2021-2022

**The complexity of gene expression: Alternative routes from gene to protein**

**223.3028 – B.Sc**

**225.4412- M.Sc.**

 **Semester B**

**Instructor:** Dr. Martin Mikl, **Email:** MiklLabHaifa@gmail.com

**Office Hours:** by appointment

**Teaching Assistants & Office Hours:** None

**Course Level:** BA+MA

**Course Type & Format:** Elective,Seminar

**Number of Hours/Credits:** 3

**Prerequisites:** Biochemistry A+B, Molecular Biology, Genetics

**Course Overview (Short Abstract):** Gene expression is at the basis of most biological processes. This course will focus on the many different ways from DNA to protein that allow the cells to fine tune gene expression and create a variety of proteins from the same DNA sequence. This includes more or less well known phenomena such as: alternative transcription start sites, transcriptional bypassing, alternative splicing, alternative polyadenylation, stop codon readthrough, programmed ribosomal frameshifting, any many more. The course will start with an overview of canonical and non-canonical ways of gene expression and how to study them (three classes, given by the lecturer - English). In the rest of the course, each lecture will be dedicated to a specific gene regulatory mechanism. Students will present research papers and we will discuss the molecular mechanisms and biological functions of these unusual mechanisms (student presentations should be in English, but can also be in Hebrew if only Hebrew speakers are present). Students will also submit a review of the article they presented (2 pages, in English), highlighting the most important findings, the biggest shortcomings, and potential future research directions. This review, the presentation and active participation in the course will form the basis for the final grade.

**Learning Outcomes – At the end of the course students will be able to:**

1. Understand the strategies different species use to diversify and regulate the transcriptome and proteome
2. Understand alternative ways of gene expression on a mechanistic and functional level
3. Critically read and assess the scientific literature in the field
4. Apply the acquired concepts to their own research projects

**Assessment (Assessment Method and Grade Composition):**

Presentation in class – 40%

Written review of a research article – 30%

Active participation in class – 30%

**Week-by-Week Content and Assignments:**

|  |  |  |
| --- | --- | --- |
| **Week #** | **Topic** | **Assignment**  |
| 1 | Overview |  |
| 2 | Scientific Background |  |
| 3 | Relevant Research Methods |  |
| 4 | Alternative promoters |  |
| 5 | Alternative polyadenylation |  |
| 6 | Alternative splicing |  |
| 7 | RNA stability |  |
| 8 | RNA localization |  |
| 9 | RNA editing |  |
| 10 | Translational regulation |  |
| 11 | Translation initiation |  |
| 12 | Ribosomal frameshifting |  |
| 13 | Stop codon readthrough |  |
| 14 | Posttranslational processing |  |

**Website:** <https://mw11.haifa.ac.il/course/view.php?id=3204>

**Reading List:**

Two research articles per research topic will be read by the student and discussed in class each week.