

SUBJECT GUIDE

**FOOD CHEMISTRY AND BIOCHEMISTRY**

| MODULE                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | CONTENT                         | YEAR | TERM                                                                                                                                                                                                                                                                                                                                                                                                                            | CREDITS | TYPE              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------|
| Food Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Food Chemistry and Biochemistry | 2nd  | 1st                                                                                                                                                                                                                                                                                                                                                                                                                             | 6.0     | Mandatory subject |
| <b>LECTURER(S)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                 |      | <b>Postal address, telephone n°, e-mail address</b>                                                                                                                                                                                                                                                                                                                                                                             |         |                   |
| <ul style="list-style-type: none"> <li>• Concepción Aguilera García</li> <li>• Ángel Gil Hernández</li> <li>• Miguel Navarro Alarcón</li> </ul>                                                                                                                                                                                                                                                                                                                                   |                                 |      | Department of Biochemistry and Molecular Biology II; Faculty of Pharmacy, Campus Universitario de Cartuja s/n, University of Granada<br>email: <a href="mailto:agil@ugr.es">agil@ugr.es</a> and <a href="mailto:caguiler@ugr.es">caguiler@ugr.es</a><br><br>Department of Nutrition and Food Science, 3rd floor, School of Pharmacy.<br>Phone number: 958 249766<br>email: <a href="mailto:nalarcon@ugr.es">nalarcon@ugr.es</a> |         |                   |
| <b>DEGREE WITHIN WHICH THE SUBJECT IS TAUGHT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                 |      |                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |                   |
| Food Science and Technology                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                 |      |                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |                   |
| <b>PREREQUISITES and/or RECOMMENDATIONS (if necessary)</b>                                                                                                                                                                                                                                                                                                                                                                                                                        |                                 |      |                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |                   |
| Having studied the subjects of General Chemistry, Biochemistry, Applied Physics and Physical Chemistry, and Microbiology                                                                                                                                                                                                                                                                                                                                                          |                                 |      |                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |                   |
| <b>BRIEF ACCOUNT OF THE SUBJECT PROGRAMME (ACCORDING TO THE DEGREE¿??)</b>                                                                                                                                                                                                                                                                                                                                                                                                        |                                 |      |                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |                   |
| <ul style="list-style-type: none"> <li>• Chemical and biochemical fundamentals in food science.</li> <li>• Chemical properties of foods.</li> <li>• Changes in food (chemical and biochemical alterations).</li> <li>• Classification, definition, functions, and the legislative criteria for the use, safety and dosage of food additives</li> </ul>                                                                                                                            |                                 |      |                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |                   |
| <b>GENERAL AND PARTICULAR ABILITIES</b>                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                 |      |                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |                   |
| <ul style="list-style-type: none"> <li>• That students can apply their knowledge to their work or vocation professionally.</li> <li>• Ability to gather and interpret relevant data to make judgments.</li> <li>• Potential to communicate information, ideas, problems and solutions to a specialized and unskilled audience.</li> <li>• To understand and improve the user des-level in the field of ICT.</li> <li>• Ability to express oneself correctly in Spanish</li> </ul> |                                 |      |                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |                   |



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- Troubleshooting.
- Teamwork
- Ability to apply theoretical knowledge to practice.
- Capacity for analysis and synthesis
- Critical thinking.
- Develop skills of research initiation.
- Motivation for quality.
- Ability to organize and plan.
- Ability to manage information.
- Sensitivity to environmental issues.
- To know models of food production, composition and physical, physico-chemical and chemical properties, to determine its nutritional value and functionality
- Learning of the analytical techniques and food analysis to ensure optimal conditions for human consumption.
- Understanding and appreciation that food is one of the cornerstones of the cultural identity of a society.
- To inform, educate and advise legal, scientific and technically public administration, the food industry and consumers to design intervention strategies and training in the field of science and food technology.

#### **OBJECTIVES (EXPRESSED IN TERMS OF EXPECTED RESULTS OF THE TEACHING PROGRAMME)**

- Properly handling of raw and processed products to minimize and/or prevent chemical and biochemical changes.
- Acquiring the ability to describe and explain the changes in food due to the processes of production, conservation and deterioration.
- Appropriate use of additives according to food law.

