

Degree programme	Type	Course
Advanced Biotechnology	OP	1

Contact lecturer

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Teaching staff

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Group languages

You can consult this information at the [end](#) of the document.

Prerequisites

Basic knowledge of:

- Protein structure
- Biochemistry
- Catalysis
- Kinetic enzyme
- Microbial growth
- Cell biology
- Chemical Engineering principles

Objectives

The objective is to present biocatalysis and its fields of application as an alternative to classical catalysis. The knowledge of biocatalysts will be deepened as the central axis of a transformation and of the aspects of engineering of the main elements that make up biotransformation, such as the biocatalyst, the reaction medium, the bioreactor and its operation. Moreover, the classification and study of different biotransformations according to the biocatalyst used will be analyzed in different case studies. The final objective is to be able to define the main elements of a biotransformation and to design a biocatalytic process.

Learning outcomes

- CA06 (Implement a biocatalytic process for industrial application, integrating the current state of biocatalysis, its fields of application and the different classes of relevant biotransformations.) Implement a biocatalytic process for industrial application, integrating the current state of biocatalysis, its fields of application and the different classes of relevant biotransformations.
- CA07 (Explain the different types of biotransformation depending on the biocatalyst used, evaluating their main characteristics.) Explain the different types of biotransformation depending on the biocatalyst used, evaluating their main characteristics.
- KA04 (Gather relevant information to determine the most appropriate operational configuration for a biotechnological process.) Gather relevant information to determine the most appropriate operational configuration for a biotechnological process.
- KA05 (Differentiate the fundamental concepts of chemical engineering in the different forms of reactor design and operation, including catalytic reactors, with special emphasis on reactors with immobilized biological catalysts.) Differentiate the fundamental concepts of chemical engineering in the different forms of reactor design and operation, including catalytic reactors, with special emphasis on reactors with immobilized biological catalysts.
- KA06 (Distinguish and choose between different reaction media used in biotransformations.) Distinguish and choose between different reaction media used in biotransformations.
- KA07 (Characterise biocatalyst immobilisation and distinguish between its different methods.) Characterise biocatalyst immobilisation and distinguish between its different methods.
- KA08 (Identify biomolecules and multi-enzyme processes of relevance to biotechnological applications, considering their function in biological systems and their possible role in human pathologies.) Identify biomolecules and multi-enzyme processes of relevance to biotechnological applications, considering their function in biological systems and their possible role in human pathologies.
- SA06 (Calculate the main elements involved in biotransformation such as the biocatalyst, reaction medium and bioreactor, as well as their operation.) Calculate the main elements involved in biotransformation such as the biocatalyst, reaction medium and bioreactor, as well as their operation.

Contents

Assignment program:

- Topic 1 Introduction to biocatalysis
- Topic 2 Biocatalysts
- Topic 3 Biocatalyst engineering
- Topic 4 Reaction medium engineering
- Topic 5 Bioreactor operation
- Topic 6 Biotransformations: case studies

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Individual study	127	5.08	CA06, CA07, KA04, KA05, KA06, KA07, KA08, SA06
theoretical classes	49	1.96	KA04, KA05, KA06, KA07, KA08
Accomplishment of work on a case study	20	0.8	CA06, KA04, KA05, KA06, KA07, KA08, SA06

Seminars and case studies	6	0.24	CA06, CA07, KA04, KA05, KA06, KA07, KA08, SA06
Search for documentation and bibliography	20	0.8	CA06, CA07, KA04, KA05, KA06, KA07, KA08

Directed activities:

- Theoretical lectures: Master classes on the concepts of the subject
- Seminars: Presentation to students of different cases of study of biotransformations and applied biocatalysis extracted from the bibliography
- Public presentation of the work: Students will orally and publicly present a summary of the most relevant results of the work and deliver the presentation to the professor in digital format through the virtual campus

Autonomous activities:

- Individual study: Individual study, preparation of diagrams and summaries.
- Documentation and bibliography search: Consultation of the bibliographic and documentary sources essential for the course.
- Realization of a work: work in groups of 2-4 students in which each group will elaborate a written work on a case study previously selected by the teacher. The work will be delivered to the teacher in paper format (printed) and in digital format through the virtual campus, in order to discuss in seminars and written presentation.

Communication with Students

Communication with students will take place through the Moodle Classroom on the Virtual Campus.

Informative note:

The use of AI is permitted to improve the drafting and style of the reports. However, generating original content with AI is strictly prohibited. If AI tools are used, their use must be explicitly declared, and it must be clearly identified what they were used for.

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Written work	20%	0	0	CA06, CA07, KA04, KA05, KA06, KA07, KA08, SA06
Oral and public presentation of the work	10%	1	0.04	CA06, CA07, KA04, KA05, KA06, KA07, KA08, SA06
Partial exam (topics 4, 5 and 6)	35%	1	0.04	CA07, KA05, KA06, KA07, KA08, SA06
Partial exam (items 1, 2 and 3)	35%	1	0.04	KA05, KA07, KA08

Scheduled evaluation process and activities

Throughout the course different evaluation activities will be carried out that will lead to the final grade of the subject obtained by continuous evaluation. Specifically, the evaluable activities will be:

- Written work on a case study that is 20% of the final grade.

- Oral and public presentation of the written work that is 10% of the final grade
- Attendance at all oral presentations is compulsory for all students
- Partial exam of topics 1, 2 and 3, which represents 35% of the final grade
- Partial examination of topics 3, 4 and 5, which represents 35% of the final grade

The written assignment and the oral presentation of the assignment are non-recoverable.

The course is considered passed if the average of the 4 activities is 5 or higher. To calculate the average, each activity must have a minimum grade of 4.

If the average of the 4 activities is less than 5, or any part is below 4, the failed activities (those with less than 5) must be retaken, except the written assignment and the oral presentation, which are non-recoverable.

Any of the following circumstances will result in a "Not Assessable" grade for the course:

- Not submitting the written assignment
- Not doing the oral presentation
- Not attending any of the exams

Scheduling of assessment activities

At the beginning of the course, groups will be formed for the written assignment. The deadlines for submission and oral presentations will be communicated through the virtual campus.

Recovery process

The student may attend the recovery session only if they have completed a set of activities representing at least two-thirds of the total course grade.

Partial exams are eliminatory; therefore, a student who has passed a partial exam cannot retake it. They must retake any partial exam in which they obtained a grade below 4, regardless of their overall average, as outlined in the "Scheduled Evaluation Process and Activities" section.

The final grade will be calculated in the same way as for continuous assessment.

Grade review procedure

For each assessment activity, a time, date, and location will be set for the student to review their work with the teacher. During this review, students may raise complaints about their grade, which will be considered by the course instructors. If the student does not attend the review session, the activity will not be reviewed afterward.

Grading

The decision to award an "Honors" distinction is up to the course instructors. UAB regulations state that an Honors grade can only be awarded to students with a final grade equal to or higher than 9.00. A maximum of 5% of the enrolled students may receive this distinction.

Student misconduct, cheating, and plagiarism

Without prejudice to other disciplinary measures deemed appropriate, any irregularities committed by a student that could lead to a variation in the grade of an assessment activity will result in a grade of zero. Therefore, cheating, plagiarism, deception, or allowing others to copy in any evaluation activity will result in a zero and the activity will be non-recoverable.

If the course requires passing one of these affected activities, the entire course will be failed directly, without the opportunity for recovery during the same academic year. In this situation, the final grade recorded will be 2.

Evaluation of repeating students

There is no different evaluation system for repeating students.

Single assessment

This course does not have a single-assessment option.

Bibliography

Books:

Immobilized Biocatalysts

Peter Grunwald (Ed.)

Pages: 510

Published: November 2018

ISBN 978-3-03897-318-8 (Pbk); ISBN 978-3-03897-319-5 (PDF)

<https://doi.org/10.3390/books978-3-03897-319-5>

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<https://www.mdpi.com/books/pdfview/book/861>

Biocatalysis for Green Chemistry and Chemical Process Development

Editor(s): Junhua (Alex) Tao, Romas Kazlauskas

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<https://onlinelibrary-wiley-com.are.uab.cat/doi/book/10.1002/9781118028308>

Carrier-bound Immobilized Enzymes: Principles, Application and Design

Author(s): Dr. Linqiu Cao

First published:29 September 2005

Print ISBN:9783527312320 |Online ISBN:9783527607662 |DOI:10.1002/3527607668

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https://bibcercador.uab.cat/permalink/34CSUC_UAB/cugbhl/alma991010341558406709

Green Biocatalysis

Editor(s): Ramesh N. Patel

First published:13 May 2016

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https://cataleg.uab.cat/iii/encore/record/C__Rb2087415?lang=cat

Autor	Fersht, Alan, 1943-
Títol	Enzyme structure and mechanism / Alan Fersht
Edició	2nd. ed.
Publicació/producció	New York : W.H. Freeman, cop. 1985
Descripció	xxi, 475 p.; 24 cm
Matèria	Enzims
ISBN	0716716143
	0716716151 (pbk.)

https://bibcercador.uab.cat/permalink/34CSUC_UAB/cugbhl/alma991002478739706709

Autor	Dixon, Malcolm
Títol	Enzymes / by Malcolm Dixon and Edwin C. Webb
Edició	3rd ed.
Publicació/producció	London : Longman, 1979
Descripció	XXIII + 1116 p.; 24 cm
Matèria	Enzims

https://bibcercador.uab.cat/permalink/34CSUC_UAB/cugbhl/alma991000758989706709

Títol	Enzyme biocatalysis : principles and applications / Andrés Illanes, editor
Publicació/producció	[Dordrecht] : Springer, 2008
Descripció	X, 391 p. : ill. ; 25 cm.

