FACULTAD DE CIENCIAS EXACTAS

Presentación curso de postgrado

Año	2019	Semestre	Primero

Nombre del Curso

PREservation of **MI**croorganisms by **U**nderstanding the protective **M**echanisms of oligosaccharides (PREMIUM)

Module I: Biotechnology and bioprocess engineering

Module I': Prebiotics: Obtaining, characterization and properties of oligosaccharides

Module II: Biochemistry and biophysics of lipid membranes

Module III: Functionalities of microbial ecosystems of traditional fermented foods

Profesor Responsable (indicando las horas que participa en el dictado de clases)

Andrea Gómez-Zavaglia (1 hora)

Docentes Participantes (indicando las horas que participa en el dictado de clases)

Catherine Béal (Profesora AgroParisTech, Francia, 30 horas)

Eric Spinnler ((Profesora AgroParisTech, Francia, 15 horas)

Yann Gohon (Institute National de la Recherche Agronomique, Francia, 9 horas)

Marie Hélène Ropers (Institute National de la Recherche Agronomique, Francia, 3 horas)

Pedro Nuno Simões (Universidade de Coimbra, Portugal 3 horas)

Paula Castilho (Universidade da Madeira, Portugal, 1 hora)

María Elvira Zuñiga-Hansen (Pontificia Universidad Católica de Valparaiso, Chile, 1 hora)

Andrés Illanes (Pontificia Universidad Católica de Valparaíso, Chile, 1 hora)

Jorge Chirife (Universidad Católica Argentina, 1 hora)

Jesús Simal-Gándara (Universidad de Vigo, 1 hora)

Duración Total (en horas)	60 horas
Modalidad (Teórico, teórico-práctico, seminario, etc)	Teórico-práctico

Tipo de evaluación prevista	Evaluación escrita		
Especificación clara si se lo considera válido para cubrir exigencias del Doctorado.			
Válido para el doctorado			
Fecha de dictado	7 al 27 de Marzo de 2019	Cupo de alumnos	Teóricos: sin cupo (aula del CIDCA) Para los TP, a realizarse en el CINDEFI, cupo 10 personas.
Inscripción desde	7 de Febrero	Hasta el día	28 de Febrero
Exigencias y requisitos de inscripción			
Bioquímicos, Químicos, Ingenieros Químicos y de Alimentos, Farmacéuticos, Biotecnólogos, Biólogos, Tecnólogos de Alimentos y carreras afines.			
Arancelamiento			

NO		SÍ	X	Montos	$4000 Gratuito para Alumnos de la Carrera de doctorado, Docentes, Investigadores y Graduados que desarrollan actividades en la Universidad Nacional de La Plata.
Destino de los fondos				Los fondos serán destinados a solventar los gastos del curso (reactivos, material descartable, fotocopias).	
Mecanismo de pago				Los pagos se efectuarán a través de la Fundación Ciencias Exactas.	

Breve resumen de los objetivos y contenidos

OBJECTIVES:

The course will be organized in **three different but interconnected independent modules**, as well as an international workshop whose presentations can be considered as an additional module (Module I').

It is allowed to participate to one or more modules, including Module I' (*workshop*), to be held at CCT-CONICET, and whose program is proposed as Annex I.

Module I: Biotechnology and bioprocess engineering (30 hours)

Objective:

-To produce competent scientists in upstream bioprocesses, through a combination of theoretical and practical experience.

Module I': Prebiotics: Obtaining, characterization and properties of oligosaccharides (15 hours)

Objective:

-To provide information about the last advances in the obtaining of fructo and galacto-oligosaccharides (FOS, GOS).

Module II: Biochemistry and biophysics of lipid membranes (15 hours)

Objective:

-To provide information about the mechanisms involved in the behavior of lactic acid bacteria on dehydration processes: biophysical processes and use of computational tools.

Module III: Functionalities of microbial ecosystems of traditional fermented foods (15 hours)
Objetive:
-To provide a deep insight on the functionalities of microbial ecosystems of traditional fermented foods, with focus on ripened cheeses.

CONTENTS:
Module I: Biotechnology and bioprocess engineering.
Bioprocesses include upstream and downstream processes that aim at producing biomass, biomolecules and building blocks for food, chemical and pharmaceutical industry. They include upstream processes that use living cells (mainly microorganisms) to obtain desired products from biosynthesis or bioconversion, and downstream processes that aim at extracting, separating and purifying the required products.
The course is designed to introduce students to the concepts, methods and applications of bioprocesses, through theoretical classes and exercises, on the following topics: microbial growth and product formation by microorganisms, measurement and quantification of growth and bioproduction, nutrient limitation, substrate and product inhibition, basic function and specificities of bioreactors, bioprocess design for batch, fed- batch and chemostat cultures. Numerous examples will help the students to understand the theoretical concepts, together with a practical work. As a central example, the lactic acid fermentation will be studied, with the aim of producing lactic acid bacteria or other interesting biomolecules.

