

# Opasraportti

## LuTK - Biochemistry (2013 - 2014)

### Biochemistry Degree Program 2013-2014

Biochemistry is the study of life at the molecular level. Based on underlying chemical principles biochemists study the details of biological systems at both macro- and micro- scales in whole organisms, in cells, in the test tube and by structural and computational based analysis. Even the simplest living systems are extremely complicated, and comprise a vast array of interconnecting processes. These processes are said to be governed by our genes, the genetic code which makes us who and what we are. Genes are not everything though; the information encoded within them is converted into proteins and it is proteins that are the primary workers in the cell, playing fundamental roles in all aspects of biochemistry. Smaller molecules also play a key role, both through the complex cycles of metabolism, generating energy and essential cellular precursors from nutrients taken from the external world and by playing a role in modulating the function of genes and of proteins.

Sometimes cellular processes go wrong, due to genetic mutations or to external environmental factors or to chance events, and then disease states such as cancer, diabetes, cystic fibrosis, Alzheimer's arise. Only by understanding both the details of the underlying mechanisms of cellular action and the complex interplay of 30,000 gene products, a million different proteins and thousands of metabolites can these diseases be understood and effective treatments generated. These treatments may be small molecules, designed both to be targeted to the appropriate site within the body and to inhibit a specific cellular process through rational drug design, or they may be macromolecules, such as proteins produced on an industrial scale by the biotech industry, or there is the growing area of gene therapy, replacing a loss of function by introducing a working gene.

All of this, the understanding of the mechanisms of cellular action at a molecular level along with the rational design and production of therapeutic treatments, is the work of the biochemist.

### Education

The education of biochemists was changed in autumn 2005 to a new degree system across the EU. The first degree is a 3-year candidate degree (BSc, Bachelor of Science) followed by a 2-year master degree (MSc, Master of Science). The purpose of the change is to harmonize degrees in biochemistry in different universities, shorten graduating times and facilitate transfer of students between universities in different EU countries. The first MSc degree programmes under a new degree system started in autumn 2008. Since autumn 2007, the Department of Biochemistry has organized a Master Degree Programme in Protein Science and Biotechnology for international students.

The Mission of the Department of Biochemistry is based on the fact that current and high level teaching cannot be given without strong basic research. This can be seen in the operational principles of the department. Innovative specialists will be needed in the field. Teaching is seen as an entity where high quality basic and doctoral education, including post doctoral training abroad, is a fundamental part of the departmental structure.

Post graduate training has an important role in the department. Research work starts at the end of MSc phase when a student is doing his Pro gradu project with research work towards a PhD being started after this. Many research groups of international level are operating in the department and about 40 PhD students are working here at present. Post graduate training involves high level training and is linked to clear research projects.

Most of the students who have graduated from the Department of biochemistry, University of Oulu are working in universities within research and teaching, while some are employed by industry, business or by different educational institutes for tasks in research, development, communication and management. One third of the graduated students

have taken the licentiate degree and about one fifth have PhD degree. Most of the latter have spent a post-doctoral period abroad.

According to the decision of the University of Oulu Board of Directors the Department of Biochemistry will merge with the Department of Medical Biochemistry and Molecular Biology, currently part of the Institute of Biomedicine at the Faculty of Medicine. The combined unit will be a faculty level independent institute. The administrative merger will start 1st January 2014. The physical merger will occur later once suitable space has been found and renovated. The new institute will be located on the Kontinkangas campus. While the curricula of the BSc and MSc degrees will not change, the teaching arrangements will change after the physical merger. The first year and the autumn term of the second year of the BSc will continue to be taught on the Linnanmaa campus. The remaining studies in the BSc and all MSc courses offered by the new institute will be taught on the Kontinkangas campus.

## Studies

The Amanuensis of the department helps in matters related to studies. In questions concerning a single study module student can contact the responsible person of the course

All courses and exams organized by department must be subscribed to via WebOodi (<https://weboodi oulu.fi/oodi>) before the relevant deadline.

The recommended order for courses for a bachelor degree is presented in the figure. For many biochemistry courses there are some previous courses required as a prerequisite.

As a part of the studies in biochemistry, a student will use literature and/or results from course experiments to make many kinds of written exercises (reports, Pro gradu etc) and presentations. A report cannot be a copy of the other text and all citations from other texts or figures must be clearly presented as references. Copying, using of the text of other students and other forms of plagiarism are forbidden and will lead to punishment and rejection of the report.

## Recommended timing for B.Sc. courses in Biochemistry

### Yr3 autumn

#### BIOCHEMISTRY

Cellular communication

Introduction to immunology \*

Essay (B.Sc. thesis)

Optional studies

#### LANGUAGE CENTER

Swedish

#### Biology

### Yr3 spring

#### BIOCHEMISTRY

Physiological biochemistry \*

Radiation and safety \*

Maturity test

Final examination

Virology\* (start 2015)

#### BIOLOGIA

Animal physiology, exercises \*

Developmental biology-histology, lecturers \*

Developmental biology-histology, exercises \*

## CHEMISTRY

## LABORATORY ANIMAL CENTRE

Laboratory course in organic chemistry I \*

Using animals in research - carrying out procedures \*

## SCIENCE AND TECHNOLOGY LIBRARY TELLUS

Introduction to information retrieval\*

### Yr2 autumn

### Yr2 spring

## BIOCHRMISTRY

## BIOCHEMISTRY

Molecular biology I

Physical biochemistry

Metabolism II

Cellular biology

Protein Chemistry I

## BIOLOGY

Concepts of genetics

## CHEMISTRY

Animal physiology, lectures \*

Organic chemistry I \*

## MATHEMATICAL SCIENCES

Introduction to analytical chemistry \*

Basic methods in statistics I

### Yr1 autumn

### Yr1 spring

## BIOCHEMISTRY

## BIOCHEMISTRY

Orientation

Metabolism I

Biomolecules for biochemists

Biochemical methodologies I

Mikrobiology

## Transferable skills for biochemists

**Language Center**

English for biochemists I

**Biology**

Cell biology

**Chemistry**

General and inorganic chemistry I

General and inorganic chemistry II

Introductory laboratory course in chemistry

Introduction to organic chemistry

\* Recommended optional studies

**Biochemistry as a minor subject**

Biochemistry courses can be attended freely by students from other departments with only one restriction: We reserve right to not allow students on the course if the work places available in the laboratory or equipment available are insufficient also for laboratory exercises the student must have sufficient prior practical experience.

All courses and exams organized by department must be subscribed to via WebOodi (<https://weboodi oulu.fi/oodi>) before the relevant deadline.

A record of biochemistry as a minor subject will be given when the amount of accepted studies is at least 15 credits.

**Examinations and grades**

The time and place of examinations are informed via timetables in the home page of department (<http://www.biochem oulu.fi>). Students must subscribe to exams via WebOodi (<https://weboodi oulu.fi/oodi>) before the relevant deadline. The grading scale is 0-5. The lowest passing grade is 1. Some courses are graded pass/fail. Three final exams are organized for each course. A course must be passed during the given time, not in another year.

The final grade for Bachelor and Master degree in biochemistry and for biochemistry as a minor subject will be calculated as follows: the Grades of graded courses are multiplied by the number of credits. The final grade is the sum of products divided by the total number of credits.

Final grades will be determined as follows:

1/5	Sufficient	1,00 – 1,49
2/5	Satisfactory	1,50 – 2,49
3/5	Good	2,50 – 3,49
4/5	Very Good	3,50 – 4,49
5/5	Excellent	4,50 – 5,00

The final grade will be given by Tuula Koret, Faculty of Science (YL132)

## Lines and degrees

Department of biochemistry offers one bachelors level degree, **Biochemistry** and two masters level degrees, **Protein Science and Biotechnology** and **Molecular and Cellular Biology**.

- 1) **Biochemistry**. B.Sc. Degree In Finnish and in English
- 2) **Protein Science and Biotechnology**. M.Sc. Degree entirely in English.
- 3) **Molecular and Cellular Biology**. M.Sc. Degree In Finnish and in English.

In addition, the Department of Biochemistry offers a Master's Degree Programme in Protein Science and Biotechnology for international students, in which curriculum differs slightly from the Protein Science and Biotechnology MSc.

## Bachelor of Science (Biochemistry)

Education leading to a Bachelor's degree in biochemistry provides the student with:

- apply fundamental knowledge in biochemistry and ancillary subjects and follow and evaluate developments in that field;
- apply scientific thinking and to use scientific methods;
- relate to and discuss the high public awareness and impact on society of biochemistry;
- complete responsible and goal-oriented teamwork and in individual work;
- capability to apply the acquired knowledge in working life;
- communicate in Finnish and Swedish as stipulated in the Degree Statute, as well as proficiency in English;
- demonstrate transferable and cognitive skills, including the ability to communicate effectively.

The credit requirement for the lower university degree of Bachelor of Science (Biochemistry) is 180. Studies are organized such that students can complete the degree within three years of full-time study.

Obligatory course units at the beginning of studies are common to all students, but students also select course units specific to their longer-term goals.

A Bachelor's degree consists of the following elements:

**B.Sc. Degree**

General studies	7 credits
Basic studies in Biochemistry	30 credits
Intermediate studies in Biochemistry	56 credits
Maturity test	0 credits
Chemistry	21 credits
Biology and statistic	18 credits
Optional studies*	48 credits
<b>Total at least</b>	<b>180 credits</b>

\* BSc studies must include a minor subject that comprises at least 25op of basic / intermediate studies

**Master of Science (Protein Science and Biotechnology; Molecular and cellular biology)**

Education leading to a Master's degree in Protein Science and Biotechnology or Molecular and cellular biology provides the student with:

- apply scientific knowledge and methods to topical tasks and to undertake scientific research with supervision;
- analyze information and data and their setting within a theoretical network accompanied by critical analysis and assessment;
- integrate the subject area as a coherent whole;
- communicate with good language skills for national and international tasks;
- demonstrate transferable and cognitive skills, including the ability to communicate effectively and critically about science using a variety of approaches;
- apply further knowledge, including the abilities to conceive, design and implement independent research and
- demonstrate capability for scientific postgraduate work.

A Master degree consists of the following elements:

**M.Sc. Degree**

Obligatory advanced courses	69-77 credits
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Maturity test	0 credits
Optional studies	43-51 credits
<b>Total at least</b>	<b>120 credits</b>

## STUDIES FOR B.Sc. DEGREE

<b>General studies 7 credits</b>	<b>credits</b>	<b>Semester</b>
Orientation (740072Y)	1	Autumn yr 1
English for biochemists I (902100Y)	3	Autumn yr 1-Spring yr 1
Swedish (901004Y)	3	Autumn yr 3
<b>Basic studies in biochemistry 30 credits</b>		
Biomolecules for biochemists (740143P)	8	Autumn yr 1-Spring yr 1
Biochemical methodologies I (740144P)	8	Autumn yr 1-Spring yr 1
Metabolism I (740146P)	6	Spring yr 1
Physical biochemistry (740145P)	6	Spring yr 2
Transferable skills for biochemists (740150P)	2	Spring yr 1
<b>Intermediate studies in biochemistry 56 credits</b>		
Molecular biology I (740361A)	8	Autumn yr 2
Mikrobiology (740363A)	6	Spring yr 1
Protein chemistry I (740364A)	8	Autumn yr 2
Cellular biology (740362A)	6	Spring yr 2
Metabolism II (740367A)	6	Autumn yr 2
Essay (B.Sc. thesis) (740376A)	10	Autumn yr 3

Cellular communication (740366A)	6	Autumn yr 3
Maturity test (740377A)	0	Spring yr 3
Final examination (740372A)	6	Spring yr 3
<b>Chemistry 21 credits</b>		
General and inorganic chemistry I (780114P)	6	Autumn yr 1
General and inorganic chemistry II (780115P)	6	Autumn yr 1
Introductory laboratory course in chemistry (780122P)	3	Autumn yr 1
Introduction to organic chemistry (780103P)	6	Autumn yr 1-Spring yr 1
<b>Biology and statistic 18 op</b>		
Cell biology (750121P)	5	Autumn yr 1
Concepts of genetics (753124P)	4	Spring yr 2
Basic methods in statistics I (806109P)	9	Spring yr 2
<b>Recommended optional studies</b>		
Radiation and safety (740368A)	5	Spring yr 3
Introduction to immunology (740379A)	3	Autumn yr 3
Virology (740380A) (starts 2015)	3	Spring yr 3
Physiological biochemistry (740371A) *	4	Spring yr 3
Animal physiology, lectures (751388A) *	4	Spring yr 2
Animal physiology, exercises (755318A)	4	Autumn yr 3
Developmental biology-histology, lectures (751367A)	4	Spring yr 3
Developmental biology-histology, exercises (755317A)	5	Spring yr 3



Introduction to analytical chemistry (780111P)	4	Autumn yr 2
Laboratory course in organic chemistry I (780332A)	4	Autumn yr 3
Organic chemistry I	6	Autumn yr 2
Using animals in research - carrying out procedures (040900S)	2.5-3	Spring yr 3
Tutoring / confidential posts (740074Y)	1,5	Year 2-3
Introduction to information retrieval (030005P)	1	Year 3

\* at least one of these is required

## Optional studies

BSc degree in biochemistry includes 48 credits of optional studies. Recommended optional courses are put together in the time table so that they do not clash with obligatory courses. However, students are free to select other university courses either in Finland or abroad. The content of courses must not be too similar to obligatory courses. Courses taken outside University of Oulu should be agreed with the departmental amanuensis in advance. BSc studies must include a minor subject that comprises at least 25op of basic / intermediate studies. Students are advised to do the minor subject in either chemistry or biology (compulsory studies in these subjects can be included in the 25op total).

### Courses for minor subject students

	credits	semester
Biomolecules (740148P)	5	Autumn-Spring
Biomolecules for Bioscientists (740147)	8	Autumn-Spring
Metabolism I (740149P)	4	Spring
Microbiology (740374A)	3	Spring
Molecular biology I (740373A)	4	Autumn

## STUDIES FOR M.Sc.DEGREE

In addition to compulsory and optional specialist courses (minimum 4 courses) student must select other courses listed in any MSc line, all together at least 108 credits. The remaining 12 credits can be either any other MSc courses or any other suitable courses according to student's career aspirations. Student is free to take courses from both lines and decide later according to subject of Pro Gradu work which MSc line to graduate in.

### Protein Science and Biotechnology (120 credits)

Compulsory courses	credits	Sen
Protein chemistry II (744620S)	3	Autu
Molecular biology II (744621S)	3	Autu
Biochemical methodologies II (747608S)	8	Autu
English for biochemists II ( 902101Y)	3	Spr
Orientation to research work (744617S) / Orientation to biochemical work (744624S)	12-20	Autu
Pro gradu experimental work in protein science and biotechnology (747691S)	28	
Pro gradu thesis in protein science and biotechnology (747692S)	20	
Maturity test (M.Sc. degree) (740672S)	0	
<b>Optional specialist courses (a minimum of 4 of these courses must be taken)</b>		
Basic aspects of protein crystallographic methods (747605S)	3	Autu
Structural enzymology (747606S)	3	Spr
Biochemistry of protein folding (747611S)	3	Spr
Systems biology (744619S)	4	Autu
Bioinformatics (747603S)	2,5	Spr
Biological NMR spectroscopy (784637S, Dept. of Chemistry)	3	Spr
Introduction to biocomputing (747604S)	3	Autu
Introduction to membrane proteins I (747609S)	3	Spr

Introduction to membrane proteins II (747610S)	2,5	Auti
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### Other optional courses

Dissertation (744618S)	18	
Scientific presentation (744625S)	1-2	
Final examination in protein science and biotechnology (747693S)	9	
Yeast genetics (744623S)	3-6	Spr
Advanced information skills (300002M, Science and Technology library Tellus)	1	
Bioreactor technology (488304S, Bioprocess Engineering Laboratory)	6	Auti
Advanced course for biotechnology (488305S, Bioprocess Engineering Laboratory)	5	Auti
Optional courses at any university	0-12	
Any other MSc level course offered by the Department of Biochemistry		

## Molecular and cellular biology (120 credits)

Obligatory courses	credits	Sen
Protein chemistry II (744620S)	3	Auti
Molecular biology II (744621S)	3	Auti
English for biochemists II ( 902101Y)	3	Spr
Orientation to research work (744617S) / Orientation to biochemical work (744624S)	12-20	Auti
Pro gradu experimental work in molecular and cellular biology (743694S)	28	
Pro gradu thesis in molecular and cellular biology (743695S)	20	
Maturity test (740672S)	0	

**Optional specialist courses (a minimum of 4 of these courses must be taken)**

Biochemistry of inherited diseases (743604S)	3	Autu
Systems biology (744619S)	4	Autu
Neurobiology (743655S)	4	Spri
Bioinformatics (747603S)	2.5	Spri
Biochemistry of cell organelles (743659S)	3	Autu
Cell cycle, DNA replication and repair (743658S)	2.5	Spri
Tumor cell biology (743657S)	3	Spri

**Other optional courses**

Biochemical methodologies II (747608S)	8	Autu
Dissertation (744618S)	18	
Virology (743661S) (starts 2015)	3	spri
Scientific presentation (744625S)	1-2	
Introduction to immunology (743660S)	3	Autu
Final examination in molecular and cellular biology (743696S)	9	
Yeast genetics (744623S)	3-6	Spri
Basic aspects of protein crystallographic methods (747605S)	3	Autu
Structural enzymology (747606S)	3	Spri
Biochemistry of protein folding (747611S)	3	Spri
Advanced information skills (300002M, Tiedekirjasto Tellus)	1	
Biological NMR spectroscopy (784637S, Dept. of Chemistry)	3	Spri

Introduction to biocomputing (747604S)	3	13 Autu
Introduction to membrane proteins I (747609S)	3	Spri
Introduction to membrane proteins II (747610S)	2,5	Autu
Genetic transformation of plants (756625S) (Dept. of Biology)	4	Autu
Secondary metabolism of plants (756618S)(Dept. of Biology)	4	Spri
Plant hormones (756627S)(Dept. of Biology)	4	Spri
Biomedical imaging methods (580402S) (Institute of biomedicine)	4	
Optional courses at any university	0-12	
Any other MSc level course offered by the Department of Biochemistry		

### **International Master´s Degree Programme in Protein Science and Biotechnology (120 credits)**

<b>Obligatory courses</b>	<b>credits</b>	<b>Semester</b>
Protein production and analysis (747601S)	8	Autumn yr1
Biochemical methodologies II (747608S)	8	Autumn yr1
Orientation to research work (744617S) / Orientation to biochemical work (744624S)	12-18	Spring yr 1
Pro gradu experimental work in protein science and biotechnology (747691S)	28	
Pro gradu thesis in protein science and biotechnology (747692S)	20	
Maturity test (M.Sc. degree) (740672S)	0	
<b>Optional specialist courses (at least 4 must be taken)</b>		
Basic aspects of protein crystallographic methods (747605S)	3	Autumn
Structural enzymology (747606S)	3	Spring

Biochemistry of protein folding (747611S)	3	Spring
Systems biology (744619S)	4	Spring
Bioinformatics (747603S)	2.5	Spring
Introduction to biocomputing (747604S)	3	Autumn
Introduction to membrane proteins I (747609S)	3	Spring
Introduction to membrane proteins II (747610S)	2.5	Autumn
Biological NMR spectroscopy (784637S) (Dept. of Chemistry)	3	Spring

### Optional courses

Dissertation (744618S)	18	
Scientific presentation (744625S)	1-2	
Final examination in protein science and biotechnology (747693S)	9	
English for biochemists II ( 902101Y)	3	Spring yr 1
Yeast genetics (744623S)	3-6	Spring
Information Skills for foreign degree students (030008P) Science and Technology library Tellus)	1	
Bioreactor technology (488304S) (Bioprocess Engineering Laboratory)	6	Autumn
Advanced course for biotechnology (488305S) (Bioprocess Engineering Laboratory)	5	Autumn
Optional courses at any university	0-12	
Any other MSc level course offered by the Department of Biochemistry		

### Optional courses at any universities

Up to 12 credits of courses can be taken from other suitable courses taught at any university. Also courses given by research units eg. Biocenter Oulu will be accepted. Courses must be connected to biochemistry or logically support some aspect of it and they will have to be at an appropriate level. The content of the courses must not be too similar

to other courses which have counted towards the students BSc degree or towards their MSc. In all cases the departmental amanuensis should be contacted to confirm acceptance / suitability. We would advise that this is done before the course is taken, especially in the case of courses taken from universities outside Finland. A list of previously accepted courses can be found on the teaching pages of the departmental web pages, please consult this list before contacting the amanuensis.

