

Academic year	2016-17
Subject	11255 - Bioactive and Functional Components of Food
Group	Group 1, 1S
Teaching guide	A
Language	English

## Subject identification

<b>Subject</b>	11255 - Bioactive and Functional Components of Food
<b>Credits</b>	0.6 de presencials (15 hours) 2.4 de no presencials (60 hours) 3 de totals (75 hours).
<b>Group</b>	Group 1, 1S (Campus Extens)
<b>Teaching period</b>	First semester
<b>Teaching language</b>	Spanish

## Professors

Lecturers	Horari d'atenció als alumnes					
	Starting time	Finishing time	Day	Start date	Finish date	Office
Joan Ribot Riutort <a href="mailto:joan.ribot@uib.es">joan.ribot@uib.es</a>	12:00	14:00	Friday	01/09/2016	17/07/2017	Despacho Q-31 (Edificio Mateu Orfila) - Room Q-31 (Building Mateu Orfila)

## Contextualisation

This subject is part of module 1 "Fundamentals in Nutrigenomics and Personalised Nutrition", being one of the basic subjects who gives the basic knowledge useful for the development and understanding of other, more specialized, specific subjects of the Master. The main objectives of the subject are:

- \* Be aware of the biochemical and molecular characteristics of nutrients and other food compounds in foods.
- \* Be aware of the methods of analysis for the determination and quantification of nutrients and other food compounds in foods.
- \* Document the amount and bioavailability of nutrients and other compounds in foods.
- \* Document the effects of the main bioactive compounds that determine the functional properties of food in humans.
- \* Perform and evaluate a risk / benefit of the main bioactive and functional compounds of foods.

Lectures:

- \* Dr. Joan Ribot is PhD in Biochemistry, specialist in Clinical Biochemistry and associate professor of the University of the Balearic Islands; with 3 six-year research experience stretches recognized by the Spanish Government and eighteen years of teaching experience at the University. He is also an active researcher; at present, her research is focused in the field of gene-nutrient/food compounds interactions and the relationship of nutrients and early nutritional interventions with the prevention of metabolic disorders associated to energy control, obesity and associated disorders, including atherosclerosis and Cancer. He has participated in numerous international cooperative research projects.

## Requirements

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There are no previous requirements.

### Skills

The skills of the Master related to this subject are given below.

#### Specific

- \* E4 - Knowing the main functional and bioactive components of the foods.

#### Generic

- \* G6 – Capacity for working in an interdisciplinary way.
- \* G8 - Ability to assess and participate in teamwork.
- \* G9 - Ability to collect, organize and critically analyze the literature (research and professional) of the discipline.
- \* G10 – Capacity to articulate the knowledge in oral and written presentations.
- \* G15 - Ability to analyze the risk / benefit balance of a new development (or innovation).
- \* CB8 - Students should be able to integrate knowledge and handle complexity, and formulate judgments based on information that was incomplete or limited, include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments.
- \* CB9 - To know how to communicate conclusions and knowledge and reason which support them to specialized and non-specialized audience clearly and without ambiguity.
- \* CB10 - Students should possess the learning skills to allow them to continue studying in a way that will have to be largely self-directed or autonomous.

#### Basic

- \* You may consult the basic competencies students will have to achieve by the end of the Master's degree at the following address: [http://estudis.uib.cat/master/comp\\_basiques/](http://estudis.uib.cat/master/comp_basiques/)

### Content

The contents of the subject are given below.

#### Theme content

##### Topic 1. Introduction

Definition of bioactive and functional compounds in foods. Essential nutrients (vitamins, minerals, fatty acids ,etc.), 'non-nutrients' and 'anti-nutrients'. Evidence of beneficial effects of bioactive compounds. Approaches to identifying bioactive compounds, and their limitations. Bioavailability of bioactive compounds. Balance between risk and benefit.

##### Topic 2. Major bioactive and functional components

Structure/subclasses. Food sources and main role in plants/animals/microorganisms. Ingestion. Absorption and bioavailability. Importance of the food matrix. Metabolic effects. Observational studies and beneficial/deleterious effects. Synergies. Farming practices to raise the content of bioactive components. Modification of nutritional profile of foods through biotechnology.

##### Topic 3. Bioactive and functional components of food

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Chemical and biological characterization of bioactive and functional components of food. Observational studies and beneficial/deleterious effects. Foods or extracts opposed to pure compounds.