#### **DETAILED SUBJECT SYLLABUS**

##### **THEORETICAL PROGRAM**

1. INTRODUCTION TO THE STUDY OF CHEMISTRY AND BIOCHEMISTRY OF FOODS. Concept and objectives of the Chemistry and Biochemistry of foods. Evolution and historical development. Relations with other sciences. Frontiers and prospects of Chemistry and Biochemistry of foods. Literature.
2. THE WATER FROM THE FOOD. Structure and properties. Water activity: bound water and free water. Sorption isotherms. Hysteresis. Influence of the composition and physical state of a food on the activity of water in foods. Influence the water activity in the food stability.
3. GENERAL PROPERTIES OF THE PROTEIN SYSTEMS OF FOODS. General properties. Protein denaturation. Effect of physical and chemical agents on food proteins. Functional properties of proteins in food systems: solubility, hydration, viscosity, gelling texturizing, emulsifying, foam formation and fixing of substances responsible for flavor.
4. STRUCTURE AND PROPERTIES OF THE MAIN PROTEIN SYSTEMS. Meat proteins. Fish protein. Egg proteins. Milk proteins. Cereal proteins. Proteins of legumes.
5. FOOD LIPIDS. Molecular structure and functions of food lipids. Crystallization of the fats. Physical properties of fats. Emulsifying power of fats: structure of the emulsifier fats and emulsifying additives of lipid nature. Food emulsions: structure, stability and causes of destabilization. Modified fats: hydrogenation, inter- and intra-esterification processes and structured fats. Distribution of lipids in major food systems: meat, fish, milk, egg, milk and vegetables. Composition of fat and oil in foods of animal and vegetable origin.
6. FOOD ADDITIVES: overview, definition of additive and processing aid. Classification, definition and functions of different types of food additives. Legislative criteria of use, safety and dosing guidelines.
7. FOOD ADDITIVES AND PROCESSING AIDS. Preservatives. Acidifying agents. Gasifying of bread dough. Use of buffers. Use of bases. Use of phosphates as moisturizers in muscular systems. Use of molten salts for homogenization of dairy products. Minor additives and ingredients used in bakery. Hardening agents. Release



and anti-caking agents. Clarifying agents. Propellant gases.

8. DYES. Natural dyes: chlorophylls, carotenoids, anthocyanins, betalains and others. Artificial dyes: classification. Azo dyes. Triphenylmethane dyes derivatives. Indigo and its derivatives.

9. THE TASTE OF FOOD: primary flavors of food. Relationship between chemical structure and taste of food. Sapid structures more characteristics of certain flavors of foods.

10. THE AROMA OF FOODS. Relationship between structure and function of food flavorings. Primary flavors of foods. Theory lace-receptor coupling. Influence of different constituents in the aroma. Threshold as a matter of perception and flavor impact. Main biosynthetic pathways of the natural flavors of food. Generation of flavor in fermented foods. Flavor generation by the food processing.

11. MONOSACCHARIDES, DISACCHARIDES AND DERIVATIVES. Structure and function of carbohydrates in food. Monosaccharides and disaccharides of food. Functional properties of monosaccharides and disaccharides. In food. Sweetening power of monosaccharides and disaccharides. Food sweeteners: relationship between sweet taste and chemical structure. Sweetening power. Inverted syrups. Sweetener additives. Intense sweeteners and polyols: types, structure, characteristics and applications.

12. POLYSACCHARIDES: STARCH. Structure. Conversion of starch into glucose. Starch oligosaccharides. Dextrins. Cidoamiloses. Starch derivatives. Modified starches: type, collection, structure, properties and applications. Biophysical and biochemical changes that occur during thermal and chemical gelatinization of starches.

13. POLYSACCHARIDES: CELLULOSE AND DERIVATIVES. Cellulose. Hemicelluloses. Cellulose derivatives.

14. POLYSACCHARIDES: GUMS. Pectins. Plant exudates gums: Arabic gum and tragacanth gum. Seed gums: guar gum and locust bean gum. Seaweed gums: alginates, carrageenans and agar-agar. Bacterial gums: xanthan gum.

15. MINERALS. Introduction. Principles of chemistry of minerals: concept of speciation, solubility in aqueous systems, and minerals and acid-base chemistry. Mineral composition of food: influencing factors and supplementation. Bioavailability of minerals: concept, influencing factors and assessment methods. Nutritional use of minerals. Specific bioavailability characteristic elements. Effects of processing on mineral content of foods. Chemical and functional properties of minerals in foods.

16. VITAMINS. Distribution of vitamins in food. Influence of type of food and maturing on the vitamin content of food. Influence of different technological processes and cooking on the vitamin content of foods. Bioavailability of vitamins. Adding vitamins to foods. Main food market supplemented.

17. INTRODUCTION TO THE ENZYMOLOGY OF FOOD. Introduction. Food enzymes of interest: carbohydrate hydrolases, lipases, proteases. Other enzymes of interest in food: isomerases, oxidoreductases, lyases and ligases.

18. ALTERATIONS OF FOOD. Overview.

19. OXIDATION OF LIPIDS: INTRODUCTION. General classification of oxidative pathways of food. Mechanisms of chemical oxidation of foodstuffs. Regulatory factors and preventing of the chemical oxidation. Other lipid oxidative pathways. Evaluation of the oxidation of a fat. Frying process. Causes that affect the average life of frying oils and maintenance of quality. Parameters for assessing the quality of a frying fat.

20. ENZYMATIC BROWNING. Introduction. Polyphenol-oxidases. Monophenol-oxidases. Diphenol-oxidases. Substrates. Mechanisms of action. Inhibitors.

