Bioorganic Chemistry

Title	Bioorganic Chemistry
Semester	F2023
Master programme in	Kemi / Miljø biologi / Chemical Biology / Molecular Health Science
Type of activity	Course
Teaching language	English
Study regulation	Read about the Master Programme and find the Study Regulations at ruc.dk Læs mere om uddannelsen og find din studieordning på ruc.dk

REGISTRATION AND STUDY ADMINISTRATIVE

Registration	Sign up for study activities at stads selvbetjening within the announced registration period, as you can see on the Studyadministration homepage. When signing up for study activities, please be aware of potential conflicts between study activities or exam dates. The planning of activities at Roskilde University is based on the recommended study programs which do not overlap. However, if you choose optional courses and/or study plans that goes beyond the recommended study programs, an overlap of lectures or exam dates may occur depending on which courses you choose.
Number of participants	The Master Programme/Institute reserves the right to cancel the course if fewer than 8 studentes are registered for the course.
ECTS	5
Responsible for the activity	William Goldring (goldring@ruc.dk) Frederik Diness (diness@ruc.dk)
Head of study	Anders Malmendal (amalm@ruc.dk)
Teachers	
Study administration	INM Registration & Exams (inm-exams@ruc.dk)
Exam code(s)	U60050

ACADEMIC CONTENT

Overall objective	Biological molecules are a source of inspiration for understanding nature and its biosynthetic processes, together with the discovery and development of new medicines. The objective of the course is to describe and illustrate the chemistry of biological molecules, such as the primary and secondary metabolites, together with their biogenetic origin and role in nature. Using examples from nature, the major biosynthetic pathways will be discussed. Furthermore, the important role these molecules play in nature and their pharmacological significance as medicines for humans will be described. A determination of natural product class and biogenesis of biological molecules, based on an analysis of the key building blocks used to assemble their structures in nature, will be covered.
Detailed description of content	The principal roles of biological molecules, including the primary and secondary metabolites (natural products), and their structural and chemical properties will be described and illustrated. A determination of natural product class and biogenesis of biological molecules, based on an analysis of the key building blocks used to assemble their structures in Nature, will be described. Biological molecules, with their interesting structures and important biological activity, are a source of inspiration for understanding Nature and its biosynthetic processes, together with the discovery and development of new medicines. The chemistry of biological molecules, such as the primary and secondary metabolites, together with their biogenetic origin and role in Nature will be described and illustrated. Using examples from Nature, the major biosynthetic pathways for the production of secondary metabolites (natural products), such as fatty acids and polyketides, phenylpropanoids, alkaloids, and isoprenoids, will be discussed. Furthermore, the important role these molecules play in Nature and their pharmacological significance as medicines for humans will be described. **Detailed Teaching Objectives and Learning Outcomes** After successful completion of the course the student will be able to demonstrate and apply: **Knowledge of** ● The structure, chemical properties and biogenetic origins of bioorganic molecules, which includes the primary metabolites (amino acids, carbohydrates, and nucleic acids) and secondary metabolites (natural products). ● The activity of biological molecules, including their role in Nature and medicinal applications in human health. **Skills in** ● Identifying structural elements and features of bioorganic molecules, together with the biosynthetic pathways and mechanisms leading to their structures. ● Problem-solving, independent learning and the application of methods to solve unfamiliar problems. **Learning outcomes** ● Read and understand scientific literature concerning bioorganic molecules. ● Be able to examine and classify a natural product structure, and understand and/or propose how it is constructed in Nature using the basic building blocks of biosynthesis. ● Understand the chemical reactivity of bioorganic molecules.

- Have a basic knowledge of the role and activity of biological molecules.

Course material and Reading list

Textbook:

Organic Chemistry with Biological Applications, 3rd Ed., J. McMurry, Cengage Learning, 2015. Chapters 19-25.

Other recommended reading:

Fox and Whitesell, Organic Chemistry, 3rd Ed., Jones and Bartlett, London, 2004.

Mann, Chemical Aspects of Biosynthesis, ed. Davies, Oxford University Press, Oxford, 1994. Oxford Chemistry Primers No 20.

Hanson, Natural Products: the Secondary Metabolites, ed. Abel, Royal Society of Chemistry, Cambridge, 2003, Tutorial Chemistry Texts No 17.