## Teaching methodology

The programmed activities have the main objectives of allowing the students to get the basic and advanced knowledge in Bioactive and Functional Components of Food, with special emphasis in the analysis of the risk/benefit balance of food components. Moreover, the combination of the different activities to be done is also focused in allowing the students to take advantage, in a practical way, of the learnt concepts in the interpretation of scientific data and in the development of specific topics related to the subject.

It is important to note that the students have the possibility of 2 itineraries for assessment (Itinerary A or Itinerary B), and they must decide which itinerary to follow.

## Workload

The volum of work for every item of the subject is given below, taken itinerary A as reference.

## In-class work activities

Modality	Name	Typ. Grp.	Description	Hours
Theory classes	Lessons	Large group (G)	The objective is to know and understand basic and advanced concepts in Bioactive and Functional Components of Food.  Lessons in the classroom, with the explanation of the lecturer in an interactive way with the students (itinerary A).	5
Seminars and workshops	Activity 1: Debate	Medium group 2 (X)	The objective is to put in practice the theory concepts learnt in the subject by the interpretation of specific scientific bibliography and the elaboration of an consensus opinion based on scientific literature about the topic of interest.  A debate on a topic of interest, setting up two groups in favour/against and exposing the position by group spokesperson, overall discussing and writing a concluding remarks (itinerary A). Students who have not attended the debate, they must individually develop an opinion based on scientific literature about the debate subject. The written opinion must be delivered two weeks after the day of the debate. The students (itinerary B) must individually develop an opinion based on scientific literature about a controversial subject proposed by the lecturer, the day set for exam in February or July.	2
Seminars and workshops	Activity 2: Food characterization (Students' oral presentations)	Medium group 2 (X)	The objective is to put in practice the theory concepts learnt in the subject by the interpretation of specific scientific bibliography and articulate knowledge in a oral presentation.  The work that the students have prepared (individually) (about the chemical and biological characterization of bioactive and functional components of one food), must be defended by oral presentation accompanied with a slide presentation. For the	6

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Modality	Name	Typ. Grp.	Description	Hours
			oral defence, each student will have a maximum of 10 min. and, afterwards, the students must answer specific questions set by the lecturer. The oral defence must be done the day set for it on the subject timetable or the day set for exam in February or July (itinerary A).	
ECTS tutorials	Activity 3: Major bioactive and functional components of foods	Small group (P)	The objective is to know and understand basic and advanced concepts in Bioactive and Functional Components of Food.  To help the students with the establishment of groups for develop activity 3, with the assignation of the bioactive and functional food component group to study in activity 3 and the preparation of the works for the activity 3. The tutorial must be done the day set for it on the subject timetable or electronically (itinerary A).	1
Assessment	Exam	Large group (G)	The objective is to consolidate and expand the knowledge about Bioactive and Functional Components of Food.  Exam with test questions of True/False answers on aspects relating to on the theory concepts of the subject developed in the lessons by the lecturer. The exam must be done the day set for it on the subject timetable (itinerary A) or the day set for exam in February or July (itinerary A and B).	1

At the beginning of the semester a schedule of the subject will be made available to students through the UIBdigital platform. The schedule shall at least include the dates when the continuing assessment tests will be conducted and the hand-in dates for the assignments. In addition, the lecturer shall inform students as to whether the subject work plan will be carried out through the schedule or through another way included in the Campus Extens platform.

### Distance education work activities

Modality	Name	Description	Hours
Individual self-study	Activity 2: Food characterization	The objective is to put in practice the theory concepts learnt in the subject by the interpretation of specific scientific bibliography.  The students must do a chemical and biological characterization of bioactive and functional components of one food, proposed by the student with the approval of the lecturer, based on scientific literature and deliver an outline of the work and the main literature used in it. This work will be used to prepare the oral presentation. The written report must be delivered the day set for it on the subject timetable or one month before the day of the oral defense if it would be in February or July (itinerary A).	14
Individual self-study	Activity 3: Questionnaire	The objective is to know and understand basic and advanced concepts in Bioactive and Functional Components of Food.  The students must individually do an extended-response, discursive questionnaire, with open acces to bibliografic materials and to internet, on aspects relating to on the theory concepts of the subject developed in the lessons by the lecturer and in activity 3 by the students. The questionnaire must be done the day set for it on the subject timetable (itinerary A) or the day set for exam in February or July (itinerary A and B).	5

