האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

The Hebrew University of Jerusalem

Syllabus

Biology and medical uses of cellular release systems - 64637

Last update 07-03-2022

HU Credits: *2*

Degree/Cycle: *1st degree (Bachelor)*

Responsible Department: *School of Pharmacy*

Academic year: *0*

Semester: *2nd Semester*

Teaching Languages: *Hebrew*

Campus: *Ein Karem*

Course/Module Coordinator: *Regina Golan Gerstl*

Coordinator Email: *reginag@hadassah.org.il*

Coordinator Office Hours: *Monday: 13-14*

Teaching Staff:
Dr. Regina Golan

Course/Module description:
This course aims to provide the basic knowledge about cellular release systems) extracellular vesicles including exosomes(, and their macromolecules cargos: mRNA, microRNA(miRNA) and other non-coding RNAs. In this course we will focus on one of the cargos of the EVs: the miRNAs. One of the aims of the course is to familiarize students with biogenesis and regulation of miRNAs, their post-transcription regulation of gene expression. The course will introduce students to bioinformatic tools and databases for analysis of miRNs. The course will also address topics related to the clinical significance of miRNAs expression and their role as diagnostic markers.
This course will cover EV history, nomenclature, biogenesis, as well as the release and uptake mechanisms, collection and processing prior to isolation, different isolation methods, characterization and quantification techniques. We will focus on the collection and processing of cell culture media and body fluids such as blood, breast milk, cerebrospinal fluid and urine prior to isolation of EVs.
We will study the biological function of EVs, in development, diseases and interspecies and intraspecies communication. This course will cover the emerging and promising application of EV for diagnosis, therapeutic use and delivery system.

Course/Module aims:
To give the student knowledge about extracellular vesicles (EVs) and their cargo. To introduce and impart them knowledge about the emerging biomedical uses of the EVs as therapeutic diagnostics and delivery systems.

Learning outcomes - On successful completion of this module, students should be able to:
After a completed course you should be able to: Discuss the nomenclature and subgroups of extracellular vesicles. Describe the RNA, protein and lipid content of extracellular vesicles.
Describe the biogenesis of miRNAs and their regulation of genes expression. Understand the miRNA function in development and diseases.
Describe the basic concepts about the most common isolation and characterization techniques of EVs and how these techniques are used in the EV field. State the benefits and limitations of the most common isolation and characterization techniques for extracellular vesicles. Explain the considerations that are important during the collection and isolation of EVs from different body fluid.
Describe the release and uptake mechanisms of extracellular vesicles.
Describe the functions of EVs. Understand the cell-cells, intraspecies and

interspecies communication by EVs. Understand the impact of EVs and their cargos on biomedical uses as therapy, diagnostic markers and delivery systems. Describe the new biomedical use of EVs.

Attendance requirements(%):

Teaching arrangement and method of instruction: Lectures

Course/Module Content:

- MicroRNA(miRNA) and gene regulation. Introduction to the field of microRNA (miRNA). History of miRNA. MicroRNA Biogenesis and Regulation. Databases and platforms. MiRNA function: post-transcription regulation of gene expression.

-Role of miRNA in Diseases (Age-Related Diseases, Heart Disease, Neurological Diseases and Immune Function Disorders and Cancer. Tumor suppressive and oncogenic miRNAs, miRNA in liquid biopsies and circulation tumor cells.

-Potential miRNA Associated Products in Clinical Trials

-Introduction to the field of extracellular vehicles (EVs) including exosomes: nomenclature and the history of EVs.

- Biogenesis, release and uptake mechanisms of EVs.

-EVs isolation: collection and processing of cell culture media and body fluids such as blood, breastmilk, cerebrospinal fluid, and urine prior to isolation of EVs. Different isolation methods and characterization/quantification techniques for EVs (ultracentrifugation, size exclusion chromatography, density gradient, kit-based precipitation, electron microscopy, cryo-TEM, flow cytometry, nanoparticle tracking analysis).
- Extracellular vesicle composition. EV cargos : mRNA, miRNA, protein, lipids. Methodologies for Studying RNAs and Proteins within EVs.
- The EVs functions. The role of EVs in cell-cell communication. Role of exosomes in disease and development. Tracking and monitoring of EV in vivo.

- EV targeting to cells, EV as diagnostics, and their clinical application.
-EVs for delivery of RNA interference therapeutics.
-EVs as epigenetic regulators. Interspecies and intraspecies communication by EVs. Milk-derived exosomes as an example of epigenetic regulation between mothers

and their babies.

Required Reading:
No

Additional Reading Material:

Course/Module evaluation:
End of year written/oral examination 70 %
Presentation 0 %
Participation in Tutorials 0 %
Project work 0 %
Assignments 30 %
Reports 0 %
Research project 0 %
Quizzes 0 %
Other 0 %

Additional information: