

Applied Biocatalysis and Biotransformations

Code: 42901
ECTS Credits: 9

| Degree | Type | Year | Semester |
|--------------------------------|------|------|----------|
| 4313772 Advanced Biotechnology | OT | 0 | 1 |

Contact

Name: Gregorio Alvaro Campos

Email: Gregorio.Alvaro@uab.cat

Use of Languages

Principal working language: spanish (spa)

Teachers

Gloria González Anadón

Marina Guillen Montalban

Prerequisites

Fluid knowledge (spoken and written) of Catalan and / or Spanish

Have the necessary degree to access the master

Objectives and Contextualisation

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. Also the classification and study of the different biotransformations according to the biocatalyst used and different case studies. The final objective is that the student is able to define the main elements of a biotransformation and can design a biocatalytic process.

Competences

- Integrate knowledge about the state of biocatalysis, its areas of application, the different kinds of biotransformations and the design of a biocatalytic process for application in industry. (Specialisation in industrial biotechnology)
- Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
- Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
- Synthesise, weigh up alternatives and engage in critical discussion.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
- Use and manage bibliography and IT resources related to biotechnology responsibly.
- Work in a multidisciplinary team.

Learning Outcomes

1. Caracteritzar l'activitat i l'estabilitat dels biocatalitzadors.
2. Descriure la cinètica, el disseny i l'operació de bioreactors.
3. Dissenyar un procés biocatalític.
4. Distingir els diferents mitjans de reacció que s'utilitzen en biotransformacions i seleccionar el medi de reacció adequat.
5. Distingir els mètodes d'immobilització dels biocatalitzadors i la caracterització del biocatalitzador immobilitzat.
6. Explicar les diferents classes de biotransformacions en funció del biocatalitzador utilitzat.
7. Identificar els diferents tipus de biocatalitzadors i avaluar-ne les característiques utilitzades en una biotransformació.
8. Identificar processos multienzimàtics.
9. Identify the advantages and disadvantages of biocatalysis and its potential in the chemical and pharmaceutical industry as a tool for sustainable development.
10. Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
11. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
12. Synthesise, weigh up alternatives and engage in critical discussion.
13. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
14. Use and manage bibliography and IT resources related to biotechnology responsibly.
15. Work in a multidisciplinary team.

Content

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

Methodology

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.

Activities



| Title | Hours | ECTS | Learning Outcomes |
|---|-------|------|---|
| Type: Directed | | | |
| Seminars and case studies | 6 | 0.24 | 12, 1, 2, 3, 4, 5, 6, 9, 7, 8, 10, 11, 13, 15, 14 |
| theoretical classes | 49 | 1.96 | 12, 1, 2, 3, 4, 5, 6, 9, 7, 8, 10, 11, 15 |
| Type: Autonomous | | | |
| Accomplishment of work on a case study | 20 | 0.8 | 12, 10, 11, 15, 14 |
| Individual study | 127 | 5.08 | 12, 1, 2, 3, 4, 5, 6, 9, 7, 8, 10, 11, 15, 14 |
| Search for documentation and bibliography | 20 | 0.8 | 14 |

Assessment

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 25% of the final grade.
- Oral and public presentation of the written work that is 15% of the final grade
- Partial exam of topics 1, 2 and 3, which represents 30% of the final grade
- Partial examination of topics 3, 4 and 5, which represents 30% of the final grade

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

The subject is considered passed if the average of the 4 activities is 5 or higher, as long as no part is less than 4.0

- If any of the following circumstances occurs, it implies a grade of Not assessable to the subject:
- Do not perform written work
- Do not perform the oral presentation of the work
- Do not perform any of the exams

Programming evaluation activities

At the beginning of the subject groups will be formed to do the written work. The delivery of written work and oral presentations will be communicated through the virtual campus.

Recovery process

The student can apply for recovery whenever he has submitted to a set of activities that represent at least two thirds of the total grade of the subject. Of these, students who have on average of all the activities of the subject a grade higher than 3.5 may be presented in the recovery.

The partial exams are eliminatory, therefore, a student who has passed a partial exam will not be able to appear for the recovery of this exam. You will have to compulsorily recover those partial exams where the student has obtained a grade lower than 4 regardless of the average obtained according to the calculation of the section "Process and programmed evaluation activities"

The calculation of the grade will be done in the same way as in the continuous evaluation

Procedure for review of qualifications

For each evaluation activity, a place, date and time of revision in which the student can review the activity with the teacher will be indicated. In this context, claims may be made on the activity grade, which will be evaluated

by the faculty responsible for the subject. If the student does not appear in this review, this activity will not be reviewed later.

Ratings

Granting a grade of honor registration is the decision of the faculty responsible for the subject. The regulations of the UAB indicate that MH can only be granted to students who have obtained a final grade equal to or greater than 9.00. You can grant up to 5% of MH of the total number of students enrolled.

Irregularities by the student, copy and plagiarism

Without prejudice to other disciplinary measures deemed appropriate, the irregularities committed by the student that may lead to a variation of the grade of an evaluation act will be scored with a zero. Therefore, copying, plagiarism, cheating, letting copy, etc. in any of the evaluation activities will involve suspending with a zero. The evaluation activities qualified in this way and by this procedure will not be recoverable. If it is necessary to pass any of these evaluation activities to pass the subject, this subject will be suspended directly, without the opportunity to recover it in the same course. In this situation the final grade that will be reflected in the minutes will be a 2.

Evaluation of repeating students

There is no provision for a different evaluation system for repeating students.

Assessment Activities

| Title | Weighting | Hours | ECTS | Learning Outcomes |
|--|-----------|-------|------|---|
| Oral and public presentation of the work | 15% | 1 | 0.04 | 12, 10, 11, 13, 15, 14 |
| Partial exam (items 1, 2 and 3) | 30% | 1 | 0.04 | 12, 1, 2, 3, 4, 5, 6, 9, 7, 8, 10, 11, 13 |
| Partial exam (topics 4, 5 and 6) | 30% | 1 | 0.04 | 12, 1, 2, 3, 4, 5, 6, 9, 7, 8, 10, 11, 13 |
| Written work | 25% | 0 | 0 | 12, 3, 10, 11, 13, 15, 14 |

Bibliography

Books:

| | |
|----------------------|--|
| 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.)

http://cataleg.uab.cat/record=b1323065~S1*cat

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](#)

http://cataleg.uab.cat/record=b1016445~S1*cat

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

http://cataleg.uab.cat/record=b1744514~S1*cat

Títol Ingenieria bioquímica / Francesc Gòdia Casablanques y Josep López Santín (editores) ; Carles Casas Alvero ... [etal.]

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

http://cataleg.uab.cat/record=b1604211~S1*cat

Títol Multi-step enzyme catalysis : biotransformations and chemoenzymatic synthesis / edited by Eduardo Garcia-Junceda

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

http://cataleg.uab.cat/record=b1465205~S1*cat

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/>