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Modality	Name	Description	Hours
Individual self-study	Study of the theory contents of the subjects	The objective is to know and understand basic and advanced concepts in Bioactive and Functional Components of Food and to consolidate the contents given in the lessons.  The students are advised to study the slides of the lessons and to consult the recommended bibliography (itinerary A and B).	6
Group self-study	Activity 3: Review or cross evaluation	The objective is to know and understand basic and advanced concepts in Bioactive and Functional Components of Food and to learn how critically evaluate a work related to the subjects of the topic.  The students (in groups of 2-3 students) must review a theory work about a group of bioactive and functional components of foods developed by others students and proposed by the lecturer and write a global and justified evaluation of the work. The written evaluating report must be delivered the day set for it on the subject timetable or the day set for exam in February or September (itinerary A).	5
Group self-study	Activity 3: Theory work	The objective is to know and understand basic and advanced concepts in Bioactive and Functional Components of Food.  The students (in groups of 2-3 students) must write a theory work about a major group of bioactive and functional components of foods proposed by the lecturer, describing their chemical structure, classes and subclasses, primary function, food sources, intake, absorption and bioavailability, metabolic and healthy effects, toxicity. The written report must be delivered the day set for it on the subject timetable or two weeks before the day set for exam in February or September (itinerary A).	22
Group or individual self-study	Activity 1: Debate/ Scientific opinion preparation	The objective is to put in practice the theory concepts learnt in the subject by the interpretation of specific scientific bibliography.  The students (in two groups) must organize the work and establish the group opinion and defence (itinerary A) or the individual opinion in favour/ against based on scientific interpretation of specific scientific bibliography (itinerary A and B).	8

### Specific risks and protective measures

The learning activities of this course do not entail specific health or safety risks for the students and therefore no special protective measures are needed.

### Student learning assessment

The students have the possibility of 2 itineraries for assessment ( Itinerary A or Itinerary B), and they must decide which itinerary to follow.

#### Activity 1: Debate

Modality	Seminars and workshops
Technique	Other methods ( <b>non-retrievable</b> )
Description	The objective is to put in practice the theory concepts learnt in the subject by the interpretation of specific scientific bibliography and the elaboration of an consensus opinion based on scientific literature about the topic of interest. A debate on a topic of interest, setting up two groups in favour/against and exposing the

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Assessment criteria	<p>position by group spokesperson, overall discussing and writing a concluding remarks (itinerary A). Students who have not attended the debate, they must individually develop an opinion based on scientific literature about the debate subject. The written opinion must be delivered two weeks after the day of the debate. The students (itinerary B) must individually develop an opinion based on scientific literature about a controversial subject proposed by the lecturer, the day set for exam in February or July.</p> <p>Itinerary A: Work in group, quality of the opinion defence, taking into account the contents, structure and the correct use of the bibliography and participation in the debate; or quality of the written opinion delivered, taking into account the contents, structure and the correct use of the bibliography.</p> <p>Itinerary B: Quality of the written opinion delivered, taking into account the contents, structure and the correct use of the bibliography.</p>
Final grade percentage: 15% for the training plan A	
Final grade percentage: 15% for the training plan B	

### Activity 2: Food characterization (Students' oral presentations)

Modality	Seminars and workshops
Technique	Oral tests ( <b>retrievable</b> )
Description	The objective is to put in practice the theory concepts learnt in the subject by the interpretation of specific scientific bibliography and articulate knowledge in a oral presentation. The work that the students have prepared (individually) (about the chemical and biological characterization of bioactive and functional components of one food), must be defended by oral presentation accompanied with a slide presentation. For the oral defence, each student will have a maximum of 10 min. and, afterwards, the students must answer specific questions set by the lecturer. The oral defence must be done the day set for it on the subject timetable or the day set for exam in February or July (itinerary A).
Assessment criteria	Quality of the slide presentation and its oral defence, as well as the capacity to adapt to the established time for the oral presentation and the answers to specific questions asked by the lecturer.
Final grade percentage: 15% for the training plan A	
Final grade percentage: 20% for the training plan B	

### Exam

Modality	Assessment
Technique	Objective tests ( <b>retrievable</b> )
Description	The objective is to consolidate and expand the knowledge about Bioactive and Functional Components of Food. Exam with test questions of True/False answers on aspects relating to on the theory concepts of the subject developed in the lessons by the lecturer. The exam must be done the day set for it on the subject timetable (itinerary A) or the day set for exam in February or July (itinerary A and B).
Assessment criteria	Objective test.
Final grade percentage: 18% for the training plan A	
Final grade percentage: 25% for the training plan B	

### Activity 2: Food characterization

Modality	Individual self-study
Technique	Papers and projects ( <b>non-retrievable</b> )
Description	The objective is to put in practice the theory concepts learnt in the subject by the interpretation of specific scientific bibliography. The students must do a chemical and biological characterization of bioactive and functional components of one food, proposed by the student with the approval of the lecturer, based on scientific literature and deliver an outline of the work and the main literature used in it. This work will be

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used to prepare the oral presentation. The written report must be delivered the day set for it on the subject timetable or one month before the day of the oral defense if it would be in February or July (itinerary A).

