

## *The Hebrew University of Jerusalem*

### *Syllabus*

## **ORGANIC CHEMISTRY FOR BIOLOGY STUDENTS - 69166**

*Last update 01-08-2023*

HU Credits: 5

Degree/Cycle: 1st degree (Bachelor)

Responsible Department: Chemistry

Academic year: 0

Semester: 2nd Semester

Teaching Languages: Hebrew

Campus: E. Safra

Course/Module Coordinator: Prof. Assaf Friedler

Coordinator Email: [assaf.friedler@mail.huji.ac.il](mailto:assaf.friedler@mail.huji.ac.il)

Coordinator Office Hours: contact by email to set a time

Teaching Staff:

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Prof Assaf Friedler,  
Mr. Shachar Bressler,  
Mr. Yonatan Sukhran,  
Ms. Dana Grunhaus

Course/Module description:

An introductory course in organic chemistry for biology and biology-related students. The course gives a comprehensive view of the field, starting from the basic principles and definitions in organic chemistry and focusing later on chemical reactions and their mechanisms. Biological aspects and view points are discussed as well.

Course/Module aims:

See Learning Outcomes.

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

To familiarize with basic concepts and fundamentals of organic chemistry, focusing on reaction mechanisms and stereo-chemistry.

To understand the role of organic chemistry in basic processes in the life sciences and in living organisms.

To solve questions similar to those dealt with in recitation classes and given in exams in previous years.

To differentiate between 2-D descriptions and 3-D projections, and to be able to transfer between different stereo-chemical descriptions of the same molecule.

Attendance requirements(%):

85%

Teaching arrangement and method of instruction: Lecture: 3 weekly hours, given in the spring semester (Canada Hall).

Recitation: 2 weekly hours. A weekly homework exercise will be published in the course website, to be followed by a solution published in the following week. The TA will solve the weekly exercise in the first hour of the weekly recitation class. Exercises are mandatory, but are not for handing-in, nor be graded.

Please note that recitation classes will be devoted for question solving and not for

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repeating the theoretical information given in the lectures, and thus attendance in both is highly important and recommended.

Course/Module Content:

1. Introduction (Bruice ch. 1):  
Rehearsal on basic concepts of general chemistry, which are important for the organic chemistry course: the atom, bonding, orbitals, steric structure of molecules, acids and bases.  
This part will NOT be given in lecture, but will be included in the first exercise.
2. Alkanes - intro to organic compounds, saturated hydrocarbons (ch. 2 and 9), nomenclature of organic compounds, how to depict reaction mechanisms.
3. Stereochemistry (ch. 5) - configuration and conformation, enantiomers, diastereomers, optical activity, chirality, Fischer/Newman projections and the transfer between them.
4. Alkyl-Halides (ch. 10-11) - nomenclature, substitution reactions (S<sub>N</sub>1, S<sub>N</sub>2), carbocations and their stability.
5. Alkenes (ch. 3-4): the double C=C bond, nomenclature, cis-trans isomerization, addition reactions of alkenes, elimination reactions (E1, E2), substitution vs. elimination.
6. Alcohols, Ethers and Thiols (ch. 12).
7. Resonance, dienes, Benzylic and Allylic (ch. 7-8).
8. Aromaticity, Benzene and its derivatives, aromatic electrophilic substitution (ch. 15-16).
9. The carbonyl group - aldehydes and ketones (ch. 18, parts of ch. 19-20): reduction-oxidation in organic compounds, nucleophilic addition, keto-enol tautomers, alpha-hydrogens acidity and alpha-hydrogen reactivity, aldol condensation.
10. Carboxylic Acids and their derivatives (ch. 17).
11. Amines (ch. 21): nomenclature, basicity, reactions.
12. Sugars (ch. 22, cyclohexane in ch. 2): conformations of cyclohexane, configurations and nomenclature of sugars, properties of sugars, isomerization in sugars, disaccharides and polysaccharides.
13. Amino acids, peptides and proteins (ch. 23 and biochemistry books): names and properties, the peptide bond, torsional angles, synthesis of peptides, secondary and tertiary structures of proteins.

Required Reading:

Organic Chemistry, 4th edition onwards, by Paula Yurkanis Bruice

Other good organic chemistry books are the books by Morrison and Boyd or by Ouellette.

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### Additional Reading Material:

*Please do not use Hebrew organic chemistry books and/or all kinds of summaries and unofficial translations.*

*It is highly important to familiarize with the English terminology, and in general to get acquainted with studies in scientific English.*

### Grading Scheme:

*Written / Oral / Practical Exam 90 %*

*Mid-terms exams 10 %*

### Additional information:

*Lecture summaries, exercises and solutions will appear in the course web site in the Moodle system.*

*The students should download and/or print them from the site by themselves - they will not be handed in in class.*

*Please note that the order of lectures in the course does not follow the book. The syllabus (above) contains detailed information about the relevant chapters in the book.*

*Models: the purchase of molecular models (in Academon store) is recommended, since they will help throughout the course. We recommend buying in groups to lower the costs.*

*Since the course is very dense, a few important tips are:*

*\* Please attend all lectures and don't try to study from the book alone. This will help you to focus according to the course demands.*

*\* Solving the exercises is of very high importance, in spite of the lack of handing-in requirements. Solve alone, check vs. the solution and ask your questions on time.*

*\* Don't postpone: the course is very loaded and crowded. History teaches us that lagging behind is very hard to compensate for.*

*\* Biology is the organic chemistry of biological molecules. All reactions in living cells are in essence organic chemistry. Therefore, if you want to know and understand biology - you must know the building blocks of organic chemistry. My best advice is, thus, to come open-minded and to be interested.*

*Important information: the components of final grade can still be changed before the beginning of the semester, and the midterm exam may be replaced by some homework assignments that may contribute a larger percentage to the final grade. we will update ASAP.*