### Department Staff

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fax: +358-8-0294 48 1141, tel +358-8-0294 48 1200, [http://www.biochem.oulu.fi/index\\_e.html](http://www.biochem.oulu.fi/index_e.html)

Updated list of staff [http://www.biochem.oulu.fi/staff/index\\_e.html](http://www.biochem.oulu.fi/staff/index_e.html)

## Tutkintorakenteet

### B.Sc. degree, Biochemistry

Tutkintorakenteen tila: published

Lukuvuosi: 2013-14

Lukuvuoden alkamispäivämäärä: 01.08.2013

#### General studies (7 op)

General studies are obligatory for all students. For biochemists the Swedish course is 3 credits.

902100Y: English for Biochemists 1, 3 op

740072Y: Orientation, 1 op

901004Y: Swedish, 2 - 3 op

#### Basic studies in biochemistry (30 op)

Basic studies are obligatory for all students.

740144P: Biochemical Methodologies I, 8 op

740143P: Biomolecules for Biochemists, 8 op

740146P: Metabolism I, 6 op

740145P: Physical Biochemistry, 6 op

740150P: Transferable skills for biochemists, 2 op

#### Intermediate studies in biochemistry (56 op)

Intermediate studies are obligatory for all students.

740362A: Cellular Biology, 6 op

740366A: Cellular Communication, 6 op

740376A: Essay (B.Sc. thesis), 10 op

740372A: Final Examination, 6 op

740377A: Maturity test (B.Sc. degree), 0 op

740367A: Metabolism II, 6 op

740363A: Microbiology, 6 op

740361A: Molecular Biology I, 8 op

740364A: Protein Chemistry I, 8 op

## Chemistry (21 op)

The chemistry courses below are obligatory for all students.

- 780114P: General and Inorganic Chemistry I, 6 op
- 780115P: General and Inorganic Chemistry II, 6 op
- 780103P: Introduction to Organic Chemistry, 6 op
- 780122P: Introductory Laboratory Course in Chemistry, 3 op

## Biology and statistic (18 op)

The courses below are obligatory for all students. Within the Concepts of genetics course biochemists take parts 1 and 3 (4 credits).

- 806109P: Basic Methods in Statistics I, 9 op
- 750121P: Cell biology, 5 op
- 753124P: Concepts of genetics, 4 - 7 op

## Optional studies (vähintään 48 op)

BSc degree in biochemistry includes 48 credits of optional studies. Recommended optional courses are put together in the time table so that they do not clash with obligatory courses. However, students are free to select other university courses either in Finland or abroad. The content of courses must not be too similar to obligatory courses. Courses taken outside University of Oulu should be agreed with the departmental amanuensis in advance. BSc studies must include a minor subject that comprises at least 25op of basic / intermediate studies. Students are advised to do the minor subject in either chemistry or biology (compulsory studies in these subjects can be included in the 25op total).

If You add other than recommended optional courses please, select option "other optional studies".

### Recommended optional studies

H325420: Recommended optional studies - BSc, 4 - 51 op

#### *Electives*

- 780389A: Organic Chemistry I, 6 op
- 780111P: Introduction to Analytical Chemistry, 4 op
- 751388A: Animal physiology, lectures, 4 op
- 755318A: Animal physiology, exercises, 4 op
- 030005P: Information Skills, 1 op
- 780329A: Laboratory Course I in Organic Chemistry, 4 op
- 740379A: Introduction to immunology, 3 op
- 740368A: Radiation and Safety, 5 op
- 740371A: Physiological Biochemistry, 4 op
- 740380A: Virology, 3 op
- 040900S: Using animals in research - carrying out procedures, 2,5 - 3 op
- 751367A: Developmental biology-histology, lectures, 4 op
- 755317A: Developmental biology-histology, exercises, 5 op
- 740074Y: Tutoring/confidential posts, 1,5 op

### Other optional studies

## International MSc in Protein Science and Biotechnology

Tutkintorakenteen tila: published

Lukuvuosi: 2013-14



Lukuvuoden alkamispäivämäärä: 01.08.2013

## Compulsory courses (76 - 82 op)

### Compulsory courses

H325423: Compulsory courses - Int MSc, Protein science and biotechnology, 76 op

#### *Obligatory*

747601S: Protein production and analysis, 8 op

747608S: Biochemical methodologies II, 8 op

747691S: Pro gradu experimental work in protein science and biotechnology, 28 op

747692S: Pro gradu thesis in protein science and biotechnology, 20 op

740672S: Maturity test (M.Sc. degree), 0 op

*Orientation to research work: work done in an academic or industrial research group. Orientation to biochemical work: work done in a non research group environment. For Int MSc in protein science and biotechnology line the sum of credits of both courses must be 12-18 ECTS cr.*

744617S: Orientation to research work, 0 - 20 op

744624S: Orientation to biochemical work, 0 - 20 op

### Optional specialist courses (at least 4 must be taken)

H325425: Optional specialist courses - MSc / Int MSc, Protein science and biotechnology, 11,5 - 21,5 op

#### *Optional specialist courses (a minimum of 4 of these courses must be taken)*

747605S: Basic aspects of protein crystallographic methods, 3 op

747606S: Structural enzymology, 3 op

747611S: Biochemistry of protein folding, 3 op

744619S: Systems biology, 4 op

747603S: Bioinformatics, 2,5 op

784637S: Biological NMR Spectroscopy, 3 op

747604S: Introduction to biocomputing, 3 op

### Optional courses

In addition to compulsory and optional specialist courses (minimum 4 courses) student must select other courses listed in any MSc line, all together at least 108 credits. The remaining 12 credits can be either any other MSc courses or any other suitable courses according to student's career aspirations.

If You plan to take courses other than listed in any MSc line, please select "Optional courses at any university (0-12 ECTS)" option below (choose the degree structure page).

### Optional courses (counted to 108 credits quota)

H325429: Optional courses - Int MSc, Protein science and biotechnology, 4,5 - 32,5 op

#### *Optional courses*

744618S: Dissertation, 18 op

744625S: Scientific presentation, 1 - 2 op

747693S: Final examination in protein science and biotechnology, 9 op

030008P: Information Skills for foreign degree students, 1 op

488304S: Bioreactor Technology, 6 op

488305S: Advanced Course for Biotechnology, 5 op

744623S: Yeast genetics, 6 op

743661S: Virology, 3 op

743660S: Introduction to immunology, 3 op

743655S: Neurobiology, 4 op

743659S: Biochemistry of cell organelles, 3 op

743658S: Cell cycle, DNA replication and repair, 2,5 op

743657S: Tumor cell biology, 3 op

580402S: Biomedical Imaging Methods, 1 - 5 op

756625S: Genetic transformation of plants, 4 - 8 op

756618S: Secondary metabolism of plants, 4 op

756627S: Plant hormones, 5 op

### Optional courses at any university (0-12 ECTS)

746601S: Advanced studies in biochemistry in other universities, 0 - 75 op

746605S: Advanced studies in biochemistry passed abroad, 0 - 75 op

## M.Sc. degree, Biochemistry (Molecular and cellular biology)

Tutkintorakenteen tila: published

Lukuvuosi: 2013-14

Lukuvuoden alkamispäivämäärä: 01.08.2013

### Compulsory courses (69 - 77 op)

H325421: Compulsory courses - MSc, molecular and cellular biology, 69 op

#### *Obligatory courses*

744620S: Protein chemistry II, 3 op

744621S: Molecular biology II, 3 op

902101Y: English for Biochemists 2, 3 op

743694S: Pro gradu experimental work in molecular and cellular biology, 28 op

743695S: Pro gradu thesis in molecular and cellular biology, 20 op

740672S: Maturity test (M.Sc. degree), 0 op

*Orientation to research work: work done in an academic or industrial research group. Orientation to biochemical work: work done in a non research group environment. The sum of credits of both courses must be 12-20 ECTS.*

744617S: Orientation to research work, 0 - 20 op

744624S: Orientation to biochemical work, 0 - 20 op

### Optional specialist courses (at least 4 must be taken) (11 - 22 op)

H325424: Optional specialist courses - MSc, molecular and cellular biology, 11 - 22 op

#### *Optional specialist courses (a minimum of 4 of these courses must be taken)*

743604S: Biochemistry of inherited diseases, 3 op

744619S: Systems biology, 4 op

743655S: Neurobiology, 4 op

747603S: Bioinformatics, 2,5 op

743659S: Biochemistry of cell organelles, 3 op

743658S: Cell cycle, DNA replication and repair, 2,5 op

743657S: Tumor cell biology, 3 op

### Optional courses (vähintään 21 op)

In addition to compulsory and optional specialist courses (minimum 4 courses) student must select other courses listed in any MSc line, all together at least 108 credits. The remaining 12 credits can be either any other MSc courses or any other suitable courses according to student's career aspirations. Student is free to take courses from both lines and decide later according to subject of Pro Gradu work which MSc line to graduate in.

If You plan to take courses other than listed in any MSc line, please select "Optional courses at any university (0-12 ECTS)" option below (choose the degree structure page).

### Optional courses (counted to 108 credits quota)

H325427: Optional courses - MSc, molecular and cellular biology, 9 - 40 op

#### *Optional courses*

744623S: Yeast genetics, 6 op  
 743661S: Virology, 3 op  
 743660S: Introduction to immunology, 3 op  
 743696S: Final examination in molecular and cellular biology, 9 op  
 744618S: Dissertation, 18 op  
 744625S: Scientific presentation, 1 - 2 op  
 300002M: Advanced Information Skills, 1 op  
 756625S: Genetic transformation of plants, 4 - 8 op  
 756627S: Plant hormones, 5 op  
 756618S: Secondary metabolism of plants, 4 op  
 747605S: Basic aspects of protein crystallographic methods, 3 op  
 747608S: Biochemical methodologies II, 8 op  
 747611S: Biochemistry of protein folding, 3 op  
 747606S: Structural enzymology, 3 op  
 747604S: Introduction to biocomputing, 3 op  
 784637S: Biological NMR Spectroscopy, 3 op  
 488304S: Bioreactor Technology, 6 op  
 488305S: Advanced Course for Biotechnology, 5 op  
 580402S: Biomedical Imaging Methods, 1 - 5 op

### Optional courses at any university (0-12 ECTS)

746601S: Advanced studies in biochemistry in other universities, 0 - 75 op  
 746605S: Advanced studies in biochemistry passed abroad, 0 - 75 op

## M.Sc. degree, Biochemistry (Protein Science and Biotechnology)

Tutkintorakenteen tila: published

Lukuvuosi: 2013-14

Lukuvuoden alkamispäivämäärä: 01.08.2013

### Compulsory courses (77 - 85 op)

H325422: Compulsory courses - MSc, Protein science and biotechnology, 77 op

#### *Compulsory courses*

744620S: Protein chemistry II, 3 op  
 744621S: Molecular biology II, 3 op  
 747608S: Biochemical methodologies II, 8 op  
 902101Y: English for Biochemists 2, 3 op  
 747691S: Pro gradu experimental work in protein science and biotechnology, 28 op  
 747692S: Pro gradu thesis in protein science and biotechnology, 20 op  
 740672S: Maturity test (M.Sc. degree), 0 op

*Orientation to research work: work done in an academic or industrial research group. Orientation to biochemical work: work done in a non research group environment. The sum of credits of both courses must be 12-20 ECTS.*

744617S: Orientation to research work, 0 - 20 op  
 744624S: Orientation to biochemical work, 0 - 20 op

### Optional specialist courses (at least 4 must be taken) (11.5 - 21.5 op)

H325425: Optional specialist courses - MSc / Int MSc, Protein science and biotechnology, 11,5 - 21,5 op

#### *Optional specialist courses (a minimum of 4 of these courses must be taken)*

747605S: Basic aspects of protein crystallographic methods, 3 op  
 747606S: Structural enzymology, 3 op  
 747611S: Biochemistry of protein folding, 3 op  
 744619S: Systems biology, 4 op  
 747603S: Bioinformatics, 2,5 op

784637S: Biological NMR Spectroscopy, 3 op  
 747604S: Introduction to biocomputing, 3 op

### Optional courses (vähintään 13.5 op)

In addition to compulsory and optional specialist courses (minimum 4 courses) student must select other courses listed in any MSc line, all together at least 108 credits. The remaining 12 credits can be either any other MSc courses or any other suitable courses according to student's career aspirations. Student is free to take courses from both lines and decide later according to subject of Pro Gradu work which MSc line to graduate in.

If You plan to take courses other than listed in any MSc line, please select "Optional courses at any university (0-12 ECTS)" option below (choose the degree structure page).

### Optional courses (counted to 108 credits quota)

H325428: Optional courses - MSc, Protein science and biotechnology, 1,5 - 31,5 op

#### *Optional courses*

744618S: Dissertation, 18 op  
 744625S: Scientific presentation, 1 - 2 op  
 747693S: Final examination in protein science and biotechnology, 9 op  
 300002M: Advanced Information Skills, 1 op  
 488304S: Bioreactor Technology, 6 op  
 488305S: Advanced Course for Biotechnology, 5 op  
 744623S: Yeast genetics, 6 op  
 743661S: Virology, 3 op  
 743660S: Introduction to immunology, 3 op  
 743604S: Biochemistry of inherited diseases, 3 op  
 743655S: Neurobiology, 4 op  
 743659S: Biochemistry of cell organelles, 3 op  
 743658S: Cell cycle, DNA replication and repair, 2,5 op  
 743657S: Tumor cell biology, 3 op  
 580402S: Biomedical Imaging Methods, 1 - 5 op  
 756625S: Genetic transformation of plants, 4 - 8 op  
 756618S: Secondary metabolism of plants, 4 op  
 756627S: Plant hormones, 5 op

### Optional courses at any university (0-12 ECTS)

746601S: Advanced studies in biochemistry in other universities, 0 - 75 op  
 746605S: Advanced studies in biochemistry passed abroad, 0 - 75 op

## Tutkintorakenteisiin kuulumattomat opintokokonaisuudet ja -jaksot

740148P: Biomolecules, 5 op  
 740147P: Biomolecules for Bioscientists, 8 op  
 747612S: Introduction to structure-based drug discovery, 4 op  
 740149P: Metabolism I, 4 op  
 740374A: Microbiology, 3 op  
 740373A: Molecular Biology I, 4 op

## Opintojaksojen kuvaukset

## Tutkintorakenteisiin kuuluvien opintokohteiden kuvaukset

### 902100Y: English for Biochemists 1, 3 op

**Voimassaolo:** 01.08.2005 -

**Opiskelumuoto:** Language and Communication Studies

**Laji:** Course

**Vastuuyksikkö:** Language Centre

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** English

**Leikkaavuudet:**

ay902100Y English for Biochemists 1 (OPEN UNI) 3.0 op

**Proficiency level:**

CEFR B2 - C1 for Reading, Speaking and Listening

**Status:**

Compulsory for all 1st year biochemistry students unless you have received the grade "L" or "E" in the Finnish matriculation exam, in which case you can be exempted for some of the course.

**Required proficiency level:**

English must have been the A1 or A2 language at school or equivalent English skills acquired otherwise.

**ECTS Credits:**

The student workload is 80 hrs work/ 3 ECTS credits.

**Language of instruction:**

English

**Timing:**

1st year autumn and spring term

**Learning outcomes:**

The aim of this course is to develop both the students' reading strategies and their oral/aural fluency.

**Learning outcomes:** By the end of the course you are expected to:

- be familiar with various reading strategies for different purposes
- apply personalised vocabulary-learning techniques
- demonstrate effective note-taking techniques and the ability to summarise when working with texts
- have demonstrated lecture listening and note-taking skills in field related situations
- be able to present field-related subjects and use appropriate field-related vocabulary
- be able to defend a position in a debate
- have demonstrated the ability to participate in pair work communication and small group discussions.

**Contents:**

Core skills practiced on this course are the following:

**EfB 1a:** reading in order to understand biochemistry texts or textbooks and research articles; applying different reading strategies to extract global or detailed information according to the reading purpose; understanding word formation in order to expand vocabulary, both general scientific and field specific; understanding basic grammatical structures of scientific English as well as text structure and cohesion markers for improved comprehension.

**EfB 1b:** oral/aural skills connected to the students' academic field as well as in everyday conversational situations are practiced to develop communicative fluency. There is a focus on pronunciation, listening and speaking skills.

**Mode of delivery:**

-

**Learning activities and teaching methods:**

See Contents

**Target group:**

1st year Biochemistry students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

902101Y English for Biochemists 2

**Recommended or required reading:**

Course materials will be provided by the teacher and a copy fee will be collected for the handouts.

**Assessment methods and criteria:**

Evaluation is based on assessment of active participation in class and the completion of homework tasks. A reading and/or oral exam will be organised if necessary.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Pass/fail

**Person responsible:**

Jolene Gear

**Working life cooperation:**

none

**Other information:**

*Registration* will take place through WebOodi.

## 740072Y: Orientation, 1 op

**Opiskelumuoto:** General Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Jari Heikkinen

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

740076Y Orientation 2.0 op

**ECTS Credits:**

1 credit

**Timing:**

B.Sc. yr1 autumn

**Contents:**

Introduction of the new students to university, academic studies and academic learning environment and give information about goal and content of the degree programme in biochemistry.