Assessment criteria Quality of the written outline of the presentation delivered, taking into account the contents, structure and the correct use of the bibliography.

Final grade percentage: 10% for the training plan A

Final grade percentage: 0% for the training plan B

### Activity 3: Questionnaire

Modality Individual self-study

Technique Extended-response, discursive examinations (**retrievable**)

Description The objective is to know and understand basic and advanced concepts in Bioactive and Functional Components of Food. The students must individually do an extended-response, discursive questionnaire, with open access to bibliographic materials and to internet, on aspects relating to on the theory concepts of the subject developed in the lessons by the lecturer and in activity 3 by the students. The questionnaire must be done the day set for it on the subject timetable (itinerary A) or the day set for exam in February or July (itinerary A and B).

Assessment criteria Quality and accuracy of the answers to the questions.

Final grade percentage: 7% for the training plan A

Final grade percentage: 0% for the training plan B

### Activity 3: Review or cross evaluation

Modality Group self-study

Technique Papers and projects (**retrievable**)

Description The objective is to know and understand basic and advanced concepts in Bioactive and Functional Components of Food and to learn how critically evaluate a work related to the subjects of the topic. The students (in groups of 2-3 students) must review a theory work about a group of bioactive and functional components of foods developed by others students and proposed by the lecturer and write a global and justified evaluation of the work. The written evaluating report must be delivered the day set for it on the subject timetable or the day set for exam in February or September (itinerary A).

Assessment criteria Quality of the written evaluation report delivered, taking into account the contents and the correct use of the bibliography.

Final grade percentage: 10% for the training plan A

Final grade percentage: 0% for the training plan B

### Activity 3: Theory work

Modality Group self-study

Technique Papers and projects (**retrievable**)

Description The objective is to know and understand basic and advanced concepts in Bioactive and Functional Components of Food. The students (in groups of 2-3 students) must write a theory work about a major group of bioactive and functional components of foods proposed by the lecturer, describing their chemical structure, classes and subclasses, primary function, food sources, intake, absorption and bioavailability, metabolic and

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healthy effects, toxicity. The written report must be delivered the day set for it on the subject timetable or two weeks before the day set for exam in February or September (itinerary A).

Assessment criteria Quality of the written report delivered, taking into account the contents, structure and the correct use of the bibliography.

Final grade percentage: 25% for the training plan A

Final grade percentage: 40% for the training plan B

## Resources, bibliography and additional documentation

Learning resources:

- \* PowerPoint presentations in lectures.
- \* Use of Moodle environment to transmit content and materials and as an interactive communication tool.
- \* Bibliographic materials (books, scientific articles, databases, etc.).

### Basic bibliography

1. Crozier A, Clifford MN, Ashihara H (editors) Plant Secondary Metabolites: Occurrence, Structure and Role in the Human Diet. Wiley-Blackwell, 2006. ISBN: 978-1-4051-2509-3
2. Colegate SM, Molyneux RJ (editors) Bioactive Natural Products Detection, Isolation, and Structural Determination (2<sup>o</sup> edition). CRC Press, 2007. ISBN: 9780849372582

