Master in Genetics and Molecular Biology

Program of the course **"Gene expression regulation in Eukaryotes" (GERE)**
Module I (6 CFU) e Module II (6 CFU)
Prof Mariangela Morlando
aa. 2025-26

1. **Complexity of Genomes**

2. **Chromatin and Transcriptional Regulation**
   - Histone modifications and modifying and remodeling complexes
   - DNA methylation
   - Mechanisms of transcriptional regulation

3. **Transcription Termination**

4. **mRNA Maturation: Capping, Splicing, and Polyadenylation**

5. **Alternative Splicing and Polyadenylation as Regulatory Mechanisms of Gene Expression**

6. **The RNA Processing and Degradation Machinery**
   - The exosome complex
   - The TRAMP complex

7. **Non-coding RNAs in Gene Expression Regulation**
   - RNA interference
   - microRNAs and piwiRNAs
   - Long non-coding RNAs
   - Circular RNAs

8. **Imprinting and X-chromosome Dosage Compensation**

9. **RNA Quality Control**
   - Pervasive transcription and its control
   - "Nonsense-mediated decay," "non-stop decay," and "no-go decay"

10. **RNA Export and Localization**

11. **mRNA turnover/Degradation**
    - Decapping complexes
    - Deadenylation complexes
    - "Processing bodies"

12. **mRNA Translational Control**

13. **RNA Modifications and Gene Expression Regulation**
    - "U-tail"
    - Chemical base modifications (m5C, m6A, Ψ)

14. **RNA Editing**

Methodologies

- Methodologies for nucleic acid quantification (Northern Blot, PCR, RT-PCR, qPCR).
- Methodologies for protein quantification (Western Blot),
- Immunoprecipitation, and fusion proteins.
- Study of protein/nucleic acid interactions (EMSA, RIP, CLIP, pull-down).
- Chromatin immunoprecipitation (ChIP).
- Yeast as a model system for eukaryotic functions.
- Cell cultures and their applications.
- Imaging
- Next-generation sequencing methodologies and data analysis.
- Methodologies for genomic editing.

Recommended textbooks

1. Jordanka Zlatanova Kensal E. van Holde **Biologia molecolare** Struttura e dinamica di genomi e proteomi Edizione italiana a cura di Vito De Pinto 2018
2. James D Watson Tania A Baker Stephen P Bell Alexander Gann Michael Levine Richard Losick **Biologia molecolare del gene** Ottava edizione italiana a cura di Paolo Plevani 2022

Didactic material available on the website https://elearning.uniroma1.it/