

## General Information – Spring 2021

Food Chemistry, 064322

4<sup>th</sup> semester

Room 300

Thursdays, 9:30-12:30

### Teaching Staff:

Instructor: Prof. Ayelet Fishman, Room 412, [afishman@technion.ac.il](mailto:afishman@technion.ac.il)  
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Office Hours: By appointment

Prerequisites: Organic Chemistry, Biochemistry

Co-requisites: Laboratory in Food Chemistry and Biochemistry

Credits: 3 points

Study hours per week: 3 lecture hours, 3 preparatory hours, 3-4 semester assignments

### Course Goals and Description

The aim of this course is to present to students basic knowledge of food chemistry. The specific goals are:

- 1) To introduce the major chemical components of food, and their effect on the physical, chemical and nutritional aspects of food.
- 2) To understand the relationship between chemical structure and food physical, chemical and nutritional properties.
- 3) To understand key chemical reactions in foods and their mechanisms, and how this understanding can be used to control food quality and stability.
- 4) To recognize the influence of major food components on the physical structure and functional properties of foods.

The course is based on lectures, and an active discussion in class is welcomed. Students are expected to read the respective chapters in the text books, as well as specific papers that will be provided in the course website. An accompanying lab course will provide hands-on experience and better understanding of the theoretical topics delivered in class.

### Learning Outcomes

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

1. Describe, classify, and characterize the different lipids common in foods.
2. Describe, classify, and characterize the different carbohydrates in foods.
3. Correlate the structure of lipids with their influence on food structure, shelf life stability, and nutritional attributes.
4. Correlate the structure and type of carbohydrates with their influence on food structure, shelf life stability, and nutritional attributes.
5. Describe the chemical reactions and mechanisms involving lipids: hydrolysis, hydrogenation, transesterification, oxidation, and deduce conditions for controlling them.
6. Describe the chemical reactions involving carbohydrates: mutarotation, isomerization, polymerization, hydrolysis, oxidation, reduction, and deduce conditions for controlling them.
7. Describe the browning reactions common in foods and assess methods for controlling them.
8. Classify antioxidants and describe their mechanisms for preventing oxidation in food.
9. Differentiate between amylases and describe their mechanism and uses in food production.
10. Describe the uses and importance of specific peptides in foods.
11. Correlate the structure of proteins from meat, wheat, and egg, with their functionality and their implication to food processing.
12. Discuss the importance and influence of water activity on chemical reactions in food and its implication to food stability.
13. Discuss the differences between food and food-supplements and review food - drug interactions: mechanisms and what can be done to overcome.
14. Read and explain professional articles in food chemistry and assess their results in view of the studied topics in the course.

### **Assignments and Grading Procedures**

Homework – 3-4 compulsory assignments during the semester, **10%** - submission will be through the Moodle.

Exams - final exam, **90%**

### **Course Schedule (Topics, Assignments, Exams)**

<b>Topic</b>	<b>Weeks</b>	<b>Content</b>	<b>Homework (12:30)*</b>
Introduction	1	Course objectives, historical background of food chemistry, organic chemistry recap, course requirements	
Lipids	1-3	Classification, physical and chemical properties of fatty acids and triglycerides, structure and	

		characteristics of phospholipids, cholesterol and eicosanoids.	
Chemical reactions of lipids	4-5	Lipolysis, hydrogenation, fractionation, interesterification, oxidation. Tailor made lipids. Oil processing in industry.	#1 29/4
Carotenoids	6	Structure, physical and chemical properties.	
Antioxidants	6-7	Classification, mechanism of action.	
Carbohydrates	7-9	Structure and function of monosaccharides, disaccharides, polysaccharides. Chemical reactions of carbohydrates. Structure and function of starch and cellulose. Enzymes in the starch industry. Sweeteners.	#2 20/5
Browning reactions	10-11	Mechanism in food and in the body (AGEs). Influence on food properties. Methods for prevention. Food and drug interactions.	#3 10/6
Peptides and proteins	12-13	Structure and function of amino acids and peptides relevant to food (e.g. monosodium glutamate, aspartame). Functional properties of proteins. Meat proteins. Color preservation in meat. Wheat and egg proteins and their functional properties.	#4 1/7

\* dates may change

Teaching days: 25/3, 8/4, 22/4, 29/4, 6/5, 13/5, 20/5, 27/5, 3/6, 10/6, 17/6, 24/6, 1/7

### Course Requirements & Course Policies

There will be homework assignments during the semester requiring the analysis of articles on specific topics studied in class, application of reactions described in the course in other contexts relating food research, etc. Homework will be checked and graded. Correct answers will be discussed in class or posted on the website. Failure to hand homework on time will result in "0" on the assignment. Copying is forbidden. Assignments that are identical will be graded as "0" and marked as "copied" and will result in 20 points deduction from the final grade. You can work together, consult with each other, but must write your own assignment. Attendance in the course is encouraged but not a prerequisite. Usage of any former slides, notes, or printed material is at your own risk and is not recommended. Slides and other materials change from year to year especially this year with a new teacher.

### Text book(s) and/or other materials

#### Required text:

- Food: The chemistry of its components, Coultate, T.P. 2009, 5th Ed., RCS Publishing, Cambridge, UK
- Food Chemistry, Fennema, O.R. 2005, 4th Ed. Marcel Dekker Inc., NY.

#### Background readings:

- Lawrence G.D. "The fats of life" Rutgers Univ. Press, 2010.
- Belitz, H.D. & Grisch W. "Food Chemistry" Springer, Heidelberg 2004.
- Mathews C. K., Van Holde R. E. & Ahern K. G. "Biochemistry" Addison-Wesley Publishing, San – Francisco, 2000.

### **Academic Integrity**

Any work submitted by a student in this course for academic credit will be the student's own work.

You are encouraged to study together and to discuss information and concepts covered in the lecture with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else.

During examinations, you must do your own work. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.