### Complementary bibliography

1. Aruoma OI. Methodological considerations for characterizing potential antioxidant actions of bioactive components in plant foods. *Mutat Res.* 2003 Feb-Mar;523-524:9-20.
2. Bengmark S, Gil A. Bioecological and nutritional control of disease: prebiotics, probiotics and synbiotics. *Nutr Hosp.* 2006 May;21 Suppl 2:72-84, 73-86.
3. Cassidy A. Potential risks and benefits of phytoestrogen-rich diets. *Int J Vitam Nutr Res.* 2003 Mar;73(2):120-6.
4. Chadwick R, Henson S, Moseley B, Koenen G, Liakopoulos M, Midden C, Palou A, Rechkemmer G, Schröder D, von Wright A. *Functional Foods.* Springer. Berlin (DE) 2003. ISBN 3540201203.
5. Davis CD. Nutritional interactions: credentialing of molecular targets for cancer prevention. *Exp Biol Med (Maywood).* 2007 Feb;232(2):176-83.
6. Ellis DR, Salt DE. Plants, selenium and human health. *Curr Opin Plant Biol.* 2003 Jun;6(3):273-9.
7. Ferrari CK. Functional foods, herbs and nutraceuticals: towards biochemical mechanisms of healthy aging. *Biogerontology.* 2004;5(5):275-89.
8. Finley JW. Proposed criteria for assessing the efficacy of cancer reduction by plant foods enriched in carotenoids, glucosinolates, polyphenols and selenocompounds. *Ann Bot (Lond).* 2005 Jun;95(7):1075-96.
9. Greathead H. Plants and plant extracts for improving animal productivity. *Proc Nutr Soc.* 2003 May;62(2):279-90.
10. Ha E, Zemel MB. Functional properties of whey, whey components, and essential amino acids: mechanisms underlying health benefits for active people (review). *J Nutr Biochem.* 2003 May;14(5):251-8.
11. Halliwell B. Dietary polyphenols: good, bad, or indifferent for your health? *Cardiovasc Res.* 2007 Jan 15;73(2):341-7.
12. Hallmans G, Zhang JX, Lundin E, Stattin P, Johansson A, Johansson I, Hulten K, Winkvist A, Aman P, Lenner P, Adlercreutz H. Rye, lignans and human health. *Proc Nutr Soc.* 2003 Feb;62(1):193-9.
13. Hernandez I, Molenaar D, Beekwilder J, Bouwmeester H, van Hylckama Vlieg JE. Expression of plant flavor genes in *Lactococcus lactis*. *Appl Environ Microbiol.* 2007 Mar;73(5):1544-52.



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14. Kochian LV, Garvin DF. Agricultural approaches to improving phytonutrient content in plants: an overview. *Nutr Rev.* 1999 Sep;57(9 Pt 2):S13-8.
15. Kris-Etherton PM, Hecker KD, Bonanome A, Coval SM, Binkoski AE, Hilpert KF, Griel AE, Etherton TD. Bioactive compounds in foods: their role in the prevention of cardiovascular disease and cancer. *Am J Med.* 2002 Dec 30;113 Suppl 9B:71S-88S.
16. Kris-Etherton PM, Lefevre M, Beecher GR, Gross MD, Keen CL, Etherton TD. Bioactive compounds in nutrition and health-research methodologies for establishing biological function: the antioxidant and anti-inflammatory effects of flavonoids on atherosclerosis. *Annu Rev Nutr.* 2004;24:511-38.
17. Kristal AR. Vitamin A, retinoids and carotenoids as chemopreventive agents for prostate cancer. *J Urol.* 2004 Feb;171(2 Pt 2):S54-8; discussion S58.
18. Lagarda MJ, Garcia-Llatas G, Farre R. Analysis of phytosterols in foods. *J Pharm Biomed Anal.* 2006 Aug 28;41(5):1486-96.
19. Liukkonen KH, Katina K, Wilhelmsson A, Myllymaki O, Lampi AM, Kariluoto S, Piironen V, Heinonen SM, Nurmi T, Adlercreutz H, Peltoketo A, Pihlava JM, Hietaniemi V, Poutanen K. Process-induced changes on bioactive compounds in whole grain rye. *Proc Nutr Soc.* 2003 Feb;62(1):117-22.
20. Losso JN, Shahidi F, Bagchi D. *Anti-Angiogenic Functional and Medical Foods.* CRC Press. Boca Raton (FL) 2007. ISBN 157444445X.
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23. Palou A, Bonet ML, Serra F. Study on Obesity and functional foods in Europe. Office for official publications of the European Communities. Luxemburg (LX) 2002. ISBN 9289442921.
24. Palou A, Picó C, Bonet ML, Oliver P, Serra F, Rodríguez AM, Ribot J. *El libro blanco de los esteroides vegetales en alimentación.* Unilever Foods SA. Barcelona (ES) 2005. ISBN 8460958507.
25. Parcker L, Hiramatsu M, Yoshikawa T. *Antioxidant Food supplements in human health.* Academic press. San Diego (CA) 1999. ISBN 0125435908.
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27. Rasmussen SE, Breinholt VM. Non-nutritive bioactive food constituents of plants: bioavailability of flavonoids. *Int J Vitam Nutr Res.* 2003 Mar;73(2):101-11.
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31. Tulp M, Bruhn JG, Bohlin L. Food for thought. *Drug Discov Today.* 2006 Dec;11(23-24):1115-21.
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33. WEBB G. P.: *Dietary Supplements and Functional Foods.* Blackwell Publishing Ltd. Oxford (UK) 2006. ISBN 1405119098.

### Other resources

<http://www.ffnmag.com/ASP/home.asp>





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