**Learning activities and teaching methods:**

10-20 h visits, discussion, group work

**Assessment methods and criteria:**

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Amanuensis and small group tutors

## 901004Y: Swedish, 2 - 3 op

**Voimassaolo:** 01.08.1995 -

**Opiskelumuoto:** Language and Communication Studies

**Laji:** Course

**Vastuuyksikkö:** Language Centre

**Opintokohteen kielet:** Swedish

**Leikkaavuudet:**

901035Y Second Official Language (Swedish), Oral Skills 1.0 op

901034Y Second Official Language (Swedish), Written Skills 1.0 op

ay901004Y Swedish (OPEN UNI) 2.0 op

**Proficiency level:**

B1/B2/C1 (CEFR scale)

**Status:**

This course is compulsory to all students except those who have at least 60 ECTS credits of Swedish studies in their degrees. The language proficiency provided by the course unit is equivalent to the language proficiency required of a state official with an academic degree working in a bilingual municipality area (Act 424/03 and Decree 481/03).

**Required proficiency level:**

The required starting proficiency level for students of all faculties is a grade of 7 or higher from the Swedish studies at secondary school (B-syllabus) or matriculation examination grade A - L or a passing grade from the Brush up course in Swedish 901018Y.

If a student doesn't meet these requirements or his/her language skills are otherwise lacking, he/she must achieve the required proficiency level BEFORE taking this compulsory Swedish course

**ECTS Credits:**

2 ECTS credits (Biochemistry 3 ECTS credits)

**Language of instruction:**

Swedish

**Timing:**

See the study guide of the Faculty of Science.

**Learning outcomes:**

Upon completion of the course the student should have acquired the necessary proficiency level in Swedish to be able to manage in the most common communication situations related to his/her professional work tasks. He/she should be able to use basic grammatical structures fairly well in both speech and writing. He/she should be able to use the most common situational phrases understandably in various communication situations. He/she should be able to find the main points in general academic texts and texts related to his/her field of study and relay this information to colleagues or an audience of laymen using Swedish. He/she should be able to write short texts relating to his/her field of study.

**Contents:**

Communicative oral and written exercises, which aim to develop the student's Swedish proficiency in areas relevant to his/her academic field and future professional tasks. The student practises oral presentation and pronunciation. Situational oral exercises done individually and in pairs and groups. Discussions in small groups. Current texts about the student's special field. Listening comprehension exercises. Written exercises relating to the student's professional field.

**Mode of delivery:**

Contact teaching

**Learning activities and teaching methods:**

2 ECTS credits: 28 hours of contact teaching (1 x 180 minutes per week) and related exercises, self-directed study. The course unit's total workload is 53 hours.

3 ECTS credits (biochemistry): 45 hours of contact teaching (2 x 90 minutes per week) and related exercises, 35 hours of self-directed study. The course unit's total workload is 80 hours.

**Target group:**

Students of the Faculty of Science

**Prerequisites and co-requisites:**

See Required Proficiency Level

**Recommended optional programme components:**

-

**Recommended or required reading:**

The material, which is special field-specific, authentic and up to date, is distributed during the course. Students must pay for their course material.

**Assessment methods and criteria:**

The course focuses on improving both oral and written language skills and requires active attendance and participation in exercises, which also require preparation time. 100% attendance is required. The course unit tests both oral and written language skills. Students participate in the teaching in either autumn semester or spring semester.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Assessment is based on continuous assessment and exams. Approved completion of the course unit requires that the student achieves at least satisfactory oral and written language skills. The grades are based on continuous assessment and the course exams. Oral and written language skills are graded separately. The possible grades are satisfactory skills (CERF proficiency level B1) and good skills (CERF proficiency levels B2-C1). For more information on the proficiency levels of oral and written language skills, see Assessment Criteria (in Finnish).

**Person responsible:**

Lecturer Rauno Varonen

**Working life cooperation:**

-

**Other information:**

Teaching will begin according to the schedule

## 740144P: Biochemical Methodologies I, 8 op

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Jari Heikkinen

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay740153P	Basic biochemistry 2: Methods (OPEN UNI)	2.0 op
740151P	Biochemical methodologies I	10.0 op
740117P	Basic methods in biochemistry	4.0 op
740136P	Laboratory course in basic methods of biochemistry	3.0 op

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

8 credits

**Language of instruction:**

Finnish

**Timing:**

B.Sc. yr1 spring

**Learning outcomes:**

Upon successful completion students are able to:

- use basic methods used in biochemical research laboratory
- Use laboratory equipment and work safely
- Prepare solutions used in the lab
- document experiments in the laboratory

**Contents:**

This module covers the basic methodologies used in practical biochemistry. The following topics will be addressed: safety in the laboratory, qualitative and quantitative observations, the calculations of concentrations and dilution factors (includes a workshop), pipette cleaning and calibration, identification and quantification of biological molecules, principals and practice of the use of centrifuges, spectrophotometry, SDS-PAGE, agarose gel electrophoresis, thin-layer and paper chromatography, basics of protein purification, extraction of chromosomal DNA from bacteria, mini-prep extraction of plasmid DNA, extraction of RNA from mammalian tissue, extraction of lipids from nutmeg, sterile technique, basic microbial growth, dialysis, filtration and pH measurement.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

18 h le, 2h exercises, 120 h lab. Laboratory work is compulsory. It is possible to complete lecture part only (3.5 ECTS).

**Target group:**

Major students, Biology BSC-BS

**Prerequisites and co-requisites:**

Biomolecules, Biomolecules for Biochemists tai Biomolecules for Bioscientists

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Continuous assessment (home works, lab reports), final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Maija Risteli and Jari Heikkinen

**Working life cooperation:**

No

**Other information:**

-



**740143P: Biomolecules for Biochemists, 8 op****Opiskelumuoto:** Basic Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Lloyd Ruddock**Opintokohteen kielet:** English**Leikkaavuudet:**

ay740157P Basic biochemistry 1: Biomolecules (OPEN UNI) 4.0 op

ay740152P Basic biochemistry 1: Biomolecules (OPEN UNI) 5.0 op

740147P Biomolecules for Bioscientists 8.0 op

740148P Biomolecules 5.0 op

**ECTS Credits:**

8 credits

**Language of instruction:**

English

**Timing:**

B.Sc yr1 autumn-spring

**Learning outcomes:**

Upon successful completion students are able to:

- tell the composition, structure and function of the major groups of biomolecules in cells; nucleic acids, proteins, carbohydrates and lipids and describe the forces that modulate their function.
- apply information in the right context and evaluate it critically
- In addition, students on the 8op versions are able to work in the biochemical laboratory, are able to solve calculations and problems and are able to interpret the scientific data they generate.

**Contents:**

This module provides an overview of biochemistry, outlining the forces involved in biomolecule structure and the chemical structures and properties of polynucleic acids, proteins, carbohydrates and lipids. There will also be an introduction to prebiotic evolution and a student debate on this subject. The module is arranged into lectures, workshops, a student debate and laboratory work. All of the exercises are in English. Both a final examination and continuous assessment will count towards the final mark and attendance of some parts is compulsory.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

30 h lectures, 48 h lab., plus exercises

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Mathews, van Holde &amp; Ahern: Biochemistry, (3rd edition), published by Addison Wesley Longman, Inc. or equivalent.

**Assessment methods and criteria:**

Continuous assessment, final examination

Read more about [assessment criteria](#) at the University of Oulu webpage.**Grading:**

1-5/fail

**Person responsible:**

Tuomo Glumoff

**Working life cooperation:**

No

**Other information:**

-

**740146P: Metabolism I, 6 op**

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tuomo Glumoff

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay740158P Basic biochemistry 3: Metabolis (OPEN UNI) 4.0 op

ay740154P Basic biochemistry 3: Metabolis (OPEN UNI) 3.0 op

740149P Metabolism I 4.0 op

**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish

**Timing:**

B.Sc. yr1 spring

**Learning outcomes:**

Students will be able to explain the main principles of how the metabolism is made up, will get a detailed picture of the energy metabolism, and will be able to organize part of the wholeness of metabolism, particularly how energy metabolism is networked to the synthesis and degradation of biomolecules.

**Contents:**

On this course the central concepts and mechanisms of metabolism, its regulation and the integration of metabolic pathways will be introduced, like anabolism and catabolism, linking of different pathways, and metabolic regulation. Especially the energy metabolism will be studied, concerning carbohydrates, lipids and the respiratory chain. Combined with the course Metabolism II the students will get a good overview on the principles of metabolism, metabolic integration and the methods to study metabolism.

**Learning activities and teaching methods:**

The module (6 credits) is arranged into lectures (30 h) and problem-based exercises and of laboratory work (40 h, attendance obligatory).

**Target group:**

Major subject students

**Recommended optional programme components:**

Biomolecules, Biomolecules for Biochemists tai Biomolecules for Bioscientists

**Assessment methods and criteria:**

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail. Problem-based exercises, laboratory work and a final exam will count towards the final grade.

**Person responsible:**

Tuomo Glumoff

## 740145P: Physical Biochemistry, 6 op

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** André Juffer

**Opintokohteen kielet:** English

**ECTS Credits:**

6 credits

**Language of instruction:**

English

**Timing:**

B.Sc. yr2 spring

**Learning outcomes:**

Upon successful completion students are able to:

- define the relevance of theoretical concepts to the biosciences
- tell where various equations of physical biochemistry come from
- discuss the link between theory and experiment

- perform simple but realistic calculations

**Contents:**

This module will cover the concepts of thermodynamics and their application to biochemical systems plus chemical and enzymatic kinetics. Topics covered will include:

*Concepts of thermodynamics:* First, Second and Third Law of Thermodynamics. Heat. Work. Enthalpy. Entropy, Gibbs and Helmholtz free energy, Chemical potential, Chemical potential of a solute, Free energy and equilibrium.

*Applications of thermodynamics:* Chemical reactions, Protein-ligand association, Acids, bases and pH regulation, Acid-dissociation constants, introduction to thermodynamics of protein folding.

*Chemical kinetics:* Basic chemical reactions and single step reactions, Applications of chemical kinetics to multistep reactions, Catalysis and enzyme kinetics.

Attendance of some parts of the course is compulsory.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

36 h lecture and exercises

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Recommended books:

Price NC *et al.*, *Principles and problems in Physical chemistry for Biochemists*, Third edition, Oxford University Press, Oxford, 2001.

Atkins P and De Paula J, *Physical chemistry*, 8ed, Oxford University Press, Oxford, 2006.

Atkins P and de Paula J. *Physical chemistry for the life science*, Oxford University Press, Oxford, 2006.

**Assessment methods and criteria:**

Homeworks, workshops, no exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

André Juffer

**Working life cooperation:**

No

**Other information:**

-

**740150P: Transferable skills for biochemists, 2 op**

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tuomo Glumoff

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

2 credits

**Language of instruction:**

Finnish

**Timing:**

BSc yr1 spring

**Learning outcomes:**

Upon successful completion students are able to:

- process gel photographs taken in practicals and embed them into lab reports
- use Microsoft Word to write reports
- create standard curves using Microsoft Excel
- explain how to construct a good oral presentation
- list the basics of good scientific practice

**Contents:**

On overview is given of a commonly used word processor (Microsoft Word) and spreadsheet (Microsoft Excel). Students will be taught to use these software to create lab reports (word processing, gel photograph processing and embedding in lab reports). Other topics are the basics of oral presentation, ethics in scientific research and good scientific practice. Attendance of some parts is compulsory.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

Lectures and computer practicals all together 14 hr, home exercises

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Tuoo Glumoff

**Working life cooperation:**

No

**Other information:**

-

**740362A: Cellular Biology, 6 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Sakari Kellokumpu

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

740323A Cell culture course 3.0 op

744610S Advanced course for cell biology 3.0 op

**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish

**Timing:**

B.Sc. yr2 spring

**Learning outcomes:**

Upon successful completion students are able to:

- interpret and analyze the general molecular mechanisms of cell functions
- plan how such molecular mechanisms can be studied in vitro and in vivo
- track the molecular defects that might be responsible for abnormal functioning of cells e.g. in disease states

**Contents:**

The aim of the course is to deepen the knowledge about where in the cell different biochemical reactions take place, how the molecules are trafficked between organelles, and how these phenomena can be studied in cultured cells. The course aims to address specifically the specific functions of the organelles in an eukaryotic cell, transport of material into and out of the cells, and how the cytoskeleton serves many of these functions. The course contains practical lab work, during which the students learn basic skills on cell culture and fluorescence microscopy. The practical course is compulsory for the Biochemistry students.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

24 h lectures, 40 h lab

**Target group:**

Major students

**Prerequisites and co-requisites:**

Cell biology, Biomolecules for biochemists, Biochemical methodologies I

**Recommended optional programme components:**

-

**Recommended or required reading:**

Lodish, et al., Molecular Cell Biology (partly), 4th edition. W.H. Freeman and Company

**Assessment methods and criteria:**

Lab reports, final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Sakari Kellokumpu

**Working life cooperation:**

No

**Other information:**

-

**740366A: Cellular Communication, 6 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Thomas Kietzmann

**Opintokohteen kielet:** English

**ECTS Credits:**

6 credits

**Language of instruction:**

English

**Timing:**

B.Sc. yr3 spring

**Learning outcomes:**

Upon successful completion students are able to:

- name, list and discuss the major intra- and intercellular signalling pathways
- present, describe and discuss characteristic features of signalling pathways
- describe how to study, examine and analyse signalling pathways

**Contents:**

The course covers basic aspects of the main cellular signalling pathways. The main emphasis will be made on the signalling pathways involved in the action of various hormones, growth factors, lipid-derived signaling molecules, and their cell surface and intracellular receptors, intracellular second messengers and protein kinases and phosphatases. The course involves a 40 h practical course (+written reports) in which cultured cells are used as targets to visualize certain hormone or drug-induced signaling molecules, their interactions, and how these regulate e.g. normal cell growth and/or cell death in culture. Attendance at practical course is obligatory.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

20 h lectures, 40 h practicals

**Target group:**

Major students

**Prerequisites and co-requisites:**

Cellular biology

**Recommended optional programme components:**

-

**Recommended or required reading:**

**Assessment methods and criteria:**

Laboratory practicals, final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Thomas Kietzmann

**Working life cooperation:**

No

**Other information:**

-

**740376A: Essay (B.Sc. thesis), 10 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tuomo Glumoff

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

10 credits

**Language of instruction:**

Finnish

**Timing:**

B.Sc. yr3 autumn

**Learning outcomes:**

Students should be able to execute a project to produce a thesis type of output, be well aware of current research trends in biochemistry, be able to critically select knowledge from the literature, be able to discuss and debate scientific results, and be able to choose and evaluate proper form of presentation for each purpose.

**Contents:**

The theme of the module is public understanding of science and the reporting of biochemical research using different methods and for different audiences. During the course students will learn on a general level about different fields of biochemistry and their specific questions, orientation of biochemical research and organization of research into projects. Practical exercises will contain presenting of a given subject in different forms, which may be a talk, a short article, a poster, a press release or a research proposal. A literature report will be written as well as a popularized presentation of it. In addition the course is linked to the module Ruotsin kieli (Swedish language).

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

about 50 h lectures, seminars, small groups and practicals, also self study and student presentations

**Target group:**

Major students

**Prerequisites and co-requisites:**

Course is for BSc yr3 students

**Recommended optional programme components:**

Information skills 030005P is recommended for completion simultaneously.

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Writing and presentation of BSc thesis.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Tuomo Glumoff

**Working life cooperation:**

No

**Other information:**

-

**740372A: Final Examination, 6 op****Opiskelumuoto:** Intermediate Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Lloyd Ruddock**Opintokohteen kielet:** English**ECTS Credits:**

6 credits

**Language of instruction:**

English

**Timing:**

B.Sc. yr3 spring

**Learning outcomes:**

Upon successful completion students are able to:

- present the full breadth of the core topics of biochemistry
- Integrate material from multiple sources

**Contents:**

This examination will test the ability of students to integrate knowledge from the core biochemistry modules they have taken during their BSc. It will include questions covering the material from Biomolecules for Biochemists, Biochemical methodologies I, Physical biochemistry, Metabolism I, Molecular biology I, Cellular biology, Microbiology, Protein Chemistry I, Cellular communication and Metabolism II. The questions will require an understanding of the basic principles of biochemistry and each will be based on subject specific material from at least two modules.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

Student self-study

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Final examination

Read more about [assessment criteria](#) at the University of Oulu webpage.**Grading:**

1-5/fail

**Person responsible:**

Conveners from the core modules coordinated by Lloyd Ruddock

**Working life cooperation:**

No

**Other information:**

-

**740377A: Maturity test (B.Sc. degree), 0 op****Opiskelumuoto:** Intermediate Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**ECTS Credits:**

0 credits

**Timing:**

BSc yr3 spring

**Learning outcomes:**

After BSc maturity test student is able to write a logical and analytical summary of his BSc thesis.

**Contents:**

Maturity test (B.Sc.) will be written in the topic of B.Sc. thesis. In the test student proves to command both the subject of B.Sc thesis and native language.

**Mode of delivery:**

Face to face teaching

**Target group:**

Major students

**Assessment methods and criteria:**

An essay written under invigilation (4 pages, 500 words).

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Tuomo Glumoff

**Working life cooperation:**

No

**Other information:**

-

## 740367A: Metabolism II, 6 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tuomo Glumoff

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

740375A Metabolism II 4.0 op

**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish

**Timing:**

B.Sc. yr2 autumn

**Learning outcomes:**

Students should be able to outline in detail how cells use various small and large molecules, how cells synthesize and degrade metabolites for their needs, and how metabolic network is connected and integrated.

**Contents:**

Metabolism II completes the discussion of energy metabolism by combining it with metabolism of nitrogen-containing compounds and synthesis and degradation of different biomolecules, as well as extends the analysis of the central concepts and mechanisms of metabolism. It will be seen how the metabolic pathways that were examined separately will be connected to each other and regulated. Some chemical mechanisms of pathways as well as ways to supply precursors for the main stream pathways will be handled. Special aspects of metabolism, like tissue specificity and physiological states, will also be studied. Photosynthesis is studied as continuation to energy metabolism.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

The module is arranged into lectures, workshops and homework (total ca. 70 h).

**Target group:**

Major subject students

**Prerequisites and co-requisites:**

Metabolism I

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Continuous assessment (homeworks, workshops), final exam



Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Tuomo Glumoff

**Working life cooperation:**

No

**Other information:**

A course for minor subject students (Metabolism II, 740375A, 4 credits) is not given any more.

## 740363A: Microbiology, 6 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Pospiech, Helmut

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

740374A	Microbiology	3.0 op
740322A	Microbiology	3.0 op
740324A	Laboratory course in microbiology	3.0 op

**ECTS Credits:**

6 credits

**Language of instruction:**

English

**Timing:**

B.Sc. yr1 spring

**Learning outcomes:**

Upon successful completion students are able to:

- define the typical features of bacteria, archaea, fungi and virus and explain the diversity of different groups of microorganisms
- explain the basic aspects of microbial metabolism
- understand the basics of microbial growth, enrichment, culture and growth control both in the environment and in contained culture
- explain the essential roles of microorganisms in our environment
- apply their knowledge for the growth and its control of standard laboratory microorganisms
- have a basic understanding of the industrial use of microorganisms or microbial compounds.