21. NON-ENZYMATIC BROWNING: mechanisms, regulatory factors and prevention.

### **THEORETICAL PROGRAM**

1. SEMINARS / WORKSHOPS. Exhibition of works by students on additives. Seminar on functional foods.
2. LABORATORY PRACTICE
  - 2.1. Practice 1. Assessing the quality of a meat product
    - Determination of its total fat content as well as its chromatographic profile.
    - Determination of its total protein content.
    - Measurement of its collagen levels.



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- 2.2.- Practice 2. Determination of polyphenoloxidase activity in fruit mesocarp  
2.3.- Practice 3. Enzymatic determination of lactose in milk.  
2.4.- Practice 4. Determining of the concentration of lactate in meat

#### **READING**

#### **KEY LITERATURE**

- Introducción a la bioquímica de los alimentos. J. B. S. Braverman. Omega., S. A. Barcelona, 1980.
- Proteínas alimentarias. Bioquímica. Propiedades funcionales. Valor nutritivo. Modificaciones químicas. J. C. Cheftel, J. L. Cuq y D. Lorient. Acribia, S. A. Zaragoza, 1989.
- Biochemistry of food. Eskin, 1990.
- Manual de bioquímica de los alimentos. C. Alais y G. Linden. Masson, S. A. Barcelona, 1990.
- Química de los alimentos: mecanismos y teoría..D. W.S. Wong. Acribia, S. A. Zaragoza, 1995.
- Química de los alimentos, 4ª edn. H. D. Belitz y W. Grosch. Acribia, S. A. Zaragoza, 1997.
- Manual de química y bioquímica de los alimentos, 3ª edn. T. P. Coultate. Acribia, S.A. Zaragoza, 1998.
- Bioquímica y valor nutritivo de los alimentos. D. S. Robinson. Acribia, S. A. Zaragoza, 2000.
- Química de los alimentos, 2ª edn. O. R. Fennema. Acribia, S. A. Zaragoza, 2000.
- Introducción a la bioquímica y tecnología de los alimentos, vol. I, 4ª edn. J. C. Cheftel y H. Cheftel. Acribia, S. A. Zaragoza, 2000.
- Mataix Verdu J. (2002). Nutrición y alimentación humana (2 tomos). Ed. Ergon. Madrid.
- Tratado de nutrición: tomo I (Bases fisiológicas y bioquímicas de la nutrición) y tomo II (Composición y calidad nutritiva de los alimentos). GIL, A. Editorial Acción Médica. Madrid, 2005.
- Química de los alimentos, 4ª edición. Baduí Dergal, S. Editorial Pearson, México, 2006
- Química de los alimentos, 5ª edn. W. Baltes. Acribia S.A. Zaragoza 2007.
- Food Chemistry , 4th revised and extended revision. H. D. Belitz, W. Grosch, P. Schieberle. Springer-Verlag, Leipzig, 2009.
- Composición y calidad nutritiva de los alimentos. Tomo II. (2010). Gil, A, editor. Tratado de Nutrición, 2ª edición. Ed. Médica Panamericana. Madrid.

#### **ADDITIONAL LITERATURE**

- Aditivos y auxiliares de fabricación en las industrias agroalimentarias, 2ª Edición. Multon, J. L. Editorial Acribia, S. A. Zaragoza 1999.
- Toxicología alimentaria. Camean, A.M.; Repetto, M. Editorial Díaz de Santos, Madrid, 2006.
- Bases de la alimentación humana. Rdriguez River, V.M., y Simón Magro, E. Netbiblo, S.L. La Coruña, 2008.



- Nutrición y alimentación. Mataix, J. Editorial Ergon. Majadahonda (Madrid), 2009.
- Bases fisiológicas y bioquímicas de la nutrición. Tomo I. (2010). Gil, A, editor. Tratado de Nutrición, 2ª edición. Ed. Médica Panamericana. Madrid.

#### RECOMMENDED INTERNET LINKS

- <http://www.nutricion.com>
- <http://www.laisla.com/uned/unitaria/com>
- <http://www.biosearchlife.es/pb/home.jsp#>
- <http://www.pulevasalud.com/ps/index.jsp>
- <http://www.puleva.es/pf/index.html>
- <http://www.nestle.es/web/index.asp>
- <http://www.AESAN>
- <http://www.senba.es/> (libros editados, recursos didácticos en red, otras web de interés)
- <http://seenweb.org/>
- <http://www.pulevasalud.com/ps/index.jsp>
- <http://www.puleva.es/pf/index.html>
- <http://www.EFSA>
- [http://sauwok.fecyt.es/apps/WOS\\_GeneralSearch\\_input.do?product=WOS&search\\_mode=GeneralSearch&SID=X2Fhelp7LEe9D3lg6pJ&preferencesSaved](http://sauwok.fecyt.es/apps/WOS_GeneralSearch_input.do?product=WOS&search_mode=GeneralSearch&SID=X2Fhelp7LEe9D3lg6pJ&preferencesSaved)



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