

**General Information**  
**Advanced Proteins course 138039**  
**Winter 2023-24:**

**Lectures (start on Feb 19 or 26\*, 2024) Mondays 14:30-16:30 – Biology Computer Farm**  
**Labs April 30\*, 2024 to May 9\*, 2023 (\*see note below)**

**Teaching Staff:**

Instructors:

Dr. Oded Kleifeld [Biology 433-4, Tel 077-8871453 [okleifeld@technion.ac.il](mailto:okleifeld@technion.ac.il)]

For office hours and/or virtual office hours by Zoom please schedule appointment by e-mail.

Support:

Dr. Layla Saied [[saied.layla@technion.ac.il](mailto:saied.layla@technion.ac.il)]

TA:

Jonathan Ram [Jonathan.ram@campus.technion.ac.il](mailto:Jonathan.ram@campus.technion.ac.il)

Bader Rayan [badar.rayan@campus.technion.ac.il](mailto:badar.rayan@campus.technion.ac.il)

Noam Cohen [noam.cohen@campus.technion.ac.il](mailto:noam.cohen@campus.technion.ac.il)

**Prerequisites:**

Introduction to Biochemistry and Enzymology (134019), Molecular Biology (134082), Metabolic Pathways (134113), Biochemistry and Metabolism Lab (134114), Cell Biology (134128).

Students from other faculties or those who completed their undergraduate studies at another institute should seek approval from the instructors prior to registration. Please contact Oded at [okleifeld@technion.ac.il](mailto:okleifeld@technion.ac.il).

**Credits:**

5 points

**Location:**

Lectures: Biology Building Computer Farm

Labs: Biology Buildings (specific details will be provided before the course begins)

**Study Hours per Week/Semester:**

1. Lectures: 2 hours per week (starting on Feb 19 or 26, 2024, until the end of the semester). Note: The final notice regarding the first lecture date will be announced in advance.
2. Labs: The main part of the course will be held over a concentrated 2-week period, which might extend to 3 weeks due to various constraints. During this period, lectures, labs, and tutorials will be held from 9:00 to 18:00 daily (2-3 days may be longer). Students will be required to submit several tasks during this time. A detailed schedule will be sent later in the semester.
3. Home Assignments: Up to 4 home assignments will be given before and during the lab part of the course.

Note: The lab part schedule may change due to circumstances

### **Course Goals and Description:**

This course aims to bring students to a common understanding of protein biology, considering the diverse scientific backgrounds of Biology graduate students. It will cover classical and modern methods of protein purification, kinetic analysis, and structure-function analysis. Students will learn these methodologies through hands-on experience in purifying an enzyme from an easily available source. The course includes lectures, lab work, and bioinformatics tutorials. It is intended for first-year graduate students in biology. A maximum of 15 students will be accepted. The course will be held over a concentrated 10 days period, during which lectures, labs, and tutorials will be conducted full-day, every day.

### **Learning Outcomes:**

Upon successful completion of this course, students should be able to:

- Lyse, and extract proteins from cells.
- Concentrate protein solutions.
- Fractionate proteins based on specific properties (charge, MW, etc.).
- Purify proteins by affinity purification.
- Separate and analyze proteins by SDS-PAGE.
- Optionally: detect proteins by immunoblot (Western blots).
- Perform basic mass spectrometry-based proteomics procedures: in-gel digestion, in-solution digestion, sample desalting.
- Analyze data from low complexity proteomic experiments.
- Conduct kinetic analysis of enzymes, including measurement and calculation of kinetic parameters under different reaction conditions.
- Optionally: Assess protein thermostability with DSF.
- Perform basic protein crystallography procedures.
- Visualize, analyze, and generate images/information from published protein structural data.
- Use and analyze protein information using online databases and bioinformatics tools.

### **Course Content/Topics:**

The course will cover protein purification, enzyme kinetics, enzyme inhibition, multi-substrate assays, UV/VIS spectroscopy, ultrafiltration, precipitation approaches, low-pressure chromatography (ion-exchange, affinity columns, gel filtration), Immunoblot (optional), electrophoresis, basic mass spectrometry for protein identification, protein thermostability, protein interactions, crystallization, structure determination, and relevant bioinformatics.

### **Assignments and Grading Procedures:**

- Home Assignments (Prelab report, Protein databases and online tools, Protein structure analysis, Short presentation about Protein purification methods - possibly in pairs): 20%
- Student participation and evaluation: 30%
- Final Written Report: 30%
- Final Presentation/Assignment (Oral or via Zoom): 20%

Note: In case of significant changes in circumstances that will affect the course (e.g., Geopolitical state in Israel, Covid etc.), these proportions may change.

**Tentative Schedule for Lab Part:**

To be published later.

**Course Requirements & Policies:**

- Recommended Reading: "Protein Purification" by Robert K. Scopes, 3rd edition (accessible online via the Technion Library: [link]).
- Attendance in all classes and labs is mandatory. Classes will start on time, and late arrivals will not be admitted.
- Active participation is expected and will be graded.