**Contents:**

This module is an introduction to general and applied microbiology and consists of lecture and laboratory exercises. In the lectures, the diversity and classification of microorganisms, especially bacteria will be introduced. Further topics are the structure and function of the prokaryotic cell, bacterial growth, metabolism and physiology, the importance of bacteria in different ecosystems as well as the industrial use of bacteria. The exercises introduce basic microbiological methods and techniques for the aseptic work. These include culture on solid and in liquid media, transfer of bacteria by streaking or spreading, the use of dilution and enrichment techniques, the inhibition of bacterial growth, measurement of bacterial growth and death, and finally the basics of transformation and bacteriophage infection and its use in molecular biology. Attendance at practical course is obligatory.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

24 hours lecture and 60 hours laboratory exercises

**Target group:**

Major students

**Prerequisites and co-requisites:**

Biomolecules for Biochemists and Biochemical methodologies I

**Recommended optional programme components:**

-

**Recommended or required reading:**

M. Salkinoja-Salonen (ed.) (2002) Mikrobiologian perusteita, Helsingin yliopisto; Michael T. Madigan, John M. Martinko, Paul V. Dunlap, and David P. Clark Parker (2010) Brock biology of microorganisms, 12th ed. Prentice Hall International. Microbiology laboratory exercises, Dept. Biochemistry (2010).

**Assessment methods and criteria:**

Continuous assessment (home works, lab reports), final exam  
Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Helmut Pospiech

**Working life cooperation:**

No

**Other information:**

-

## 740361A: Molecular Biology I, 8 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mirva Saaranen, Kaija Autio

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

740373A	Molecular Biology I	4.0 op
740318A	Molecular Biology	4.0 op
740337A	Laboratory Course in Molecular Biology	3.0 op

**ECTS Credits:**

8 credits

**Language of instruction:**

Finnish

**Timing:**

B.Sc. yr2 autumn

**Learning outcomes:**

After this course students should understand the basics of molecular biology and be able to use modern molecular biology methods.

**Contents:**

The course covers gene structure, DNA replication, recombination, transcription, translation and basics of gene expression. The student will learn the most common recombinant DNA techniques, such as PCR, use of restriction endonucleases, preparation of recombinant plasmids and DNA sequencing. Attendance of some parts is compulsory.

**Learning activities and teaching methods:**

20 h lectures, 4 h computer exercise, 80 h lab, theoretical exercises, homeworks

**Target group:**

Major subject students

**Prerequisites and co-requisites:**

Cellular biology, Biomolecules for Biochemists and Biochemical methodologies I

**Recommended optional programme components:**

-

**Recommended or required reading:**

Mathews, CK, van Holde KT, Applins DR, Anthony-Cahill SJ: Biochemistry (4th edition, 2012). Optional.

**Assessment methods and criteria:**

Homeworks 40 %, lab reports 20 % and final exam 40 %.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail.

**Person responsible:**

Kaija Autio

**Working life cooperation:**

No

**Other information:**

## 740364A: Protein Chemistry I, 8 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Martti Koski

**Opintokohteen kielet:** English

**ECTS Credits:**

8 credits

**Language of instruction:**

English

**Timing:**

B.Sc. yr2 autumn

**Learning outcomes:**

Upon successful completion students are able to:

- tell the relevance of protein structure, including post-translational modification, to protein function
- describe the techniques available to purify proteins and to study protein function and have an appreciation of the applications and limitations of these techniques
- analyze a wide range of biochemical data and solve problems relating to the interpretation of data concerning protein function and basic structural characterization

**Contents:**

This module provides more detailed information on the chemistry of proteins. Topics covered include protein purification, reversible and irreversible covalent modifications of proteins, protein translocation, protein degradation, an introduction to the protein folding problem, protein structure analysis, basic enzyme catalysis mechanisms and co-enzymes. The module includes lectures, continuous assessments, group works, student presentations, and laboratory exercises. Final examination, lecture attendance/ continuous assessments, presentations and laboratory reports will all count towards the final mark. Attendance at laboratory exercises is obligatory.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

30 h lectures, 80 h lab, exercises

**Target group:**

Major students

**Prerequisites and co-requisites:**

Biomolecules for Biochemists, Biochemical methodologies I

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Presentation, lab reports, final exam, attendance / continuous assessment  
Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Kristian Koski

**Working life cooperation:**

No

**Other information:**

-

## 780114P: General and Inorganic Chemistry I, 6 op

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Kaila

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay780117P	General and Inorganic Chemistry A (OPEN UNI)	5.0 op
ay780118P	General and Inorganic Chemistry B (OPEN UNI)	5.0 op
780113P	Introduction to Chemistry	12.0 op
780109P	Basic Principles in Chemistry	4.0 op
780101P	Introduction to Physical Chemistry	7.0 op
780102P	Introduction to Inorganic Chemistry	5.0 op
780109P	Basic Principles in Chemistry	4.0 op

**ECTS Credits:**

6 credits/160 hours of work

**Language of instruction:**

Finnish

**Timing:**

1 st Autumn

**Learning outcomes:**

After this course the student should understand basic concepts of chemistry as described in international general chemistry curriculum.

**Contents:**

Basic concepts of chemistry, chemical formula, chemical reaction, chemical equation, oxidation-reduction reactions, stoichiometry, gases, thermodynamics, electrons in atoms, periodic table, chemical bond.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

40 hours of lectures and applications, 24 hours of exercises and 96 hours of self-study

**Target group:**

Biochemistry, Chemistry, compulsory. In the entity of 25 credits (minor studies), compulsory. Physical sciences, Mathematical sciences, optional.

**Prerequisites and co-requisites:**

Upper secondary school chemistry

**Recommended optional programme components:**

This course is a part of the earlier lectured course 780113P Introduction to Chemistry (12 credits).

**Recommended or required reading:**

Petrucci, R.H., Herring, F.G., Madura, J.D. ja Bissonnette, C.: General Chemistry: Principles and Modern Applications, 10. painos (myös 7., 8. ja 9. painos), Pearson Canada Inc., Toronto, 2011. Chapters 1-11, 12.5-7,13.2,19.1-5.

**Assessment methods and criteria:**

Two intermediate examinations or one final examination

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Lecturer Leena Kaila

**Working life cooperation:**

No

**Other information:**

No

## 780115P: General and Inorganic Chemistry II, 6 op

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Kaila

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay780117P	General and Inorganic Chemistry A (OPEN UNI)	5.0 op
ay780118P	General and Inorganic Chemistry B (OPEN UNI)	5.0 op
780113P	Introduction to Chemistry	12.0 op
780101P	Introduction to Physical Chemistry	7.0 op
780102P	Introduction to Inorganic Chemistry	5.0 op
780109P	Basic Principles in Chemistry	4.0 op

**ECTS Credits:**

6 credits/160 hours of work

**Language of instruction:**

Finnish

**Timing:**

1 st Autumn

**Learning outcomes:**

After this course the student should understand basic concepts of chemistry as described in international general chemistry curriculum.

**Contents:**

Intermolecular forces, phase equilibrium, reaction kinetics, chemical equilibrium, acid-base equilibrium, equilibrium in water solutions of slightly soluble salts, electrochemistry.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

40 hours of lectures and applications, 26 hours of exercises, 94 hours of self-study

**Target group:**

Biochemistry, Chemistry, compulsory. In the entity of 25 credits (minor studies), compulsory. Physical sciences, Mathematical sciences, optional.

**Prerequisites and co-requisites:**

Upper secondary school chemistry

**Recommended optional programme components:**

This course is a part of the earlier lectured course 780113P Introduction to Chemistry.

**Recommended or required reading:**

Petrucci, R.H., Herring, F.G., Madura, J.D. ja Bissonnette, C.: General Chemistry: Principles and Modern Applications, 10. painos (myös 7., 8. ja 9. painos), Pearson Canada Inc., Toronto, 2011. Chapters 12.1-4, 13-18, 19.6-8,20.

**Assessment methods and criteria:**

Two intermediate examinations or one final examination

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Lecturer Leena Kaila

**Working life cooperation:**

No

**Other information:**

No

## 780103P: Introduction to Organic Chemistry, 6 op

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Johanna Kärkkäinen, Marja Lajunen

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780112P	Introduction to Organic Chemistry	4.0 op
780103P2	Organic Chemistry I	6.0 op
780108P	Basic Course in Organic Chemistry	6.0 op

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

6 credits/160 hours of work

**Language of instruction:**

Finnish. Book-examination in English as well.

**Timing:**

1st autumn and 1st spring

**Learning outcomes:**

After this course, the student can explain organic chemistry fundamentals, basic concepts and terminology, can use them for description of organic chemistry phenomena. He/she can name organic structures, explain their properties, deduce basic reaction types and solve their mechanisms.

**Contents:**

Basic reactions of organic compounds, basic principles of stereochemistry and reaction mechanisms: Addition, elimination, substitution, including electrophilic aromatic substitution, reactions of carbonyl group. Applications.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

52 hours of lectures and applications plus 6 hours of exercises, 102 hours of independent self-study

**Target group:**

Biochemistry, Chemistry, compulsory. In the study entity of 25 credits compulsory.

Physical Sciences, Mathematical Sciences, optional.

**Prerequisites and co-requisites:**

Upper secondary school chemistry

**Recommended optional programme components:**

The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**

Hart, H., Hart, D.J. and Craine, L.E.: Organic Chemistry: A Short Course, 10<sup>th</sup> ed. or the newer edition, Houghton Mifflin Boston, 1999; Hart, H., Hart, D.J. and Craine, L.E.: Study Guide & Solutions Book, Organic Chemistry: A Short Course, 10<sup>th</sup> ed. or the newer edition, Houghton Mifflin Boston, 1999.

**Assessment methods and criteria:**

Three intermediate examinations or one final examination

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Prof. Marja Lajunen and Ph.D. Johanna Kärkkäinen

**Working life cooperation:**

No

**Other information:**

No

**780122P: Introductory Laboratory Course in Chemistry, 3 op**

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits/80 hours of work

**Language of instruction:**

Finnish

**Timing:**

1st autumn or spring

**Learning outcomes:**

After this course the student can apply laboratory safety instructions and act accordingly. He/she can communicate by using basic laboratory terminology and work in a group under the guidance. The student identifies basic laboratory tools and can use them properly. He/she can perform basic inorganic determinations: acid-base titrations, mass analysis or spectroscopic measurements and can apply them to analyze inorganic synthetic products, or use study thin layer chromatography to study purity of organic products. The student can write a report related to the performance and analysis of the synthesis.

**Contents:**

Laboratory safety, Bunsen burner, balances, volumetric measures, gravimetric determination, acid-base titration, pH, titration curves, acid-base indicators, buffer solutions, synthesis and analysis of an inorganic product, spectrophotometric determination, an organic synthesis, TLC. Written report.

**Mode of delivery:**

Supervised laboratory work

**Learning activities and teaching methods:**

Safety in laboratory 2 hours, 40 hours of laboratory work + demonstrations, 38 hours of self study

**Target group:**

Biochemistry, Biology, Chemistry, Process Engineering, Environmental engineering, compulsory. In the entity of 25 credits, compulsory. Physical Sciences, Geology, Mathematical Sciences, optional.

**Prerequisites and co-requisites:**

Basic Principles in Chemistry (780109P) or Introduction to Chemistry (780113P) passed, or participation in the courses General and Inorganic Chemistry I (780114P) and General and Inorganic Chemistry II (780115P).

**Recommended optional programme components:**

The course Basic Principles in Chemistry (780109P) or Introduction to Chemistry (780113P) passed, or Biochemistry, Chemistry and teacher education students of Mathematics and Physics: simultaneous participation in the courses General and Inorganic Chemistry I (780114P) and General and Inorganic Chemistry II (780115P).

**Recommended or required reading:**

Instruction Book (in Finnish): Kemia perustyöt

**Assessment methods and criteria:**

Final examination. Laboratory works and final examination has to be completed within next two terms. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

The course utilizes verbal grading scale pass/fail.

**Person responsible:**

Prof. Marja Lajunen and teaching assistants

**Working life cooperation:**

No

**Other information:**

Attendance at the lecture of Safety at work is compulsory. Deadline of the written report is binding. Failure will lead to the renewal of the work.

**806109P: Basic Methods in Statistics I, 9 op**

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Mathematical Sciences

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Jari Päckilä

**Opintokohteen oppimateriaali:**

**Grönroos, Matti (2)** , , 2003

**Heikkilä, Tarja** , , 1998

**Helenius, Hans** , , 1989

**Ranta, Esa (2)** , , 1991

**Wild, Christopher J.** , , 2000

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

806119P A Second Course in Statistics 5.0 op

806116P Statistics for Economic Sciences 5.0 op

806117P Analysis of continuous response variable 5.0 op



**ECTS Credits:**

9 cr

**Learning outcomes:**

On successful completion of this course, the student will be able to

- use basic methods of collecting and describing data
- apply methods of statistical inference in some simple situations
- interpret listing of some statistical software

**Contents:**

Principles of collecting data and describing data with suitable tables, graphs and numerical measures are treated. The basic idea of estimation and statistical tests will be presented as well as some of the most common used confidence intervals and statistical tests. One aim is also to give basic knowledge from some statistical software.

**Person responsible:**

Marjatta Mankinen (economics) and Jari Pääkkilä (others)

**750121P: Cell biology, 5 op**

**Voimassaolo:** - 31.07.2020

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Biology

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Saarela, Seppo Yrjö Olavi

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 ECTS credits / 133 hours of work.

**Language of instruction:**

Finnish.

**Timing:**

B.Sc. 1<sup>st</sup> autumn.

**Learning outcomes:**

The student is familiar with cellular structure and functioning in plant and animal cells, understands the social structures in multicellular species and knows why and how the genetic organizations (in nucleus, chloroplast and mitochondria) are co-operating, maintaining and regulating the cellular metabolism. Student understands the common origin and evolution of life on planet Earth, and understands the material basis and mechanisms of this continuity.

**Contents:**

During the recent years especially the development of molecular and microscopic and imaging techniques has increased our knowledge on cells and their social interactions. The structural and functional characteristics of plant and animal cells will be covered as well as the genetic organization maintaining and regulating the system.

**Mode of delivery:**

Face-to-face teaching.

**Learning activities and teaching methods:**

72 h lectures, three exams (zoology, botany, genetics). Home essays and internet material.

**Target group:**

Compulsory to the biology and biochemistry students.

**Prerequisites and co-requisites:**

Good basics in biology from elementary school.

**Recommended optional programme components:**

Cell biology is prerequisite for the following courses: Developmental biology-histology lectures and exercises (751367A, 755317A), Animal physiology lectures and exercises (751388A, 755318A), Functional plant biology lectures and exercises (752345A, 756341A), Concepts of genetics (753124P). Course also gives readiness for studies in molecular biology and biochemistry.

**Recommended or required reading:**

Textbooks Alberts, B. et al. 2008: Molecular Biology of the Cell (5e). Garland Science Publishing, London, 1268 p. ISBN: 0815341067. (Lodish et al. 2008: Molecular Cell Biology (6e). Freeman, New York, 1150 p.). Heino J. & Vuento M. 2004: Solubiologia (2e), WSOY, Porvoo 320 p. <http://cc oulu.fi/~ssaarela/>

The availability of the literature can be checked from [this link](#).

**Assessment methods and criteria:**



Three exams.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5 / Fail. Final grade is average value of the three exams.

**Person responsible:**

Prof. Seppo Saarela, Prof. Hely Häggman and N.N.

**Working life cooperation:**

No.

**Other information:**

-

## 753124P: Concepts of genetics, 4 - 7 op

**Voimassaolo:** - 31.07.2015

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Biology

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Savolainen Outi, Heidi Aisala-Aalto, Kuittinen, Helmi Helena

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

757109P Concepts of genetics 5.0 op

**ECTS Credits:**

4-7 ECTS credits / 107-187 hours of work.

**Language of instruction:**

Finnish.

**Timing:**

B.Sc. 1<sup>st</sup> spring.

**Learning outcomes:**

To understand and apply basic concepts of genetics, at Mendelian and molecular level .

**Contents:**

Part 1. Mendelian genetics, including the ideas of quantitative and population genetics. Part 2. Molecular genetics: replication, transcription, translation, genetic code, mutations, repair of DNA. Part 3. Selected topics on developmental genetics, and genetics of health and diseases.

**Mode of delivery:**

Face-to-face teaching.

**Learning activities and teaching methods:**

72 h lectures and seminars, 115 h independent studies, exam.

**Target group:**

Compulsory to the biology students (7 cr.) Biochemistry students: parts 1 and 3 (4 cr.) compulsory, biophysics students.

**Prerequisites and co-requisites:**

Cell biology (750121P) or equivalent knowledge.

**Recommended optional programme components:**

This course is prerequisite to all other genetics courses.

**Recommended or required reading:**

Materials are in Optima. Klug et al. 2012. Concepts of Genetics (10. ed). Pearson, 896 p. Alberts, B. et al. 2008: Molecular Biology of the Cell (5. ed). Garland Science Publishing, London, 1268 p.

The availability of the literature can be checked from [this link](#).

**Assessment methods and criteria:**

Homeworks, home exams, lecture diary, exams.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5 / Fail.

**Person responsible:**

N.N.

**Working life cooperation:**

No.

**Other information:**

-

**H325420: Recommended optional studies - BSc, 4 - 51 op**

Voimassaolo: 01.08.2012 -

**Opiskelumuoto:** Intermediate Studies**Laji:** Study module**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

*Electives***780389A: Organic Chemistry I, 6 op****Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Hormi Osmo**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

780385A Organic Chemistry I 9.0 op

**ECTS Credits:**

6 credits/160 hours of work

**Language of instruction:**

Finnish

**Timing:**2<sup>nd</sup> autumn**Learning outcomes:**

After passing the course the student can explain the basics in molecular orbitals in simple organic compounds such as ethane, basics in physical organic chemistry especially the Hammett plot, details in nucleophilic substitution, conformation and stereochemistry in organic compounds.

**Contents:**

Molecular orbitals in organic compounds, conformation theory, Hammett plot, nucleophilic substitution and stereochemistry.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

50 hours of lectures, 110 hours self study

**Target group:**

Chemistry, compulsory. In the entity of 60 credits, compulsory.

**Prerequisites and co-requisites:**

Introduction to Organic Chemistry (780103P) and Introduction to Chemistry (780113P) or Introduction to Physical Chemistry (780101P).

**Recommended optional programme components:**

The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**

Clayden, J., Greeves, N., Warren, S. and Wothers, P.: Organic Chemistry, Oxford University Press, 2001. Chapters 1-4, 7, 16-18, 34 ja 42 and pages 1090-1100.

**Assessment methods and criteria:**

Two intermediate examinations or one final examination  
Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Prof. Osmo Hormi

**Working life cooperation:**

No

**Other information:**

No

**780111P: Introduction to Analytical Chemistry, 4 op**

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Paavo Perämäki

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780110P Analytical Chemistry I 5.5 op

**ECTS Credits:**

4 credits /107 hours of work

**Language of instruction:**

Finnish

**Timing:**

2nd autumn

**Learning outcomes:**

Upon completion the student should have acquired knowledge and understanding of basic concepts of quantitative chemical analysis employing classical methods of analysis.

**Contents:**

Steps in quantitative analysis, statistical evaluation of analytical data, chemical equilibrium in aqueous solutions, gravimetry, titrimetry, spectrophotometry.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

30 hours of lectures + 10 hours of exercises + 67 hours of self-study

**Target group:**

Chemistry, compulsory. In the study entity of 25 credits compulsory.  
Biochemistry, Mathematical Sciences, Physical Sciences, optional.

**Prerequisites and co-requisites:**

General and Inorganic Chemistry I and II (780114P and 780115P) or Introduction to Chemistry (780113P) or Basic Principles in Chemistry (780109P).

**Recommended optional programme components:**

The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**

Saarinen, H. ja Lajunen, L.H.J.: Analyttisen kemian perusteet, Oulun yliopistopaino, 2004.

**Assessment methods and criteria:**

Two intermediate examinations or one final examination

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Prof. Paavo Perämäki

**Working life cooperation:**

No

**Other information:**

No

**751388A: Animal physiology, lectures, 4 op**

**Voimassaolo:** - 31.07.2015

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Biology

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Saarela, Seppo Yrjö Olavi

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

755323A Animal physiology lectures 5.0 op

**ECTS Credits:**

4 ECTS credits / 107 hours of work.

**Language of instruction:**

Finnish.

**Timing:**

B.Sc. 2nd spring.

**Learning outcomes:**

After completing the course the student is able to form a general view of animal body functions, the regulation of organ systems, and the background of human health and diseases.

**Contents:**

Course focus on the basic problematic of physiological themes including nervous system, muscles, circulation, nutrition, metabolism, immune system, hormones and reproduction physiology.

**Mode of delivery:**

Face-to-face teaching.

**Learning activities and teaching methods:**

50 h lectures and independent studying, mid-semester exams, home essays.

**Target group:**

Compulsory to the biology students.

**Prerequisites and co-requisites:**

Cell biology (750121P) or equivalent knowledge.

**Recommended optional programme components:**

This course is a prerequisite for the courses Animal physiology, exercises (755318A), Comparative animal physiology (751x84A/S) and Advanced course in animal physiology (751635S).

**Recommended or required reading:**

Reece, J.B. Urry, L.A. Cain, M.L., Wasserman, S.A. Minorsky, P.V. & Jackson R.B. 2011: Campbell Biology (9e). Pearson, Global Edition, 1309 p, handouts.

The availability of the literature can be checked from [this link](#).

**Assessment methods and criteria:**

Home essays and exam.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5 / Fail.

**Person responsible:**

Prof. Seppo Saarela.

**Working life cooperation:**

No.

**Other information:**

-

**755318A: Animal physiology, exercises, 4 op**

**Voimassaolo:** 01.08.2011 - 31.07.2015

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Biology

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Saarela, Seppo Yrjö Olavi

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

755327A Animal physiology exercises 5.0 op

**ECTS Credits:**

4 ECTS credits / 107 hours of work.

**Language of instruction:**

Finnish.

**Timing:**

B.Sc. 3<sup>rd</sup> autumn.

**Learning outcomes:**

Students know basic physiological methods and can design simple experiments.

**Contents:**

The laboratory course will familiarize students with the use of simple experimental trials, laboratory tests and computer aided measurements the physiological basic principles.

**Mode of delivery:**

Face-to-face teaching.

**Learning activities and teaching methods:**

32 h laboratory training, exam.

**Target group:**

BS compulsory, TEAbs optional.

**Prerequisites and co-requisites:**

Cell biology (750121P) and Animal physiology, lectures (751388A).

**Recommended optional programme components:**

This course is a prerequisite for the courses Comparative animal physiology (751x84A/S), and Advanced animal physiology (751635S).

**Recommended or required reading:**

Animal physiology course booklet.

**Assessment methods and criteria:**

Exam.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5 / Fail.

**Person responsible:**

Prof. Seppo Saarela.

**Working life cooperation:**

No.

**Other information:**

-

**030005P: Information Skills, 1 op**

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Faculty of Technology

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Sassali, Jani Henrik, Koivuniemi, Mirja-Liisa

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

030004P Introduction to Information Retrieval 0.0 op

**ECTS Credits:**

1 ECTS credit

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd year

**Learning outcomes:**

Students know the different phases of information retrieval process and basic techniques of scientific information retrieval. They will find the most important reference databases of their discipline and know how to evaluate information sources and retrieval results.

**Contents:**

Retrieval of scientific information, the retrieval process, key databases of the discipline, and evaluation of information retrieval and information sources.

**Mode of delivery:**

Blended teaching: classroom training, web-based learning material and exercises in Optima environment, a final assignment on a topic of the student's own choice

**Learning activities and teaching methods:**

Training sessions 8h, group working 7h, self-study 12h

**Target group:**

Compulsory for all students of the Faculty of Technology. In the Faculty of Science the course is compulsory for students of biology, physics, geosciences, chemistry, geography and information processing science. The course is optional for students of biochemistry and mathematics.

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Web learning material <https://wiki oulu.fi/display/030005P>.

**Assessment methods and criteria:**

Passing the course requires participation in the training sessions and successful completion of the course assignments.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Science and Technology Library Tellus, tellustieto (at) oulu.fi

**Working life cooperation:**

-

**Other information:**

-

**780329A: Laboratory Course I in Organic Chemistry, 4 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Juha Heiskanen, Johanna Kärkkäinen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits/107 hours of work

**Language of instruction:**

Finnish, English on demand, materials in English (partly)

**Timing:**

2<sup>nd</sup> autumn

**Learning outcomes:**

Upon completion of the five different syntheses of the course, the student is familiar with safety issues, glassware and equipment, use of laboratory notebook and written reporting of laboratory experiments. He /she should be able to work by using basic techniques of organic chemistry such as distillation, extraction, crystallization, TLC.

**Contents:**

Five different organic syntheses.

**Mode of delivery:**

Face-to-face teaching in the laboratory

**Learning activities and teaching methods:**

2 h lectures (obligatory for all), 50 h/ laboratory of supervised, independent laboratory work and 55 h/lab of self-study and reporting.

**Target group:**

Chemistry, compulsory

**Prerequisites and co-requisites:**

General and Inorganic Chemistry I and General and Inorganic Chemistry II (780114P and 780115P), or Introduction to Chemistry (780113P) or Introduction to Physical Chemistry (780101P) and Introduction to Inorganic Chemistry (780102P) or Basic Principles in Chemistry (780109P), Introduction to Organic Chemistry (780103P), and Introductory Laboratory Course (780122P) passed.

**Recommended optional programme components:**

Participation in the course 780389A organic Chemistry I.

**Recommended or required reading:**

Clayden, J., Greeves, N., Warren, S. and Wothers, P.: Organic Chemistry, Oxford University Press, 2001. Laboratory Course Manual.

**Assessment methods and criteria:**

Works, reports and the preliminary exam passed. The works must be done within the next two years. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail. Laboratory works and reporting 2/3 and exam 1/3

**Person responsible:**

Ph.D. Juha Heiskanen

**Working life cooperation:**

No

**Other information:**

The reports must be returned to the teacher by the given deadline. Otherwise you have to do the work again.

**740379A: Introduction to immunology, 3 op**

**Voimassaolo:** 01.08.2011 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tuomo Glumoff

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

743660S	Introduction to immunology	3.0 op
740378A	Basic immunobiology for biochemists	3.0 op
741661S	Immunobiology	3.0 op
740369A	Immunobiology	3.0 op

**ECTS Credits:**

3 credits

**Language of instruction:**

Partly Finnish, partly English

**Timing:**

B.Sc. yr3 autumn or M.Sc yr1-yr2 autumn

**Learning outcomes:**

After the course students will be able to identify, analyze and apply essential cellular molecules, components and mechanisms related to immunology, and complete their previous knowledge of molecular and cellular biology and protein chemistry with immunobiochemistry issues.

**Contents:**

The course handles both unspecific and specific immune response mechanisms, antibody structure and diversity, antibody-based immunodiagnostics, as well as basics of virus biochemistry.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

Lectures (12 h), a written home exercise, and a final exam.

**Target group:**

Major and minor subject undergraduates



**Prerequisites and co-requisites:**

Preliminary required courses: Molekyylibiologia I, Protein chemistry I and Solun biologia, or equivalent basic molecular biology, protein chemistry and cell biology studies.

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Home exercise, final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Tuomo Glumoff

**Working life cooperation:**

No

**Other information:**

This module is the same as 743660S Introduction to immunology

**740368A: Radiation and Safety, 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Sakari Kellokumpu

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

740320A	Radiochemistry and Radiation Safety	4.5 op
740339A	Laboratory course in isotope techniques	1.5 op

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

B.Sc. yr3 spring

**Learning outcomes:**

Upon completion the students should be able to

- understand the character of ionizing radiation
- know biological effects of radiations
- work safely in the isotope laboratory
- know legislation and regulatory guides on radiation safety

**Contents:**

This course is composed of two lecture items, radiochemistry and radiation legislation, and practical course. Radiochemistry course will describe nature of radioactivity, decay types, interaction of radiation with matter and biological effects of ionizing radiation. In the legislation part radiation law and regulatory guides on radiation safety will be examined. During the practical course students will be familiarized with the use of radioisotopes, radiation protection and radiation safety rules. They will also be familiarized with some typical ways to use radiation in research work. Passing the lecture part not less than 3 (and the legislation part at least 3) and completion of practical course will qualify to act as a radiation safety officer

(radiation law 592/91 18§) in the following fields of competence: 1) Use of unsealed sources in industry, research and education, 2) Use of sealed sources and X-ray appliances in industry, research and education, 3) Trade in radioactive substances.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

Course is organized in co-operation with Department of Physics. 26 h lectures, 8 h exercises, 2 practicals with sealed radiation sources, 40 h lab

**Target group:**

Major students

**Prerequisites and co-requisites:**

Biochemical methodologies I, Metabolism I and Molecular biology I

**Recommended optional programme components:**

-

**Recommended or required reading:**

Lecture handout, Radiation act and Radiation degree, Regulatory Guides on radiation safety, laboratory manual

**Assessment methods and criteria:**

Laboratory practicals, final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Sakari Kellokumpu

**Working life cooperation:**

No

**Other information:**

-

**740371A: Physiological Biochemistry, 4 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Vasily Antonenkov

**Opintokohteen oppimateriaali:**

**Murray, R.K.,** , 2006

**Opintokohteen kielet:** English

**Leikkaavuudet:**

742627S Physiological biochemistry 4.0 op

**ECTS Credits:**

4 credits

**Language of instruction:**

English

**Timing:**

B.Sc. yr3 spring

**Learning outcomes:**

Aim of the course is to get students familiar with :

- Specific aspects of human biochemistry
- Structure, tasks and function of different organs

- Systemic and intracellular regulation of metabolism
- Functional and regulatory relations of different organs

**Contents:**

Lectures include information about morphology, function and role in metabolism of adipose tissue, kidney, muscle tissue and cytoskeleton, alimentary system and liver. They also focus on structure of biomembranes, composition and function of endocrine system, hormone synthesis and signal transduction. Mechanisms of action of hormones (especially steroid hormones), their cell surface and intracellular receptors, second messengers and other regulatory molecules will be discussed.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

18 h lectures, 4 h seminars, and 10 h laboratory work. Seminars and laboratory work are compulsory.

**Target group:**

Major students

**Prerequisites and co-requisites:**

Basic biochemistry, cellular and molecular biology

**Recommended optional programme components:**

Alternative course: 751388A Animal physiology, lectures 4 op

**Recommended or required reading:**

Murray et al. Harpers' Illustrated Biochemistry (28 or 29<sup>th</sup> edition)

**Assessment methods and criteria:**

Final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Vasily Antonenkov

**Working life cooperation:**

No

**Other information:**

Recommended optional course

**740380A: Virology, 3 op**

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Thomas Kietzmann

**Opintokohteen kielet:** English

**Leikkaavuudet:**

743661S Virology 3.0 op

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

BSc. yr3 spring (starts 2015)

**Learning outcomes:**

Upon successful completion students are able to:

- discuss the major groups of viruses and their infection and replication mechanisms
- present and discuss characteristic features of specific viruses and their relation to pathogenesis and immunity
- describe diagnostic methods and antiviral therapy

**Contents:**

The course covers basic aspects of virology. The main emphasis will be made on viral infection, replication, transcription, proteinsynthesis, virological diagnostics, infection kinetics, defense against viruses, ways of infection, vaccination, and antiviral therapy. The course involves lectures 10h and 10h seminars where the students should be able to recapitulate major aspects of the taught material in 5-7 min presentations.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

24 h lectures and student presentations in seminars

**Target group:**

Major students

**Prerequisites and co-requisites:**

Cellular biology

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Thomas Kietzmann

**Working life cooperation:**

No

**Other information:**

This module is the same as Virology (743661S)

**040900S: Using animals in research - carrying out procedures, 2,5 - 3 op**

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Laboratory Animal Centre

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Voipio Hanna-marja

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

040911S Using animals in research - carrying out procedures 3.0 op

Ei opintojaksokuvauksia.

**751367A: Developmental biology-histology, lectures, 4 op**

**Voimassaolo:** - 31.07.2015

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Biology

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Hohtola, Esa Juhani

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

755320A Developmental biology-histology, lectures 5.0 op

**ECTS Credits:**

4 ECTS credits / 107 hours of work.

**Language of instruction:**

Finnish.

**Timing:**

B.Sc. 1 st spring.

**Learning outcomes:**

After completing the developmental biology -part of the course the student is able to name the most important events of embryonic development and the structural changes related to them. The student is also able to describe the principles gene regulation related to embryonic development. After completing the histology-part of the course the student is able to describe the various tissue types and the microscopic structure of important organs and is also able to identify tissue types and organs from microscopic sections.

**Contents:**

Motto: "It is not birth, marriage, or death, but gastrulation, which is truly the most important time in your life." (Lewis Wolpert, 1986). Developmental biology will cover gametogenesis, fertilization, forming of embryonic tissue layers (gastrulation), embryonic induction, signal molecules and the differentiation of the most important tissues and organs (organogenesis). Histology will first cover various tissue types, their cell types and matrix composition. Thereafter, the microscopic structure and tissue composition of various organs and organ systems will be covered. In both parts, practical exercises on drawing from microscopic slides (see 755317A) will support lectures.

**Mode of delivery:**

Face-to-face teaching.

**Learning activities and teaching methods:**

38 h lectures and two exams.

**Target group:**

Compulsory to biology students.

**Prerequisites and co-requisites:**

Cell biology (750121P) or equivalent knowledge.

**Recommended optional programme components:**

-

**Recommended or required reading:**

Lecture notes, lecture handouts. Recommended reading: Sariola, Frilander ym., Solusta yksilöksi: Kehitysbiologia, Duodecim, Helsinki 2003; Gilbert: Developmental Biology, Sinauer Press, 6.ed. 2000, or newer; Young & Heath: Wheater's Functional Histology, Churchill Livingstone, 4. ed. 2000, or newer. The availability of the literature can be checked from [this link](#).

**Assessment methods and criteria:**

2 lecture exams.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5 / Fail.

**Person responsible:**

Prof. Esa Hohtola.

**Working life cooperation:**

No.

**Other information:**

-

**755317A: Developmental biology-histology, exercises, 5 op****Voimassaolo:** 01.08.2011 - 31.07.2019**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Department of Biology**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Saarela, Seppo Yrjö Olavi**Opintokohteen kielet:** Finnish**ECTS Credits:**

5 ECTS credits / 133 hours of work.

**Language of instruction:**

Finnish.

**Timing:**B. Sc. 1<sup>st</sup> spring.**Learning outcomes:**

After completing the developmental biology -part of the course the student is able to name the most important events of embryonic development and the structural changes related to them. The student is also able to describe the principles gene regulation related to embryonic development. After completing the histology-part of the course the student is able to describe the various tissue types and the microscopic structure of important organs and is also able to identify tissue types and organs from microscopic sections.

**Contents:**

Motto: "It is not birth, marriage, or death, but gastrulation, which is truly the most important time in your life." (Lewis Wolpert, 1986). Developmental biology will cover gametogenesis, fertilization, forming of embryonic tissue layers (gastrulation), embryonic induction, signal molecules and the differentiation of the most important tissues and organs (organogenesis). Histology will first cover various tissue types, their cell types and matrix composition. Thereafter, the microscopic structure and tissue composition of various organs and organ systems will be covered. In both parts, practical exercises on drawing from microscopic slides (see 755317A) will support lectures.

**Mode of delivery:**

Face-to-face teaching.

**Learning activities and teaching methods:**

44 h exercises, microscopic studying and drawing from the preparates.

**Target group:**

BS: compulsory, TEAbs optional.

**Prerequisites and co-requisites:**

Cell biology (750121P) or equivalent knowledge.

**Recommended optional programme components:**

Same time with Developmental biology-histology lectures (751367A).

**Recommended or required reading:**

Handout.

**Assessment methods and criteria:**

Exercise exam.

Read more about [assessment criteria](#) at the University of Oulu webpage.**Grading:**

1-5 / Fail.

**Person responsible:**

Prof. Seppo Saarela.

**Working life cooperation:**

No.

**Other information:**

-

**740074Y: Tutoring/confidential posts, 1,5 op**

**Opiskelumuoto:** General Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Jari Heikkinen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

1.5 credits

**Contents:**

For this study a student acts as a tutor for a group of new students, as a member of Working group on development of teaching (OKTR) or as a member of working committee of OKTR .

**Learning activities and teaching methods:**

10-20 h tutoring of a small group, autumn yr2-yr3, activity in Working group on development of teaching (OKTR) or in working committee of OKTR. Optional.

**Assessment methods and criteria:**

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Amanuensis

**H325423: Compulsory courses - Int MSc, Protein science and biotechnology, 76 op**

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Study module

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

*Obligatory*

**747601S: Protein production and analysis, 8 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Lloyd Ruddock

**Opintokohteen kielet:** English

**Leikkaavuudet:**

747618S Protein production and analysis 10.0 op

**ECTS Credits:**

8 credits

**Language of instruction:**

English

**Timing:**

Int M.Sc. yr1 autumn

**Learning outcomes:**

Upon successful completion students are able to:

- tell and discuss the relevance of protein structure, including post-translational modification, to protein function
- assess the techniques available to purify proteins and to study protein function and an appreciation of the applications and limitations of these techniques
- interpret a wide range of biochemical data and to solve problems relating to the interpretation of data relating to protein function and basic structural characterization

**Contents:**

This module provides an overview of recombinant protein production and analysis. Topics covered include an overview of DNA technology, PCR, cloning, mutagenesis, protein production, purification, enzyme catalysis, protein structure analysis, basic proteomics and mass spectrometry. This course covers some of the material taught in Protein Chemistry I (740364A) and Molekyylibiologia I (740361A) and therefore cannot be taken by students who have either of these modules.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

46 contact hours of lectures and seminars, 80 hours of lab

**Target group:**

Int MSc in Prot Sci

**Prerequisites and co-requisites:**

A BSc in biochemistry or a closely related subject.

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Continuous assessment (problem solving exercises, lab reports)

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Lloyd Ruddock

**Working life cooperation:**

No

**Other information:**

-

**747608S: Biochemical methodologies II, 8 op**

**Voimassaolo:** 01.08.2009 -



**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Ulrich Bergmann

**Opintokohteen kielet:** English

**Leikkaavuudet:**

740365A Biochemical Methodologies II 8.0 op

**ECTS Credits:**

8 credits

**Language of instruction:**

English

**Timing:**

MSc 1st autumn

**Learning outcomes:**

Upon successful completion students are able to:

- describe the theoretical basis of the main biochemical analysis methods for proteins
- identify and use the different instruments
- describe the potential of the different analytical techniques and develop strategies for addressing specific questions in protein & proteome-analysis
- integrate data from multiple sources and evaluate it critically

**Contents:**

During this module students will produce and analyze their own protein samples. The course will cover principles and practical applications of some of the more advanced methodologies used in practical biochemistry, including fluorescence spectroscopy, stopped flow analysis of enzymatic reactions, circular dichroism, surface plasmon resonance, micro-calorimetry, mass spectrometry, and proteomics based on 2D electrophoresis. For assessment each student has to write a research report in the style of a scientific publication. Attendance is compulsory.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

120 h lab., including pre-lab lectures plus exercises

**Target group:**

Obligatory for M.Sc. in Protein Science and biotechnology

**Prerequisites and co-requisites:**

Protein production and analysis (747601S) or Protein chemistry I (740364A)

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Report written in style of a scientific publication

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Ulrich Bergmann

**Working life cooperation:**

No

**Other information:**

-

**747691S: Pro gradu experimental work in protein science and biotechnology, 28 op****Opiskelumuoto:** Advanced Studies**Laji:** Practical training**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Lloyd Ruddock**Opintokohteen kielet:** English**ECTS Credits:**

28 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2

**Learning outcomes:**

After the experimental work students is able to:

- undertake scientific research with supervision using typical methods in biochemistry
- plan and perform experiments in laboratory, perform efficient time management, consider his motivation and how to improve that, work independently and as part of a team
- identify and solve practical problems, record and critically evaluate data

**Contents:**

This module provides an extensive, 6 month, project in a research group. The experimental work can be started after 30 op of Master studies have been completed. Students are responsible for finding a suitable research group in which they wish to undertake the Pro Gradu work. Students should produce a short (typically 2 page) study plan detailing the proposed content of their Pro Gradu work, supervisor(s) and start date which must be approved before they start work. The Pro Gradu thesis is based only on the work done during the first 6 months of work by the student on the project, except in cases of mitigating circumstances. The work may be undertaken in the research groups of department of Biochemistry or in any other suitable research group in Finland or abroad.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

Independent work

**Target group:**

M.Sc. in Protein science and biotechnology

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Laboratory work of six months

Read more about [assessment criteria](#) at the University of Oulu webpage.**Grading:**

pass/fail

**Person responsible:**

Lloyd Ruddock

**Working life cooperation:**

Yes

**Other information:**

**747692S: Pro gradu thesis in protein science and biotechnology, 20 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Diploma thesis

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tuomo Glumoff

**Opintokohteen kielet:** English

**ECTS Credits:**

20 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr2

**Learning outcomes:**

On successful completion of this course, the student is able to:

- retrieve and appraise information critically and integrate information to new entity
- communicate in science and make and defend scientific arguments.

**Contents:**

The Pro gradu thesis (typically around 50-60 pages long) is based on the experimental work undertaken by the student and the contextualization of the research and the results based on the published literature in the field. For detailed instructions see <http://www.biochem oulu.fi/>.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

-

**Target group:**

M.Sc. in Protein science and biotechnology

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Written thesis

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Working life cooperation:**

No

**Other information:**

-

**740672S: Maturity test (M.Sc. degree), 0 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

0 credits

**Language of instruction:**

Finnish / English

**Timing:**

M.Sc. yr2

**Learning outcomes:**

-

**Contents:**

Will be written in context to Pro gradu thesis. In the test student must show a good command of both language skills and their field of Pro gradu thesis. If student's native language is not Finnish or Swedish Faculty of Science will define language in the test.

**Target group:**

Majors students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Written abstract of Pro Gradu thesis

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Working life cooperation:**

No

**Other information:**

-

*Orientation to research work: work done in an academic or industrial research group. Orientation to biochemical work: work done in a non research group environment. For Int MSc in protein science and biotechnology line the sum of credits of both courses must be 12-18 ECTS cr.*

#### **744617S: Orientation to research work, 0 - 20 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Practical training

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Jari Heikkinen

**Opintokohteen kielet:** English

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

12 - 20 credits (see Other information)

**Language of instruction:**

English

**Timing:**

MSc yr 1

**Learning outcomes:**

After this course student has gained experience of practical work done in research groups. Student is able to:

- demonstrate goal-oriented teamwork
- apply methods used in proper environment
- discuss the practical work done and reflect his knowledge

**Contents:**

This module provides an introduction to research work via the active integration of students into research groups and/or via one to two week advanced practical courses. The integration into groups can be either full-time or part-time research work, with 1.5op being awarded for each full-time week equivalent worked. A maximum of 6op can be awarded for working in one research group. The research groups do not need to be in the Department of Biochemistry, University of Oulu, but advance permission should be sought if the research group is not part of the University of Oulu.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

Independent work

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Research work

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Jari Heikkinen

**Working life cooperation:**

Yes

**Other information:**

The sum of credits from courses 744624S and 744617S must be 12-20 credits (for Int MSc in protein science line 12-18 credits)

**744624S: Orientation to biochemical work, 0 - 20 op**

**Voimassaolo:** 01.08.2011 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Practical training

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Jari Heikkinen

**Opintokohteen kielet:** English

**Leikkaavuudet:**

744629S Orientation to biochemical work 0.0 op

744617S Orientation to research work 0.0 op

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

12-20 credits (see Other information)

**Language of instruction:**

English/Finnish

**Timing:**

M.Sc. yr1

**Learning outcomes:**

After this course student has gained experience of practical work done in non-research group environment. Student is able to:

- demonstrate goal-oriented teamwork
- apply methods used in proper environment
- discuss the practical work done and reflect his knowledge

**Contents:**

This module provides an introduction to non-research work in companies or other suitable environment. The work can be either full-time or part-time work, with 1.5op being awarded for each full-time week equivalent worked. A maximum of 6op can be awarded for working in one work placements. Each placement must be agreed in advance with the responsible person.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

Independent work

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

non-research work

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Pass/fail

**Person responsible:**

Jari Heikkinen

**Working life cooperation:**

Yes

**Other information:**

The sum of credits from courses 744624S and 744617S must be 12-20 credits (for Int MSc in protein science line 12-18 credits)

## **H325425: Optional specialist courses - MSc / Int MSc, Protein science and biotechnology, 11,5 - 21,5 op**

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Study module

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

*Optional specialist courses (a minimum of 4 of these courses must be taken)*

**747605S: Basic aspects of protein crystallographic methods, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Wierenga Rikkert

**Opintokohteen kielet:** English

**Leikkaavuudet:**

744615S Basic aspects of protein crystallographic methods 3.0 op

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 autumn

**Learning outcomes:**

Upon successful completion students are able to:

- describe the key aspects of the protein crystallization methods
- describe the importance of crystals for obtaining the structure of a protein
- describe the importance of the Fourier transform method in the structure determination method
- describe the phase problem
- describe the importance of the anomalous differences

**Contents:**

The course will describe the principles of x-ray diffraction theory. It will focus on aspects used in the field of protein crystallography including following topics: Crystallisation of proteins, symmetry properties of crystals, X-ray sources and detectors, the diffraction pattern and the reciprocal lattice, the phase problem, isomorphous differences and the MIR-method, anomalous differences and the MAD-method.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

20 h lectures and seminars

**Target group:**

M.Sc. in Protein Science and biotechnology

**Prerequisites and co-requisites:**

Biomolecules and Protein chemistry I or Protein production and analysis or equivalent

**Recommended optional programme components:**

-

**Recommended or required reading:**

Drenth, J.: Principles of protein X-ray crystallography (2nd edition); Blow, D.: Outline of crystallography for biologists (1st edition, 2002)

**Assessment methods and criteria:**

Oral presentation

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Rik Wierenga

**Working life cooperation:**

No

**Other information:**

-

**747606S: Structural enzymology, 3 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Wierenga Rikkert**Opintokohteen kielet:** English**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 spring

**Learning outcomes:**

Upon successful completion students are able to:

- discuss the methods that are used to crystallize proteins
- describe the basic concepts of the transition state theory
- define the relation between reaction rates and free energy barriers
- describe enzyme reaction mechanisms
- describe the concepts of catalytic bases and acids
- illustrate active site strain
- tell the importance of active site electrostatics
- describe the concept of transition state analogues

**Contents:**

General and specific aspects of the reaction mechanism of several well studied enzymes will be discussed. It will include the serine proteases (such as chymotrypsin and trypsin). The following topics will be addressed: Chemical catalysis, transition state theory, forces stabilizing the enzyme-ligand interaction, structural properties of proteins, enzyme kinetics, crystallization of proteins, general aspects of enzyme catalysed reactions, reaction mechanisms of serine proteases, transition state analogues. The course is aimed at biochemistry and chemistry students.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

20 h lectures and seminars

**Target group:**

M.Sc. in Protein science and biotechnology

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Oral presentation

Read more about [assessment criteria](#) at the University of Oulu webpage.**Grading:**



pass/fail

**Person responsible:**

Rikkert Wierenga

**Working life cooperation:**

No

**Other information:**

-

**747611S: Biochemistry of protein folding, 3 op**

**Voimassaolo:** 01.06.2011 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Lloyd Ruddock

**Opintokohteen kielet:** English

**Leikkaavuudet:**

747602S Biochemistry of protein folding 2.5 op

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc., yr1-yr2 spring

**Learning outcomes:**

Upon successful completion students are able to:

- present and discuss issues presented in the primary literature on a variety of aspects of protein folding.
- display an understanding of the theoretical and practical implications of *in vivo*, *in vitro* and *in silico* studies on protein folding and the integration of results.
- demonstrate the ability to interpret a wide range of data from multiple sources, to critically evaluate and contextualise this data and to solve problems relating to interpretation.

**Contents:**

This module provides an introduction to protein folding *in vivo*. Topics covered include protein folding and quality control in the endoplasmic reticulum, mechanisms regulating protein folding including the unfolded protein response, the catalysis of native disulphide bond formation, the biochemistry of molecular chaperones and the role of molecular chaperones and protein folding catalysts in other cellular events.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

16 contact hours of lectures and seminars

**Target group:**

M.Sc. in Protein science and biotechnology

**Prerequisites and co-requisites:**

Protein chemistry I (740364A) or Protein production and analysis (747601S) or equivalent

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

The module is assessed based on a report prepared on individual topics and on participation in the seminars.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Lloyd Ruddock

**Working life cooperation:**

No

**744619S: Systems biology, 4 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tuomo Glumoff

**Opintokohteen kielet:** English

**ECTS Credits:**

4 credits

**Language of instruction:**

English

**Timing:**

M.Sc. 1st-2nd autumn

**Learning outcomes:**

After the course student is able to define the cell as an ensemble of structural and functional parts. He is also able to connect and describe their current knowledge on cellular, molecular and structural biology into a general view. The student is also able to assess scientific information critically on novel research findings and the problems associated with massive amounts of novel scientific information.

**Contents:**

The module aims to give a holistic picture of the cell as a system. Cells contain numerous molecules and complex structures that interact with each other to form complex interaction networks such that when taken together they form a new whole, which cannot be understood by just investigating the parts. Methods to collect and assemble biological/biochemical information for systems analysis will be introduced. Possibilities of systems approach will be critically discussed in relation to available research techniques, techniques of the future, applications, research targets, as well as from the philosophical and ethical point of view including applicability of the systems theory in biosciences.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

The module consists of 22 h of lectures, discussions and case studies, ca. 5h of computing exercises

**Target group:**

Major students

**Prerequisites and co-requisites:**

B.Sc. in biochemistry or a related subject or otherwise adequate knowledge on cellular, molecular and structural biology.

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Study diaries will be assessed for a mark on scale 1 to 5 upon request. Otherwise marking will be Pass/fail. There is no exam and thus presence on certain amount of the course is compulsory. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Tuomo Glumoff

**Working life cooperation:**

No

**Other information:**

-

**747603S: Bioinformatics, 2,5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Ari-Pekka Kvist

**Opintokohteen kielet:** English

**ECTS Credits:**

2.5 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 spring

**Learning outcomes:**

Upon successful completion student are able to:

- use web-based bioinformatics tools.
- process the information and find solutions to various problems
- analyse and present the findings in the form of a report

**Contents:**

This course introduces basic concepts and methodology in bioinformatic research. Basic computational methods of DNA and protein handling and database searches are introduced. Other methods may include joining database and proteomic searches and evolutionary views of biocomputing. After this course a student has insight of basic methodology of bioinformatics. Attendance to practicals is compulsory.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

8 hr lectures, 30 h practicals

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Ari-Pekka Kvist

**Working life cooperation:**

No

**Other information:**

-

**784637S: Biological NMR Spectroscopy, 3 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Mattila, Sampo Antero**Opintokohteen kielet:** English**ECTS Credits:**

3 credits/80 hours of work

**Language of instruction:**

English

**Timing:**

The course is lectured every year.

**Learning outcomes:**

After the course the students have basic knowledge and hands on experience with backbone assignment of small  $^{15}\text{N}$ / $^{13}\text{C}$  labelled protein using most common 3 dimensional triple resonance NMR spectra.

**Contents:**

During the course the students get hands on experience on setting up and acquiring multi dimensional spectra as well as processing and converting data to other formats and assigning protein backbones.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

14 hours of lectures + applications, 30 hours of exercises, 36 hours of self-study

**Target group:**

Chemistry, optional

**Prerequisites and co-requisites:**

No specific prerequisites

**Recommended optional programme components:**

The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**

Zerbe (ed): Bio-NMR in Drug Research, Wiley-VCH and Cavanagh: Protein NMR Spectroscopy, Academic Press, 1995 (partly) ISBN: 0121644901.

**Assessment methods and criteria:**

The seminar at the end of the course, exercises and home assignments  
Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Lecturer Sampo Mattila

**Working life cooperation:**

No

**Other information:**

No

**747604S: Introduction to biocomputing, 3 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** André Juffer**Opintokohteen kielet:** English**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 autumn

**Learning outcomes:**

Upon successful completion students are able to:

- discuss several biocomputing techniques
- decide which method to use under what circumstances
- judge the quality of an analysis of a given problem by means of biocomputing techniques

**Contents:**

An overview is given of commonly employed techniques of biocomputing to study the structural, dynamical, functional and thermodynamical properties of proteins and membranes and their interaction with other molecules. This will include a overview of computer simulation techniques such as molecular dynamics, Monte Carlo and Langevin (stochastic, Brownian) dynamics, but also concepts of continuum electrostatics, statistical thermodynamics, protein modeling techniques, protein-ligand affinity calculations and the computer simulation of the protein folding process and enzyme action. In addition, some topics in the field of Bioinformatics are discussed as well and certain commonly employed protein modeling software is introduced.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

20 h lectures, student tasks

**Target group:**

M.Sc. in Protein science and biotechnology

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Recommended books:

Leach, A.R., *Molecular modelling. Principles and applications*, Second edition, Prentice Hall, New York, 2001Berendsen, H.J.C *Simulating the physical world. Hierarchical modeling from quantum mechanics to fluid dynamics.*, Cambridge University Press, Cambridge, 2007**Assessment methods and criteria:**

Presentation, group discussion

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

André Juffer

**Working life cooperation:**

No

**Other information:**

-

**H325429: Optional courses - Int MSc, Protein science and biotechnology, 4,5 - 32,5 op**

Voimassaolo: 01.08.2012 -

**Opiskelumuoto:** Advanced Studies**Laji:** Study module**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

*Optional courses***744618S: Dissertation, 18 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Lloyd Ruddock**Opintokohteen kielet:** English**Leikkaavuudet:**

744631S Dissertation 15.0 op

**ECTS Credits:**

18 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2

**Learning outcomes:**

Upon successful completion students are able to:

- apply information in the right context, integrate information from a wide range of sources and evaluate it critically
- communicate science in extensive written format and discuss and defend scientific arguments
- demonstrate independent work including self motivation, planning, organizational skills and time management.

**Contents:**

This module is based around the student producing an extensive, in-depth literature report in the style of a scientific review. Students are responsible for finding a suitable supervisor for their dissertation with whom they will discuss the scientific background and relevant literature. Students are strongly encouraged to meet with their supervisor weekly to discuss progress and ideas and to resolve problems. A one-page outline of the dissertation subject area, including details of the supervisor (who need not be from the University of Oulu), must be approved by the module convener before starting this module. While the dissertation subject can be closely linked with the Pro Gradu project subject, students are advised that having distinct topics for these two modules will look better on their CV.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

480 hours of student work

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Written report

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Lloyd Ruddock

**Working life cooperation:**

No

**Other information:**

-

**744625S: Scientific presentation, 1 - 2 op**

**Voimassaolo:** 01.03.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Jari Heikkinen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

1-2 credits

**Language of instruction:**

Finnish and English

**Timing:**

M.Sc.

**Learning outcomes:**

The student makes a presentation and participates in an international scientific conference with their own presentation. The presentation may be a poster, a talk or equivalent. The student uses the skills learned in the B.Sc. or otherwise in planning and realizing the presentation. The student practices communication skills necessary for research work.

**Contents:**

Student participates in a conference and delivers a poster, a talk or equivalent. The contents of which must include student's own results, for example from the Master's Thesis work. The pro gradu supervisor or other suitable person supervises the planning and realization of the presentation.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

A poster, a talk or equivalent is delivered. The workload of the course may vary depending on the extent and the form of presentation.

**Target group:**

Major students (MSc)

**Prerequisites and co-requisites:**

No compulsory preceding courses

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Study diary, a copy of presentation or poster

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Amanuensis

**Working life cooperation:**

No

**Other information:**

The amount of credits is estimated based on the workload of the planning and realization of the presentation, but not the length of the meeting.