Matèria	Enzims -- Biotecnologia
	Enzims -- Síntesi
ISBN	9781402083600

https://bibcercador.uab.cat/permalink/34CSUC_UAB/cugbhl/alma991008142159706709

Títol	Ingeniería bioquímica/Francesc Gòdia Casablanques y Josep López Santín (editores) ; Carles Casas Alvero ... [et al.]
Publicació/producció	Madrid : Síntesis, DL 1998
Descripció	350 p. : il.; 24 cm
Col·lecció	Ciencias químicas (Síntesis). Tecnología bioquímica y de los alimentos
Matèria	Enginyeria bioquímica
ISBN	8477386110

http://cataleg.uab.cat/record=b1425826~S1*cat

Autor	Bommarius, A. S.
Títol	Biocatalysis : [fundamentals and applications] / A.S.Bommarius, B.R.Riebel
Publicació/producció	Weinheim : Wiley-VCH, 2004
Descripció	XXIII, 611 p.; 24 cm
Matèria	Enzims
ISBN	3527303448

https://bibcercador.uab.cat/permalink/34CSUC_UAB/cugbhl/alma991010349685006709

Títol	Multi-step enzyme catalysis : biotransformations and chemoenzymatic synthesis / edited by Eduardo Garcia-Junceda
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Publicació/producció	Weinheim : Wiley-VCH ; Chichester : John Wiley, 2008
Descripció	241 p. ; 25 cm
Matèria	Catàlisi
	Enzims -- Biotecnologia
ISBN	9783527319213

http://cataleg.uab.cat/record=b1747444~S1*cat

Títol	Immobilization of enzymes and cells / edited by Gordon F. Bickerstaff
Publicació/producció	Totowa : Humana Press, 1997
Descripció	XIV, 367 p.;23 cm
Col·lecció	Methods in biotechnology ; 1
Matèria	Enzims immobilitzats
	Enzims -- Biotecnologia
	Cèl·lules immobilitzades
ISBN	0896033864

https://bibcercador.uab.cat/permalink/34CSUC_UAB/cugbhl/alma991010401253806709

Autor	Faber, Kurt
Títol	Biotransformations in organic chemistry : a textbook : with 37 figures, 238 schemes and 16 tables / Kurt Faber
Edició	5th revised and corrected ed.
Publicació/producció	Berlin: Springer-Verlag, cop. 2004

Descripció	XI, 453 p. : il; 24 cm
Matèria	Reaccions químiques
	Química orgànica -- Reaccions
ISBN	3540200975

http://cataleg.uab.cat/record=b1615815~S1*cat

Autor	Grunwald, Peter
Títol	Biocatalysis : biochemical fundamentals and applications / Peter Grunwald
Publicació/producció	London : Imperial College Press, 2009
Descripció	xvi, 1035 p. : il. ; 24 cm
Matèria	Enzims -- Biotecnologia
	Biotecnologia
ISBN	9781860947711
	1860947719

https://cataleg.uab.cat/record=b1778458~S1*cat

Kourist, R. (2015), Biocatalysis in Organic Synthesis. Science of Synthesis, Vol. 1-3. Edited by Kurt Faber, Wolf-Dieter Fessner and Nicholas J. Turner.. Angew. Chem. Int. Ed., 54: 12547. doi:10.1002/anie.201508130

Search engines of scientific bibliography:

Scholar Google: http://scholar.google.es/advanced_scholar_search?hl=en&lr=

Scopus: <http://www.scopus.com/scopus/search/form.url?display=authorLookup>

Scifinder: Software disponible a la UAB

Science Direct: <http://www.sciencedirect.com/science/journals>

ISI Web of Knowledge: <http://www.accesowok.fecyt.es/login/>

Interesting web sites:

Base de dades d'enzims BRENDA: <http://www.brenda-enzymes.info/>

National Center for Biotechnology Information: <http://www.ncbi.nlm.nih.gov/>

ExPASy (Expert Protein Analysis System) Proteomic Server: <http://www.expasy.ch/>

Software

No software

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this [link](#). To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TEm) Theory (master)	1	Catalan	first semester	afternoon
(SEMm) Seminars (master)	1	Catalan	first semester	afternoon