sperm overload.
12. **Premature CG release** – In vitro manipulation can trigger early CG exocytosis, compromising fertilization.

Lesson II

POST-NATAL OOGENESIS – structural modification of the nucleus

1. **Oocyte Nuclear Structure review:** Nucleolus, nucleoplasm, nuclear envelope, nuclear pores

2. Structural Modifications of the nucleus during the growth phase:

•Increase in Oocyte Diameter

•Nuclear Translocation Toward Ooplasm Periphery

•Chromatin Remodeling During Growth Phase

3. Chromatin Configuration in Oocyte Maturation

•**Immature Oocytes**: Interdispersed chromatin.

•**Mature Oocytes**: Condensed chromatin.

4. Way to visualize Chromatin configuration: **Chromatin Staining Techniques**

- **Optical dyes (e.g. Lacmoid)**
  - Low-cost, simple microscopy.
  - Provides cytoplasmic and nuclear membrane integrity information.
  - Lower DNA affinity than fluorescent dyes.

•**Fluorescent Dyes (e.g., DAPI, Hoescht, Sybr Green)**:

- High-cost, requires advanced microscopy.
- Higher DNA affinity.
- Used for live cell analysis (supravital staining).

Lesson II

POST-NATAL OOGENESIS – structural modification of the nucleus

5. Chromatin Configuration as a marker of Developmental potential

•NSN (Non-Surrounded Nucleolus) Configuration: Immature oocytes.

•SN (Surrounded Nucleolus) Configuration: Maturing oocytes.

6. Oocyte Maturation & Transcriptional Block

•**Purpose of Transcription Inhibition**:

- Allows accumulation of necessary cellular resources.
- Maintains genetic stability and prevents errors during meiosis.

7. Monitoring Transcriptional Block:

- Fluorescent BrdU (Bromodeoxyuridine) labeling.