**747693S: Final examination in protein science and biotechnology, 9 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Lloyd Ruddock

**Opintokohteen kielet:** English

**ECTS Credits:**

9 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2

**Learning outcomes:**

Upon successful completion students should be able to:

- discuss the full breadth of the core topics of biochemistry, protein science and biotechnology
- Integrate material from multiple sources

**Contents:**

This examination will test the ability of students to integrate knowledge from BSc and MSc level protein science and biotechnology. The questions will require an understanding of the principles of biochemistry and protein science and will be based on subject specific material from relevant BSc and MSc level modules. The format will be an oral examination.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**



Student self-study

**Target group:**

M.Sc. in Protein science and biotechnology

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Oral examination

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Lloyd Ruddock

**Working life cooperation:**

No

**Other information:**

-

**030008P: Information Skills for foreign degree students, 1 op**

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Faculty of Technology

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Sassali, Jani Henrik, Koivuniemi, Mirja-Liisa

**Opintokohteen kielet:** English

**ECTS Credits:**

1 ECTS credit

**Language of instruction:**

English

**Timing:**

The course is held in the spring semester

**Learning outcomes:**

Students know the different phases of scientific information retrieval process and basic techniques of systematic information search. They will find the most important reference databases of their discipline and know how to evaluate information sources and search results.

**Contents:**

Retrieval of scientific information, the search process, key databases of the discipline, and evaluation of information retrieval and information sources.

**Mode of delivery:**

Blended teaching: classroom training, web-based learning material and exercises in Optima environment, a final assignment on a topic of the student's own choice

**Learning activities and teaching methods:**

Training sessions 8h, self-study 19h

**Target group:**

The course is intended to degree students of the Faculty of Science and the Faculty of Technology. The course is compulsory for the Master's Degree Programme (BCBU) in Environmental Engineering (BEE).

**Prerequisites and co-requisites:**

It is recommended that the student knows the basic services of Oulu University Library. The student can participate in the Library ABC –training (<http://www oulu.fi/library/node/10710>).

**Recommended optional programme components:**

-

**Recommended or required reading:**

Parts from the following chapters of the Toolbox of Research: <https://wiki oulu.fi/display/tor/1.1+Finding+scientific+information>  
<https://wiki oulu.fi/display/tor/1.3.1+Evaluation+based+on+academic+publishing>

**Assessment methods and criteria:**

Passing the course requires participation in the training sessions and successful completion of the course assignments.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Science and Technology Library Tellus, tellustieto (at) oulu.fi

**Working life cooperation:**

-

**Other information:**

-

**488304S: Bioreactor Technology, 6 op**

**Voimassaolo:** 01.08.2005 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Johanna Panula-Perälä

**Opintokohteen kielet:** English

**Leikkaavuudet:**

488321S Bioreactor technology 5.0 op

480431S Bioprocesses II 5.0 op

**ECTS Credits:**

6 cr

**Language of instruction:**

English

**Timing:**

The course is held in autumn semester during period I and II. It is recommended to complete the course in the 4<sup>th</sup> year.

**Learning outcomes:**

After completing this course, the student will be able to verbally describe the most common equipment, materials and methods related to biotechnological processes, microbial growth and cultivation and sterilization. The student will be able to apply different mathematical formulas for biocatalysis and for the bioreactor performance and use those to plan and analyze bioprocesses. The student will also be able to produce, analyze and interpret data from bioprocesses.

**Contents:**

Biotechnological process: General process schemes, batch, fed batch and continuous processes, biocatalysts and raw materials. Reactor design and instrumentation. Sterilization: kinetics of heat

inactivation and practical implementation of sterilization methods. Mathematical description and quantification of the function of biocatalysts. Monod and Michaelis-Menten models, reaction rates and their determination. The lag phase of growth, cellular maintenance, cell death. Kinetics of product and by-product formation. Kinetics of oxygen and heat transfer. Oxygen and heat balances: significance and calculations. Power consumption. Scale-up and scale-down.

**Mode of delivery:**

Blended teaching.

**Learning activities and teaching methods:**

Lectures 36 h / exercises 6 h / homework 50 h / self-study 68 h.

**Target group:**

Master students of bioprocess engineering and environmental engineering students in M.Sc. Programme in Green Chemistry and Bioproduction. Master students from process engineering and biochemistry with required prerequisites.

**Prerequisites and co-requisites:**

The bachelor level courses by the Environmental Engineering (especially 488301A Microbiology, 488302A Basics of biotechnology) or respective knowledge.

**Recommended optional programme components:**

-

**Recommended or required reading:**

Lectures: Lecture hand outs; Doran, P. M. Bioprocess engineering principles. Academic Press. London, 2010 . Supplementary material: Enfors, S.-O., Häggström, L. . Bioprocess technology fundamentals and applications. Royal Institute of Technology. Stockholm 2011. ; Biotechnology (Vol 2 ): Fundamentals of biochemical engineering. . Toim. H.-J. Rehm and G. Reed, Weinheim, Wiley-VCH. 1991. Villadsen J., Nielsen J., Liden G. Bioreactor engineering principles. Springer Verlag, 2011.

**Assessment methods and criteria:**

Lectures, exercises, final exam, homework. Grade will be composed of final exam, exercises and homework Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**

University teacher Johanna Panula-Perälä, postdoctoral research fellow Sanna Taskila

**Working life cooperation:**

No

**Other information:**

-

**488305S: Advanced Course for Biotechnology, 5 op**

**Voimassaolo:** 01.08.2005 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Sanna Taskila

**Opintokohteen kielet:** English

**Leikkaavuudet:**

480450S Bioprocesses III 5.0 op

**ECTS Credits:**

5 cr

**Language of instruction:**

English

**Timing:**

The course is held in autumn and spring semesters during periods III and IV. It is recommended to complete the course in the 4<sup>th</sup> or 5<sup>th</sup> year.

**Learning outcomes:**

After completing this course, the student will be able to describe the most important techniques - both up- and downstream - in protein and metabolite production. Further, the student will be able to present main features of the biotechnology based on renewable raw materials.

**Contents:**

Microbial homologous and heterologous protein production. Physiological and process related items in the production of selected microbial metabolites. Principles and practices in metabolic engineering. Methods for process intensification. Unit operations in product recovery and purification. Specific features of biorefineries.

**Mode of delivery:**

Blended teaching.

**Learning activities and teaching methods:**

Lectures 30 h / exercises 6 h / homework 44 h / self-study 50 h.

**Target group:**

Master students of bioprocess engineering, environmental engineering students in M.Sc. Programme in Green Chemistry and Bioproduction, and process engineering students in Master's degree programme in Biomass, Technology and Management. Master students from process engineering and biochemistry with required prerequisites.

**Prerequisites and co-requisites:**

Prerequisites: The preceding courses by the Bioprocess Engineering Laboratory (especially 488301A Microbiology, 488302A Basics of biotechnology and 488304S Bioreactor technology) or respective knowledge.

**Recommended optional programme components:**

-

**Recommended or required reading:**

Will be announced at the lectures.

**Assessment methods and criteria:**

Lectures and final examination, exercises and the report. Grade will be composed of homework exercises, final examinations and report.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Postdoctoral research fellow Sanna Taskila, university researcher Johanna Panula-Perälä

**Working life cooperation:**

No

**Other information:**

-

**744623S: Yeast genetics, 6 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Alexander Kastaniotis

**Opintokohteen kielet:** English

**Leikkaavuudet:**

744616S Yeast genetics and molecular biology 2.5 op

744613S Yeast genetics 1.5 op

**ECTS Credits:**

3-6 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 spring

**Learning outcomes:**

Upon successful completion students are able to:

- tell a basic knowledge of yeast genetics and physiology
- tell the basic principles of using the yeast model organism to address fundamental genetic and cell biological problems
- (practical course) describe variety of genetic and molecular biology techniques commonly used to manipulate baker's yeast in the pursuit of biological questions

**Contents:**

This course is an introduction to *Saccharomyces cerevisiae* as a model organism and the use of classical and molecular genetic approaches in this yeast to study basic cellular processes. We will also focus on genetic screens and selections designed to identify targets of interest. Aspects of transcriptional regulation will be discussed to provide a basic understanding for some of the screens and selections introduced. The lecture part is open to all students that fulfill the enrollment requirements, and equals 3 op. Performance in the course will be assessed by participation in the course review session at the beginning of each lecture (10% of total grade) and by a final written examination. The practical part of this is a block practical spread over two weeks (2 days – 3 days – 2 days – 3 days) running almost parallel to lecture course. It is designed to provide training in techniques and concepts commonly used in yeast genetics (streaking, spotting, mating, tetrad analysis, transformation, colony-color based assays, carbon source-dependent expression of genes, as well as generation and cloning of mutants). This part of the course has limited enrollment for 16 people.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

16 h lectures, 10 days practical, final exam and oral participation in course review session

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Course review sessions, final exam, experiment reports

Read more about [assessment criteria](#) at the University of Oulu webpage.**Grading:**

1-5/fail

**Person responsible:**

Alexander Kastaniotis

**Working life cooperation:**

No

**Other information:**

-

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Thomas Kietzmann

**Opintokohteen kielet:** English

**Leikkaavuudet:**

740380A Virology 3.0 op

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-2 spring (starts 2015)

**Learning outcomes:**

Upon successful completion students are able to:

- discuss the major groups of viruses and their infection and replication mechanisms
- present and discuss characteristic features of specific viruses and their relation to pathogenesis and immunity
- describe diagnostic methods and antiviral therapy

**Contents:**

The course covers basic aspects of virology. The main emphasis will be made on viral infection, replication, transcription, proteinsynthesis, virological diagnostics, infection kinetics, defense against viruses, ways of infection, vaccination, and antiviral therapy. The course involves lectures 10h and 10h seminars where the students should be able to recapitulate major aspects of the taught material in 5-7 min presentations.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

24 h lectures and student presentations in seminars

**Target group:**

MSc / Molecular and cellular biology

**Prerequisites and co-requisites:**

Cellular biology

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Thomas Kietzmann

**Working life cooperation:**

No

**Other information:**

This module is the same as Virology (740380A)

**743660S: Introduction to immunology, 3 op****Voimassaolo:** 01.08.2011 -**Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Tuomo Glumoff**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

740379A	Introduction to immunology	3.0 op
740378A	Basic immunobiology for biochemists	3.0 op
741661S	Immunobiology	3.0 op
740369A	Immunobiology	3.0 op

**ECTS Credits:**

3 credits

**Language of instruction:**

Partly Finnish, partly English

**Timing:**

B.Sc. yr3 autumn or M.Sc. yr1-yr2 autumn

**Learning outcomes:**

After the course students will be able to identify, analyze and apply essential cellular molecules, components and mechanisms related to immunology, and complete their previous knowledge of molecular and cellular biology and protein chemistry with immunobiochemistry issues.

**Contents:**

The course handles both unspecific and specific immune response mechanisms, antibody structure and diversity, antibody-based immunodiagnostics, as well as basics of virus biochemistry.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

Lectures (12 h), a written home exercise, and a final exam

**Target group:**

MSc/ molecular and cellular biology

**Prerequisites and co-requisites:**

Preliminary required courses: Molekyylibiologia I, Protein chemistry I and Solun biologia, or equivalent basic molecular biology, protein chemistry and cell biology studies.

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Home exercise, final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.**Grading:**

1-5/fail

**Person responsible:**

Tuomo Glumoff

**Working life cooperation:**

No

**Other information:**

This module is the same as 740379A Introduction to immunology

**743655S: Neurobiology, 4 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Heape Martin

**Opintokohteen kielet:** English

**ECTS Credits:**

4 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 spring

**Learning outcomes:**

The course is intended for students with little, or no prior education in the Neurosciences. At the end of the course, the students are able to:

- describe and define the general structural and functional organisation of the mammalian nervous system, and of the developmental and functional differentiation, and the roles of its cellular components.
- identify the selected areas of the neurosciences in which major research drives are currently undertaken.
- summarize a background knowledge of Neurobiology sufficiently to feel comfortable in undertaking a postgraduate research project in diverse fields of the Neurosciences.

**Contents:**

The course will focus mainly on the cell biology and biochemistry of cellular differentiation and function in the mammalian nervous system. Lectures cover: Embryology and structure of the mammalian nervous system - Cells and the extracellular environment in nervous tissues - Neuronal structure and function - Glial cells of the CNS and PNS - Functional and structural relationships between neurons and glia - Myelin synthesis, maintenance and function in the CNS and PNS - Cellular biochemistry of the transmission of the nervous impulse. The module includes an article analysis in small groups and presentation. Active participation and performance in article analysis exercises will contribute to the final mark.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

8-10 h lectures and 5-7 h group work (depending on number of students: maximum = 30 students).

**Target group:**

M.Sc./ Molecular and cellular biology

**Prerequisites and co-requisites:**

Biomolecules for Biochemists, Cellular Biology (740362A) or equivalent. In addition, the "Cellular communication" course (740366A) is a strong advantage, but not required.

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Presentation, Essay

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail



**Person responsible:**

Anthony Heape

**Working life cooperation:**

No

**Other information:**

-

**743659S: Biochemistry of cell organelles, 3 op****Voimassaolo:** 01.08.2010 -**Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Kalervo Hiltunen**Opintokohteen kielet:** English**Leikkaavuudet:**

743656S Biochemistry of cell organelles 2.5 op

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 autumn

**Learning outcomes:**

Upon successful completion students are able to:

- Describe structure and function of the key cell organelles
- Discuss role of organelles in pathology
- Characterize metabolites transfer and action of channels and transporters
- Assess basic principles of biogenesis of cell organelles

**Contents:**

The course covers basic aspects of cell and membrane biology providing knowledge on structure and function of mitochondria, endoplasmic reticulum (ER) and peroxisomes. More detailed discussion will be on aspects of mitochondrial inheritance, function in health and diseases, mitophagy, role of organelles in aging, lipid synthesis in ER, intra- and extracellular transfer of lipids, structural and functional properties of membrane channels and transporters, soluble metabolite-transfer proteins, integration of different functions in peroxisomes. In addition to lectures (16 h) the course involves two seminars (4 h) where the students should present reports of cellular lipid traffic and isolation of cellular organelles.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

20 h lectures and student presentations in seminars

**Target group:**

Major students/Molecular and cellular biology

**Prerequisites and co-requisites:**

B.Sc. in biochemistry or biology or otherwise adequate knowledge on basic biochemistry, cellular and molecular biology

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Vasily Antonenkov

**Working life cooperation:**

No

**Other information:**

-

**743658S: Cell cycle, DNA replication and repair, 2,5 op**

**Voimassaolo:** 01.08.2010 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Pospiech, Helmut

**Opintokohteen kielet:** English

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

MSc yr1-yr2 spring

**Learning outcomes:**

Upon successful completion students are able to:

- explain why maintenance of genomic stability is required and how is it achieved?
- describe how DNA replication works and how is it studied
- describe how DNA damage is repaired
- summarize how DNA replication and repair is coordinated within the cell cycle, the DNA damage response and cell growth
- predict how DNA replication and repair is associated with disease and cancer

**Contents:**

The genetic information of all organisms is stored in the form of DNA. Since loss of DNA signifies loss of genetic information, DNA has to be maintained. This is in contrast to other biological macromolecules, which can be degraded and replaced by newly synthesised molecules. As a consequence, DNA has also to be copied faithfully during the process of DNA replication that precedes every cell division. Damage inflicted continuously to the DNA has to be repaired. Eucaryotic DNA replication, DNA repair and DNA damage response are tightly coordinated in the context of the cell cycles and the nuclear metabolism.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

16 h lectures

**Target group:**

MSc in molecular and cellular biology

**Prerequisites and co-requisites:**

B.Sc. in Biochemistry or Molecular Biology (or equivalent)

**Recommended optional programme components:**

-

**Recommended or required reading:**

Lecture handouts and review articles

**Assessment methods and criteria:**

Presence at the lectures compulsory, preparatory questions and homework  
Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Helmut Pospiech

**Working life cooperation:**

No

**Other information:**

-

**743657S: Tumor cell biology, 3 op**

**Voimassaolo:** 01.08.2010 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Thomas Kietzmann

**Opintokohteen kielet:** English

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 spring

**Learning outcomes:**

Upon successful completion students are able to:

- name, list and discuss the major aspects including formation of a tumor cell
- present, describe and discuss characteristic aspects of oncogenes and tumor suppressor genes
- use methods to study, examine and to analyse tumor genesis and tumor progression

**Contents:**

The course covers basic aspects of the main pathways inducing formation of a tumor. The main emphasis will be made on the formation of oncogenes, the action of tumor suppressor genes and the induction of tumors by viruses.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

20 h lectures

**Target group:**

MSc / Molecular and cellular biology

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Thomas Kietzmann

**Working life cooperation:**

No

**Other information:**

-

**580402S: Biomedical Imaging Methods, 1 - 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Institute of Health Sciences

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Simo Saarakkala

**Opintokohteen kielet:** English

**ECTS Credits:**

4 ECTS

**Language of instruction:**

English

**Timing:**

Master studies. The course is not organized every year.

**Learning outcomes:**

The student knows and can describe the basic principles and main applications of imaging techniques used in biomedical research.

**Contents:**

Differences between in vivo, ex vivo and in vitro imaging. Optical in vivo imaging, optical tomography, magnetic resonance imaging, Fourier transform infrared microspectroscopy, Raman microspectroscopy, micro-computed tomography, basics of image analysis and interpretation.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

Lectures, demonstrations, practical exercise. Final exam.

**Target group:**

Master Students of Medical and Wellness technology and all other who are interest in methods of biomedical imaging.

**Recommended or required reading:**

Required literature is given in the lectures.

**Assessment methods and criteria:**

Exercises. Written exam.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5 or fail

**Person responsible:**

Docent Simo Saarakkala

**Working life cooperation:**

No

**Other information:**

This course is a part of specialization of Biomedical Technology and Medical imaging.

**756625S: Genetic transformation of plants, 4 - 8 op****Voimassaolo:** - 31.07.2015**Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Biology**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Häggman, Hely Margaretha**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

756652S Genetic transformation of plants 5.0 op

**ECTS Credits:**

4-8 ECTS credits / 107-212 hours of work.

**Language of instruction:**

Finnish / English.

**Timing:**M.Sc. 1<sup>st</sup> or 2<sup>nd</sup> autumn, every second year.**Learning outcomes:**

The student will assess and apply the concept of genetical modification. The student will apply the different techniques of genetic transformation and will judge their pros and cons.

**Contents:**

The lectures will cover gene constructs, marker-genes, different genetic transformation methods, legislation, and commercial cultivations. The exercises will familiarize the students with the most common genetic transformation methods including Agrobacterium-mediated transformation, electroporation, biolistic transformation and VIGS.

**Mode of delivery:**

Face-to-face teaching.

**Learning activities and teaching methods:**

Lab course + demonstrations (45 h) and lectures (20 h), reports, seminar or essay, lecture exam and final conclusions.

**Target group:**

BSb: compulsory MSc studies either course Advanced course in plant biology (752682S) 9 cr or Genetic transformation of plants (756625S) 8 cr.

**Prerequisites and co-requisites:**

Lectures of Advanced course in plant biology (752682S) helps in following the course.

**Recommended optional programme components:**

-

**Recommended or required reading:**

Handout and supplementary reading given in lectures and exercises.

