TIME FOR A QUICK REVIEW

Lesson IV
BIOCHEMICAL MODIFICATION OF THE CYTOPLASM

1. RNA Accumulation and Function
- Messenger RNA (mRNA), ribosomal RNA (rRNA), and transfer RNA (tRNA)
- Polyadenylation of mRNA and its roles (stability, transport, translation)
- Utilization of stored RNA in early post-fertilization stages

2. Transition from Oocyte to Mature Gamete
- Conclusion of RNA synthesis at the end of the growth phase
- Oocyte activation and transition to the zygote
- Assembly of the new embryonic genome

3. Protein Accumulation and Localization and Meiotic Competence
- Role of cell cycle proteins in oocyte development (e.g., Cyclins, CDC25)
- Sequestration and translocation of key proteins for meiotic resumption

4. Meiotic Quiescence and Resumption
- Inhibitory factors in follicular fluid
- Hormonal stimulation and cell cycle activation

5. Growth and Maturation Timelines in Different Mammals
- Differences between rodents, pigs, and larger mammals

Lesson Va

BIOCHEMICAL MODIFICATION OF THE NUCLEUS

1. Epigenetic remodelling of chromatin and fuctional endpoints

- Global genome silencing before fertilization
- Gene imprinting and permanent gene expression suppression

2. Epigenetic Marks and Chromatin Regulation

•Role of **writers**, **erasers**, and **readers** in modifying chromatin

3. Global DNA Methylation in Oogenesis

•Timeline of DNA methylation during follicular development
•Methods for assessing DNA methylation (immunofluorescence with 5-methylcytosine antibody)
•Correlation between chromatin configuration changes and transcription suppression

4. CpG Island Methylation and Genomic Imprinting

•For the establishment of **germline differentially methylated regions (gDMRs)**
•Genomic imprinting: parental-specific gene expression (approx. 100 genes in humans)
•Examples of paternally imprinted genes (maternally expressed) and maternally imprinted (paternally expressed).

•5. Methods for Detecting DNA Methylation

•**Bisulfite mutagenesis:** conversion of unmethylated cytosine into uracil
•**First and second-generation sequencing (Sanger, NGS)** for methylation analysis
•**Third-generation sequencing (Nanopore technology)**: real-time detection of DNA methylation

UNIT II – Lesson Vb

1. Role of Imprinted Genes in Mammals
•Regulate the synthesis of proteins involved in embryonic and fetal growth
•Influence parental behavior (lactation, mother-child interaction)

2. Methylation of Imprinted Genes
•Occurs during gametogenesis and remains stable

3. ART and Genetic Imprinting
•ART can alter genetic imprinting, increasing the risk of rare diseases in newborns
•Epidemiological studies suggest a higher risk of imprinting disorders in children conceived via IVF and ICSI

4. First Experiment on the Function of Imprinted Genes (Surani, 1984)
•Creation of uniparental embryos (androgenetic and gynogenetic)
•Results: abnormal development, proving that both parental genomes are necessary
•Maternal genes are crucial for embryonic development, while paternal genes are essential for extraembryonic tissues

5. Telomerase Activity and Embryonic Development
•Telomerase maintains telomere length, ensuring proper cell division and stability
•Its activity is tightly modulated also according to its subcellular localization