Module I' (Annex I): The Workshop is organized within the scope of the European project **H2020-MSCA-RISE-2017.** (2018-2021). "Preservation of microorganisms by understanding the protective mechanisms of oligosaccharides" (PREMIUM) Code: 777657, to be held at CCT-CONICET La Plata, on 11-13th March 2019.

Module II: Biochemistry and biophysics of lipid membranes
This module will be devoted to understand the molecular mechanisms beyond the protective effect of polyhydroxy compounds during dehydration processes. Particular emphasis will be put into model membranes and their limits for studying dehydration processes, as well as their characterization, specifically in what concerns the water interface. Manipulation and extraction of protein membranes. Separative techniques for lipids and proteins at the laboratory scale. Molecular dynamics simulations of lipid bilayers will be also addressed (Elements of computer simulation of the interactions of oligosaccharides with lipid bilayer membranes by molecular dynamics).

Module III:
This module will be devoted to the microbial ecosystems of traditional fermented products, with focus on cheese technology (diversity of substrates, diversity and origins of species involved in the microbial ecosystems, flavor generation by microorganisms in cheeses, and other functionalities of cheese microbial ecosystems.

References
-Doran P.M. (2012). Bioprocess engineering principles. Academic Press Ltd.
-Mozzi F., Raya R.R., Vignolo G.M. (eds.) (2016). Biotechnology of Lactic Acid Bacteria: Novel Applications, 2nd Edition, John Wiley & Sons, Ltd.
-Shuler M.L., Kargi F. (2002). Bioprocess engineering - basic concepts. 2nd edition, Prentice Hall.
-D. Montet and RC Rey Ed. (2015). Fermented Foods, Part I: Biochemistry and Biotechnology. CRC Press -Taylor & Francis.
- D. Montet and RC Rey Ed., CRC Press -Taylor & Francis (2017). Fermented Foods, Part II: Technological Interventions.
-P. McSweeney, P. Fox, P. Cotter, D. Everett. Cheese: chemistry, Physics and Microbiology. (2017) 1302p – Elsevier (Amsterdam).
-A. Eck and JC Gillis (Editors). Cheesemaking from science to Quality Insurance. (2000), Lavoisier (Paris).
- N. Bou-Rabee (2014). Time Integrators for Molecular Dynamics. Entropy. 16: 138-162.

Contacto con el responsable			
Dirección	Centro de Investigación y Desarrollo en Criotecnología de Alimentos. Calle 47 y 116. 1900. La Plata.		
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Adjuntar programa detallado de actividades.

Horario	Jueves 7/08	Viernes 8/03
9.30-12.30	**MODULE I: Design of fermentation processes for the production of lactic acid starters** Strain, environmental conditions, bioreactor, downstream processes; main steps, main constraints, need for quantification (with examples in the food industry) **Catherine Béal**	**MODULE I: Fermentation kinetics** -Kinetics of biomass and metabolite production, rates, yields, productivity **Catherine Béal**
Intervalo		
14.30-16.30	**MODULE I: Processing a fermentation** -Main steps of a fermentation process -Film: Example of lactic acid starters fermentation **Catherine Béal**	**MODULE I:** 2 case studies: quantification of the production of frozen lactic acid starters and of a primary metabolite **Catherine Béal**

Horario	Martes 12/03	Miércoles 13/03	Jueves 14/03	Viernes 15/03
09.00-13.30	**MODULE I': Workshop (program Annex I)** "Preservation of microorganisms by understanding the protective mechanisms of oligosaccharides"		**MODULE II:** Membrane models: interests and limitations. Manipulation of membrane proteins. Techniques for characterization **Yann Gohon**	**MODULE II:** Lipids from lactic acid bacteria. Properties and characterization. **Marie Hélène Ropers**
INTERVALO				
14.00-17.00	**MODULE I': Workshop (program, Annex I)** "Preservation of microorganisms by understanding the protective mechanisms of oligosaccharides"		**MODULE II:** Separation techniques for lipids. Databank for membrane proteins **Yann Gohon**	**MODULE II:** All-atom molecular dynamics simulations of lipid bilayer membranes. Elements of computer simulation of the interactions of molecular entities (*viz.* oligosaccharides) with lipid bilayer membranes by molecular dynamics. **Pedro Nuno Simões**

