



# *The Hebrew University of Jerusalem*

## *Syllabus*

### *Introduction to Technologies and Tools in Biomedical Research - 94874*

*Last update 19-03-2025*

*HU Credits: 4*

*Degree/Cycle: 2nd degree (Master)*

*Responsible Department: Bio-Medical Sciences*

*Academic year: 0*

*Semester: 2nd Semester*

*Teaching Languages: English*

*Campus: Ein Karem*

*Course/Module Coordinator: Prof Yael Stern-Bach  
Dr. Amalia Tabib*

*Coordinator Email: [yael.stern-bach@mail.huji.ac.il](mailto:yael.stern-bach@mail.huji.ac.il)*

*Coordinator Office Hours: scheduled by Email*

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Teaching Staff:

Dr. Shaya Lev,  
Dr. Ori Shalev,  
Prof. Yael Stern-Bach,  
Prof. Michael Berger,  
Prof. Ayal Ben-Zvi,  
Dr. Lior Nissim,  
Dr. Shai Sabbah,  
Dr. Hanan Schoffman,  
Mr. Yoel Yeretz Perez,  
Mr. Or Reuven,  
Mr. Meir Azagoury,  
Dr. Yariv Maron

Course/Module description:

*This will primarily be a training course for master student indented to open the first year of master in which the students will be introduced to various biomedical research approaches and tools. This will include introduction to instruments in the faculty core facility. Students will learn the theories of the approaches and their applications in research. While each student starts master studies with different backgrounds, they will be able to translate knowledge established during their bachelor's into practical methodologies for their master training. In addition, this course will include introduction to the faculty research infrastructure, overview of research approaches in their future labs and that of other groups in the faculty.*

Course/Module aims:

*To expose students to various scientific approaches, methods and instruments and their applications in biomedical research. Mastering both theories of the approaches and their applications in research.*

Learning outcomes - On successful completion of this module, students should be able to:

*To evaluate research questions with advance research approaches.  
To plan scientific system by using different research approaches.  
To know both theories and practical applications of each approach.  
All these will serve as future guidance for the student's future research.*

Attendance requirements(%):

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60%

*Teaching arrangement and method of instruction: Lectures, assignments and exercises.*

*Course/Module Content:*

*1. Imaging approaches and microscopy:*

- *Introduction:*

*Electromagnetic spectrum*

*The light wave characters: wavelength & energy, Amplitude, phase*

*Introduction to imaging infrastructure including light microscopy unit, EM unit, image analysis service, spectrophotometric and the imaging center for pre-clinical animal model (including PET/CT/MRI/ultrasound).*

- *Light microscope:*

*Bright field*

*Phase contrast*

- *Fluorescent microscope:*

*Fluorescent microscope*

*Confocal microscope*

*Time lapse microscopy*

*Super Resolution – STORM*

*Super Resolution – STED*

- *Electron Microscope:*

*Transmission Electron Microscope (TEM)*

*Scanning Electron Microscope (SEM)*

*2. Flow cytometry & FACS*

*Principle of operation: FACS components (laser, optics, flow, and types of detectors and their location).*

*Type signals received: Area, Width and Height.*

*Protocols, applications, analysis of results and presentation.*

*3. Molecular Biology*

- *Sequencing methods*

*Sanger, next generation sequencing*

- *Single cell technologies*

*Microfluidics (10X Genomics) etc.*

- *Amplification & quantitation methods*

*qPCR& PCR*

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LAMP

MDA & WGA

PCR, qPCR

- Gene manipulation

KD

shRNA, siRNA, miRNA

KO, KI

Classical, crispr

Induced KO – cre-loxp, ER

Crispr as a tool for Activation of genes.

- Epigenetics:

ChIP, Cut & run, Bisulfite, RRBS

- Genomics

Chromosome Conformation Capture- HiC, 4C, 3C

4. Proteins

Western blot

Co-IP

MassSpec

Required Reading:

1. Molecular Biology of The Cell, Alberts et al., 6th ed. 2014-
2. Essential Cell Biology, Alberts et al., 5nd Ed. 2019.
3. Molecular Cell Biology, Lodish et al, 8th Ed, 2016
4. Genes XI, Lewin, 2012

Additional Reading Material:

Grading Scheme:

Computerized Exam - At the cluster % 70

Submission assignments during the semester: Exercises / Essays / Audits / Reports / Forum / Simulation / others 30 %

Additional information:

Unjustified attendance of less than 60% will prevent taking the final exam.