Overall plan and expected work effort

5 ECTS corresponds to 135 hours of work

The work load for the student:

Preparation time Contact time

- Lectures and workshops: 40 hours

Study and preparation time:

- Reading and self-revision problems: 20 hours
- Theoretical problem preparation: 20 hours
- Reading time: 25 hours
- Revision and exam preparation: 30 hours

Total 135 hours

Format

Evaluation and feedback

The course includes formative evaluation based on dialogue between the students and the teacher(s).

Students are expected to provide constructive critique, feedback and viewpoints during the course if it is needed for the course to have better quality. Every other year at the end of the course, there will also be an evaluation through a questionnaire in SurveyXact. The Study Board will handle all evaluations along with any comments from the course responsible teacher.

Furthermore, students can, in accordance with RUCs 'feel free to state your views' strategy through their representatives at the study board, send evaluations, comments or insights form the course to the study board during or after the course.

Programme

The course is organized around a combination of lectures (powerpoint, boardwork, and discussion; 30 hrs) and problem solving workshops (10 hrs). See study.ruc.dk for a detailed coure schedule, and the course page on Moodle for a schedule, course description and other documents, together with lecture notes and problem solving questions.

Each lecture section is followed by a problem solving workshop, organized according to the course schedule on Moodle. Students will find

	questions associated with a particular lecture section either at the end of the set of lecture notes, or as separate files uploaded to the course Moodle page. Students are expected to complete or attempt the problem solving questions associated with a particular workshop, before it takes place, and be prepared to present their solutions, in whole or in part, during the workshop.

ASSESSMENT

Overall learning outcomes	After successful completion of the course the student will be able to: • account for the structure, chemical properties and biogenetic origins of bioorganic molecules, which includes the primary metabolites (amino acids, carbohydrates, and nucleic acids) and secondary metabolites (natural products) • account for the activity of biological molecules and relate this to their role in nature and medicinal applications in human health • identify structural elements and features of bioorganic molecules, together with the biosynthetic pathways and mechanisms leading to their structures • apply this knowledge in new contexts • use scientific literature concerning bioorganic molecules in problem solving • examine and classify a natural product structure, and understand and/or propose how it is constructed using the basic building blocks of biosynthesis • relate the chemical reactivity of bioorganic molecules to their chemical structure.
Form of examination	Individual written invigilated exam. The duration of the exam is 3 hours. Permitted support and preparation materials for the exam: Computer without internet access during the exam, pocket calculator, course material and own notes. Assessment: Pass/Fail. Moderation: Internal co-assessor.
Form of Re-examination	Samme som ordinær eksamen / same form as ordinary exam
Type of examination in special cases	
Examination and assessment criteria	The individual written invigilated exam is based on a set of problem solving questions. Assesment criteria: • account for the structure, chemical properties and biogenetic origins of bioorganic molecules, which includes the primary metabolites (amino acids, carbohydrates, and nucleic acids) and secondary metabolites (natural products) • account for the activity of biological molecules and relate this to their role in nature and medicinal applications in human health

- identify structural elements and features of bioorganic molecules, together with the biosynthetic pathways and mechanisms leading to their structures
- apply problem based skills and methods to solve unfamiliar problems
- examine and classify a natural product structure, and understand and/or propose how it is constructed in Nature using the basic building blocks of biosynthesis
- relate the chemical reactivity of bioorganic molecules to their chemical structure

Exam code(s) Exam code(s) : U60050

Course days:

Hold: 1

Bioorganic Chemistry (CB)

time 09-02-2023 10:15 til
09-02-2023 12:00

location 12.2-079 - teori 12.2 (15)

Teacher William Goldring (goldring@ruc.dk)

Bioorganic Chemistry (CB)

time 13-02-2023 14:15 til
13-02-2023 16:00

location 12.2-079 - teori 12.2 (15)

Teacher William Goldring (goldring@ruc.dk)

Bioorganic Chemistry (CB)

time 16-02-2023 10:15 til
16-02-2023 12:00

location 12.2-079 - teori 12.2 (15)

Teacher William Goldring (goldring@ruc.dk)

Bioorganic Chemistry (CB)

time	23-02-2023 10:15 til 23-02-2023 12:00
location	12.2-079 - teori 12.2 (15)
Teacher	William Goldring (goldring@ruc.dk)