Horario	Lunes 18/03	Martes 19/03	Miércoles 20/03	Jueves 21/03	Viernes 22/03
9.00-12.00	**MODULE I (TP):**	**MODULE I (TP):**	**MODULE I (TP):**	**MODULE I (TP):**	**MODULE III:** Introduction to

	Cultivation processes -Batch, continuous and fed-batch processes **Catherine Béal**	-1 case study: quantification of the production of secondary metabolite -1 case study: comparison of batch and continuous fermentation **Catherine Béal**	-Day 2: carrying out the fermentation (inoculation, sampling, growth measurement, determination of glucose / lactic acid concentrations: enzymatic kits and/or HPLC) **Catherine Béal**	-Day 3: data analysis, growth curves, growth rates, yields **Catherine Béal**	traditional fermented products and to their microbial ecosystems. How the cheese technology is creating a diversity of substrates (composition, structure) that will determine the cheese size **Eric Spinnler**
INTERVALO					
14.00-17.00	**MODULE I (TP):** 2 case studies: bioproduction using continuous fermentation and fed-batch process **Catherine Béal**	**MODULE I (TP):** **Practical work: production of lactic acid starters** **Lactic acid fermentation at controlled pH and temperature (at the center for industrial fermentation)** -Day 1: preparation of the fermentation: medium, pH probe calibration, sterilization, inoculum preparation **Catherine Béal**	*Continuation*	**FREE**	***Continuation***

Horario	Lunes 25/03	Martes 26/03	Miércoles 27/03
09.30-12.00	**MODULE III:** Diversity and origins of species involved in the microbial ecosystems involved in cheese manufacture **Eric Spinnler**	**MODULE III:** Other functionalities of cheese microbial ecosystems Study of practical case on different cheeses (Tutorials) a.Blue cheeses b.Soft washed rind cheeses c.Soft mould ripened cheeses d.Hard non cooked cheeses e.Hard cooked cheeses **Eric Spinnler**	**Exam MODULE I (1 HOUR)**
INTERVALO			
14.00-16.00	**MODULE III:** Flavour generation by micro-organisms in cheeses: a.From sugars and organic acids b.From lipids c.From proteins **Eric Spinnler**	**MODULE III:** ***Continuation tutorials*** For this part, the number of groups and examples will depend on the number of students. **Eric Spinnler**	**Exam MODULE III (1 HOUR)**

ANNEX I (Program Module I')

MARCH 12-13TH 2019

- **WORKSHOP:** ***PREBIOTICS: OBTAINING, CHARACTERIZATION AND PROPERTIES OF OLIGOSACCHARIDES***

Tuesday 12th, 2019

13.30-14.15	María Elvira Zuñiga-Hansen Production of fructo-oligosaccharides (FOS)
14.15-14.45	Andrea Gomez-Zavaglia Monitoring the FOS production
14.45-15.15	Nelson Romano Using alternative substrates for the production of FOS (I)
15.15-15.45	*Coffee break*
15.45-16.15	Micaela Ureta Using alternative substrates for the production of FOS (II)
16.15-17.00	Carolina Schebor Incorporating FOS in the formulation of healthy candies

Wednesday 13th, 2019

9.00-9.45	Andrés Illanes "Technological challenges in the production of lactose-derived prebiotics"
9.45-10.30	Paula Castilho "Oligosaccharides obtained by direct extraction and hydrolysis"
10.30-10.45	*Coffee break*
10.45-11.15	Mauricio Santos (Andrea Gomez-Zavaglia) FTIR associated to multivariate analysis to monitor the synthesis of FOS/GOS
11.15-11.45	Pablo Mobili "Multivariate analysis associated to Raman spectroscopy"
11.45-12.15	Elizabeth Tymczyszyn (Andrea Gómez-Zavaglia) "Interaction of FOS and GOS with lipid membranes"
12.15-13.45	*Informal lunch*
13.45-14.30	Jorge Chirife, Diego Rocha Parra, I. Jasel Alvarez and Clara Zamora "Encapsulation of red wine polyphenols using lyophilization and spray drying"
14.30-15.15	Jesús Simal-Gándara "Characterization of anti-oxidants"
15.15-15.45	*Coffee break*
15.45-16.15	Esteban Gerbino (to be defined)
16.15-17.00	Caroline Pénicaud Towards the definition of environmentally friendly processes for preserving lactic acid bacteria

END OF THE WORKSHOP