Bioorganic Chemistry (CB)

time	27-02-2023 14:15 til 27-02-2023 16:00
location	12.2-079 - teori 12.2 (15)
Teacher	William Goldring (goldring@ruc.dk)

Bioorganic Chemistry (CB)

time	02-03-2023 10:15 til 02-03-2023 12:00
location	12.2-079 - teori 12.2 (15)
Teacher	William Goldring (goldring@ruc.dk)

Bioorganic Chemistry (CB)

time	09-03-2023 10:15 til 09-03-2023 12:00
location	12.2-079 - teori 12.2 (15)
Teacher	William Goldring (goldring@ruc.dk)

Bioorganic Chemistry (CB)

time	13-03-2023 14:15 til 13-03-2023 16:00
location	12.2-079 - teori 12.2 (15)
Teacher	William Goldring (goldring@ruc.dk)

Bioorganic Chemistry (CB)

time	16-03-2023 10:15 til 16-03-2023 12:00
location	12.2-079 - teori 12.2 (15)
Teacher	William Goldring (goldring@ruc.dk)

Bioorganic Chemistry (CB)

time	23-03-2023 10:15 til 23-03-2023 12:00
location	12.2-079 - teori 12.2 (15)
Teacher	William Goldring (goldring@ruc.dk)

Bioorganic Chemistry (CB)

time	27-03-2023 14:15 til 27-03-2023 16:00
location	12.2-079 - teori 12.2 (15)
Teacher	William Goldring (goldring@ruc.dk)

Bioorganic Chemistry (CB)

time	30-03-2023 10:15 til 30-03-2023 12:00
location	12.2-079 - teori 12.2 (15)
Teacher	William Goldring (goldring@ruc.dk)

Bioorganic Chemistry (CB)

time	03-04-2023 14:15 til 03-04-2023 16:00
location	12.2-079 - teori 12.2 (15)
Teacher	Frederik Diness (diness@ruc.dk)

Bioorganic Chemistry (CB)

time	13-04-2023 10:15 til 13-04-2023 12:00
location	12.2-079 - teori 12.2 (15)
Teacher	Frederik Diness (diness@ruc.dk)

Bioorganic Chemistry (CB)

time	17-04-2023 14:15 til 17-04-2023 16:00
location	12.2-079 - teori 12.2 (15)
Teacher	William Goldring (goldring@ruc.dk) Frederik Diness (diness@ruc.dk)

Bioorganic Chemistry (CB)

time	20-04-2023 10:15 til 20-04-2023 12:00
location	12.2-079 - teori 12.2 (15)
Teacher	Frederik Diness (diness@ruc.dk)

Bioorganic Chemistry (CB)

time	24-04-2023 14:15 til 24-04-2023 16:00
location	12.2-079 - teori 12.2 (15)
Teacher	William Goldring (goldring@ruc.dk) Frederik Diness (diness@ruc.dk)

Bioorganic Chemistry (CB)

time	27-04-2023 10:15 til 27-04-2023 12:00
location	12.2-079 - teori 12.2 (15)
Teacher	Frederik Diness (diness@ruc.dk)

Bioorganic Chemistry (CB)

time	01-05-2023 14:15 til 01-05-2023 16:00
location	12.2-079 - teori 12.2 (15)
Teacher	William Goldring (goldring@ruc.dk) Frederik Diness (diness@ruc.dk)

Bioorganic Chemistry (CB)

time	04-05-2023 10:15 til 04-05-2023 12:00
location	12.2-079 - teori 12.2 (15)
Teacher	William Goldring (goldring@ruc.dk)

Bioorganic Chemistry (CB)

time	08-05-2023 14:15 til 08-05-2023 16:00
location	12.2-079 - teori 12.2 (15)
Teacher	William Goldring (goldring@ruc.dk)

Bioorganic Chemistry (CB)

time	11-05-2023 10:15 til 11-05-2023 12:00
location	12.2-079 - teori 12.2 (15)
Teacher	William Goldring (goldring@ruc.dk)

Bioorganic Chemistry - Exam (CB)

time	30-05-2023 10:00 til 30-05-2023 13:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	07.2-008 - undervisningslokale (128)

Bioorganic Chemistry - Reexam (CB)

time	09-08-2023 10:00 til 09-08-2023 13:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	07.1-008 - undervisningslokale (60)