**Assessment methods and criteria:**

Report, seminar and exam.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5 / Fail.

**Person responsible:**

Prof. Hely Häggman.

**Working life cooperation:**

No.

**Other information:**

-

**756618S: Secondary metabolism of plants, 4 op**

**Voimassaolo:** - 31.07.2014

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Biology

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Häggman, Hely Margaretha

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 ECTS credits / 107 hours of work.

**Language of instruction:**

Finnish / English.

**Timing:**

M.Sc. 1<sup>st</sup> or 2<sup>nd</sup> spring, (arranged if resources allow).

**Learning outcomes:**

The students will be able to define the role of plant secondary metabolism/metabolites, and the biosynthetic pathways involved. The possible role of secondary metabolites will be touched upon.

**Contents:**

General introduction to phenolic compounds, terpenoids, sterols, alkaloids; their synthesis and meaning for the plant. The economic importance and potential of plant secondary metabolites as fine chemicals and important traits of plants concerning quality and resistance will be discussed. The technological and economic feasibility of the large-scale culture of plant cells for the production of secondary metabolites are touched. Isolation and processing of useful metabolites will be discussed.

**Mode of delivery:**

Face-to-face teaching.

**Learning activities and teaching methods:**

Lectures 18 h and seminars 4 h, literature, final exam.

**Target group:**

-

**Prerequisites and co-requisites:**

No.

**Recommended optional programme components:**

-

**Recommended or required reading:**

Literature agreed on lectures.

**Assessment methods and criteria:**

Exam.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5 / Fail.

**Person responsible:**

Prof. Hely Häggman.

**Working life cooperation:**

No.

**Other information:**

-

**756627S: Plant hormones, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Biology

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Häggman, Hely Margaretha

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 ECTS credits / 107 hours of work.

**Language of instruction:**

Finnish / English.

**Timing:**

M.Sc. 1<sup>st</sup> or 2<sup>nd</sup> spring, every second year.

**Learning outcomes:**

The students will assess the plant hormone action, understand hormone interactions and the significance of the hormone balance as well as the molecular mechanisms.

**Contents:**

Plant hormones are signalling molecules with profound effects on growth and development at trace quantities. Until quite recently plant development was considered to be regulated by auxins, gibberellins, cytokinins, ethylene and abscisic acid. New analytical and molecular methods have evidenced new plant hormone receptors and signalling pathways. During the lectures the mode of action of the hormones and the latest literature is used to gain the most recent view of the topic.

**Mode of delivery:**

Face-to-face teaching.

**Learning activities and teaching methods:**

20 h and exam.

**Target group:**

Suitable for BSb and ecophysicologists.

**Prerequisites and co-requisites:**

Basics of functional plant biology lectures and exercises (752345A, 756341A).

**Recommended optional programme components:**

-

**Recommended or required reading:**

Chapters concerning plant hormones from Taiz, L. & Zeiger, E. 2010: Plant Physiology. Sinauer Associates Inc. 5. ed. and literature given in the lectures.

The availability of the literature can be checked from [this link](#).

**Assessment methods and criteria:**

Exam.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5 / Fail.

**Person responsible:**

Prof. Hely Häggman.

**Working life cooperation:**

No.

**Other information:**

-

**746601S: Advanced studies in biochemistry in other universities, 0 - 75 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Lloyd Ruddock**Opintokohteen kielet:** Finnish**Voidaan suorittaa useasti:** Kyllä

Ei opintojaksokuvauksia.

**746605S: Advanced studies in biochemistry passed abroad, 0 - 75 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Lloyd Ruddock**Opintokohteen kielet:** English**Voidaan suorittaa useasti:** Kyllä

Ei opintojaksokuvauksia.

**H325421: Compulsory courses - MSc, molecular and cellular biology, 69 op****Voimassaolo:** 01.08.2012 -**Opiskelumuoto:** Advanced Studies**Laji:** Study module**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

*Obligatory courses***744620S: Protein chemistry II, 3 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Evangelia Kapetaniou**Opintokohteen kielet:** English**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**



M.Sc. yr1 autumn

**Learning outcomes:**

After the course, the students are able to:

- describe professional literature dealing with advanced techniques of protein analysis
- plan and implement the purification of a given protein on a large scale
- present and explain work related to protein purification and analysis

**Contents:**

This module provides a “real-life” approach to practical protein chemistry, including purification, biophysical analysis, enzymatics, etc. It comprises a small number of revision lectures, but it is primarily based on problem solving based exercises with a further level of complexity built in compared with Protein Chemistry I. The module includes a student presentation, but does not include a final examination. The final mark comprises marks from continuous assessment. Attendance of some parts of the course is compulsory.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

12 h seminars, plus exercises and a student report

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Continuous assessment, presentation

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Pass/fail

**Person responsible:**

Evangelia Kapetaniou

**Working life cooperation:**

No

**Other information:**

-

**744621S: Molecular biology II, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Elitsa Dimova, Daniela Mennerich

**Opintokohteen kielet:** English

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1 autumn

**Learning outcomes:**

After the course students are able to:

- discuss the general features of DNA manipulating/amplifying enzymes
- design (on paper or in silico) oligonucleotides for PCR amplification, set up restriction digests and ligation reactions in order to carry out basic and advanced cloning procedures
- use basic tools used in the genetic manipulation of mice

**Contents:**

This module provides a “real-life” approach to practical molecular biology, including DNA cloning strategies, site directed mutagenesis, generation of transgenic mice, etc. It comprises concept overview lectures, but it is primarily based on complex problem solving based exercises including written reports and group student presentations, but does not include a final examination. The final mark comprises marks from continuous assessment. Attendance of the course is required.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

12 h seminars, plus student presentations

**Target group:**

Major students

**Prerequisites and co-requisites:**

The course is designed for students familiar with DNA organization, gene structure & genetic concepts (ORF, codon, heterologous and homologous recombination).

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Written report, student presentation

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Elitsa Dimova

**Working life cooperation:**

No

**Other information:**

-

**902101Y: English for Biochemists 2, 3 op**

**Voimassaolo:** 01.08.2005 - 31.08.2016

**Opiskelumuoto:** Language and Communication Studies

**Laji:** Course

**Vastuuyksikkö:** Language Centre

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** English

**Leikkaavuudet:**

ay902101Y English for Biochemists 2 (OPEN UNI) 3.0 op

**Proficiency level:**

C1 on the CEFR scale

**Status:**

Compulsory for all biochemistry master's degree students (starting academic year 2015-16).

**Required proficiency level:**

Participants are expected to have studied English as an A1 or A2 language at school or to have acquired equivalent skills elsewhere.

**ECTS Credits:**

3 ECTS credits

**Language of instruction:**

English

**Timing:**

Next offered academic year 2015-16 – timing to be announced later

**Learning outcomes:**

The course aims to help you acquire understanding of the conventions and expectations of the academic community of biochemists for scientific reporting, and develop presentation and writing skills for your future professional life.

**Learning outcomes:**

By the end of the course, you are expected to be able to

1. write a research article that follows the main discourse conventions of biochemistry
2. prepare and deliver an oral scientific presentation supported by an effective slideshow
3. apply the rules of referencing
4. use a sufficient range of appropriate academic vocabulary relevant to your discipline
5. write with a good level of linguistic accuracy and correct punctuation
6. structure your work for optimal clarity and impact
7. make good use of feedback from peers and teachers to improve your own scientific production

**Contents:**

This course will cover presentation skills (1 ECTS credit) and writing for scientific purposes (2 ECTS credits).

**Mode of delivery:**

Contact teaching and web-supported feedback

**Learning activities and teaching methods:**

Contact teaching 24 hours / optional tutorials / independent work 56 hrs. Attendance at all classroom sessions is **compulsory**.

**Target group:**

4th year biochemistry students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

902100Y English for Biochemists 1 must be completed

**Recommended or required reading:**

Course materials will be provided by the teachers and a copy fee will be charged.

**Assessment methods and criteria:**

Assessment is based on regular completion and quality of course tasks, with particular emphasis on the final product of each part of the course: the final presentation and the final draft of a research article in biochemistry.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Pass/Fail

**Person responsible:**

Heather Kannasmaa (presentation skills) and Suzy McAnsh (scientific writing)

**Working life cooperation:**

-

**Other information:**

-

**743694S: Pro gradu experimental work in molecular and cellular biology, 28 op****Opiskelumuoto:** Advanced Studies**Laji:** Practical training**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Lloyd Ruddock**Opintokohteen kielet:** English**ECTS Credits:**

28 credits

**Language of instruction:**

Finnish / English

**Timing:**

M.Sc. yr1-2

**Learning outcomes:**

On successful completion of this course, the student has

- Increased appreciation of how research leads to knowledge and how technologies may be applied /adapted to address a research question
- Developed abilities to work independently and as part of a team - self motivation, diplomacy, planning and organizational skills and time management.
- Developed abilities to identify and solve practical problems, to design and execute experiments and how to record and critically evaluate data.

**Contents:**

This module provides an extensive, 6 month, project in a research group. The experimental work can be started after 30 op of Master studies have been completed. Students are responsible for finding a suitable research group in which they wish to undertake the Pro Gradu work. Students should produce a short (typically 2 page) study plan detailing the proposed content of their Pro Gradu work, supervisor(s) and start date which must be approved before they start work. The Pro Gradu thesis is based only on the work done during the first 6 months of work by the student on the project, except in cases of mitigating circumstances. The work may be un-dertaken in the research groups of department of Biochemistry or in any other suitable research group in Finland or abroad.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

6 months project in a research group

**Target group:**

FM/Molekyyli- ja solubiologia

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Research work 6 months

Read more about [assessment criteria](#) at the University of Oulu webpage.**Grading:**

pass/fail

**Person responsible:**

Lloyd Ruddock

**Working life cooperation:**

Yes

**Other information:**

-

**743695S: Pro gradu thesis in molecular and cellular biology, 20 op****Opiskelumuoto:** Advanced Studies**Laji:** Diploma thesis**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Tuomo Glumoff**Opintokohteen kielet:** English**ECTS Credits:**

20 credits

**Language of instruction:**

Finnish / English

**Timing:**

M.Sc. yr2

**Learning outcomes:**

On successful completion of this course, the student has

- Developed skills in retrieving, appraising critically and integrating information.
- Developed skills in communicating science and in making and defending scientific arguments.

**Contents:**

The Pro gradu thesis (typically around 50-60 pages long) is based on the experimental work undertaken by the student and the contextualization of the research and the results based on the published literature in the field. For detailed instructions see <http://www.biochem oulu.fi/>.

**Mode of delivery:**

Face to face teaching

**Target group:**

M.Sc./ Molecular and cellular biology

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

--

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Written thesis

Read more about [assessment criteria](#) at the University of Oulu webpage.**Grading:**

1-5/fail

**Working life cooperation:**

No

**Other information:**

-

**740672S: Maturity test (M.Sc. degree), 0 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

0 credits

**Language of instruction:**

Finnish / English

**Timing:**

M.Sc. yr2

**Learning outcomes:**

-

**Contents:**

Will be written in context to Pro gradu thesis. In the test student must show a good command of both language skills and their field of Pro gradu thesis. If student's native language is not Finnish or Swedish Faculty of Science will define language in the test.

**Target group:**

Majors students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Written abstract of Pro Gradu thesis

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Working life cooperation:**

No

**Other information:**

-

*Orientation to research work: work done in an academic or industrial research group. Orientation to biochemical work: work done in a non research group environment. The sum of credits of both courses must be 12-20 ECTS.*

#### **744617S: Orientation to research work, 0 - 20 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Practical training

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Jari Heikkinen

**Opintokohteen kielet:** English

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

12 - 20 credits (see Other information)

**Language of instruction:**

English

**Timing:**

MSc yr 1

**Learning outcomes:**

After this course student has gained experience of practical work done in research groups. Student is able to:

- demonstrate goal-oriented teamwork
- apply methods used in proper environment
- discuss the practical work done and reflect his knowledge

**Contents:**

This module provides an introduction to research work via the active integration of students into research groups and/or via one to two week advanced practical courses. The integration into groups can be either full-time or part-time research work, with 1.5op being awarded for each full-time week equivalent worked. A maximum of 6op can be awarded for working in one research group. The research groups do not need to be in the Department of Biochemistry, University of Oulu, but advance permission should be sought if the research group is not part of the University of Oulu.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

Independent work

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Research work

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Jari Heikkinen

**Working life cooperation:**

Yes

**Other information:**

The sum of credits from courses 744624S and 744617S must be 12-20 credits (for Int MSc in protein science line 12-18 credits)

**744624S: Orientation to biochemical work, 0 - 20 op**

**Voimassaolo:** 01.08.2011 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Practical training

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Jari Heikkinen

**Opintokohteen kielet:** English

**Leikkaavuudet:**

744629S Orientation to biochemical work 0.0 op

744617S Orientation to research work 0.0 op

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

12-20 credits (see Other information)

**Language of instruction:**

English/Finnish

**Timing:**

M.Sc. yr1

**Learning outcomes:**

After this course student has gained experience of practical work done in non-research group environment. Student is able to:

- demonstrate goal-oriented teamwork
- apply methods used in proper environment
- discuss the practical work done and reflect his knowledge

**Contents:**

This module provides an introduction to non-research work in companies or other suitable environment. The work can be either full-time or part-time work, with 1.5op being awarded for each full-time week equivalent worked. A maximum of 6op can be awarded for working in one work placements. Each placement must be agreed in advance with the responsible person.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

Independent work

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

non-research work

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Pass/fail

**Person responsible:**

Jari Heikkinen

**Working life cooperation:**

Yes

**Other information:**

The sum of credits from courses 744624S and 744617S must be 12-20 credits (for Int MSc in protein science line 12-18 credits)

**H325424: Optional specialist courses - MSc, molecular and cellular biology, 11 - 22 op**

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Study module

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.



*Optional specialist courses (a minimum of 4 of these courses must be taken)*

### **743604S: Biochemistry of inherited diseases, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Heli Ruotsalainen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish

**Timing:**

M.Sc yr1-yr2 autumn

**Learning outcomes:**

Upon completion the student should understand

- The most common inherited diseases and how they can be analyzed and treated
- Biochemistry behind the inherited diseases
- How to make an understandable presentation from the field of inherited diseases
- how to answer questions raised by the presentation

**Contents:**

This course provides information on mutations behind inherited diseases: how mutations are inherited, how they will be found and how they can be cured by gene therapy. Scientific articles will also be studied by small groups.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

18 h lectures and students' tasks

**Target group:**

M.Sc./Molecular and cellular biology

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Thompson & Thompson, Genetics in Medicine,; Strachan, T., Read, A.P.: Human Molecular Genetics, Bios. Scientific Publishers Limited; Aula *et al.*, Perinnöllisyyslääketiede; the newest editions. Scientific articles.

**Assessment methods and criteria:**

Homeworks, oral presentation, final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Heli Ruotsalainen

**Working life cooperation:**

No

**Other information:**

**744619S: Systems biology, 4 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Tuomo Glumoff**Opintokohteen kielet:** English**ECTS Credits:**

4 credits

**Language of instruction:**

English

**Timing:**

M.Sc. 1st-2nd autumn

**Learning outcomes:**

After the course student is able to define the cell as an ensemble of structural and functional parts. He is also able to connect and describe their current knowledge on cellular, molecular and structural biology into a general view. The student is also able to assess scientific information critically on novel research findings and the problems associated with massive amounts of novel scientific information.

**Contents:**

The module aims to give a holistic picture of the cell as a system. Cells contain numerous molecules and complex structures that interact with each other to form complex interaction networks such that when taken together they form a new whole, which cannot be understood by just investigating the parts. Methods to collect and assemble biological/biochemical information for systems analysis will be introduced. Possibilities of systems approach will be critically discussed in relation to available research techniques, techniques of the future, applications, research targets, as well as from the philosophical and ethical point of view including applicability of the systems theory in biosciences.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

The module consists of 22 h of lectures, discussions and case studies, ca. 5h of computing exercises

**Target group:**

Major students

**Prerequisites and co-requisites:**

B.Sc. in biochemistry or a related subject or otherwise adequate knowledge on cellular, molecular and structural biology.

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Study diaries will be assessed for a mark on scale 1 to 5 upon request. Otherwise marking will be Pass/fail. There is no exam and thus presence on certain amount of the course is compulsory. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Tuomo Glumoff

**Working life cooperation:**

No

**Other information:**

-

**743655S: Neurobiology, 4 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Heape Martin

**Opintokohteen kielet:** English

**ECTS Credits:**

4 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 spring

**Learning outcomes:**

The course is intended for students with little, or no prior education in the Neurosciences. At the end of the course, the students are able to:

- describe and define the general structural and functional organisation of the mammalian nervous system, and of the developmental and functional differentiation, and the roles of its cellular components.
- identify the selected areas of the neurosciences in which major research drives are currently undertaken.
- summarize a background knowledge of Neurobiology sufficiently to feel comfortable in undertaking a postgraduate research project in diverse fields of the Neurosciences.

**Contents:**

The course will focus mainly on the cell biology and biochemistry of cellular differentiation and function in the mammalian nervous system. Lectures cover: Embryology and structure of the mammalian nervous system - Cells and the extracellular environment in nervous tissues - Neuronal structure and function - Glial cells of the CNS and PNS - Functional and structural relationships between neurons and glia - Myelin synthesis, maintenance and function in the CNS and PNS - Cellular biochemistry of the transmission of the nervous impulse. The module includes an article analysis in small groups and presentation. Active participation and performance in article analysis exercises will contribute to the final mark.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

8-10 h lectures and 5-7 h group work (depending on number of students: maximum = 30 students).

**Target group:**

M.Sc./ Molecular and cellular biology

**Prerequisites and co-requisites:**

Biomolecules for Biochemists, Cellular Biology (740362A) or equivalent. In addition, the "Cellular communication" course (740366A) is a strong advantage, but not required.

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Presentation, Essay

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Anthony Heape

**Working life cooperation:**

No

**Other information:**

-

**747603S: Bioinformatics, 2,5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Ari-Pekka Kvist

**Opintokohteen kielet:** English

**ECTS Credits:**

2.5 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 spring

**Learning outcomes:**

Upon successful completion student are able to:

- use web-based bioinformatics tools.
- process the information and find solutions to various problems
- analyse and present the findings in the form of a report

**Contents:**

This course introduces basic concepts and methodology in bioinformatic research. Basic computational methods of DNA and protein handling and database searches are introduced. Other methods may include joining database and proteomic searches and evolutionary views of biocomputing. After this course a student has insight of basic methodology of bioinformatics. Attendance to practicals is compulsory.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

8 hr lectures, 30 h practicals

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Ari-Pekka Kvist

**Working life cooperation:**

No

**Other information:**

-

**743659S: Biochemistry of cell organelles, 3 op****Voimassaolo:** 01.08.2010 -**Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Kalervo Hiltunen**Opintokohteen kielet:** English**Leikkaavuudet:**

743656S Biochemistry of cell organelles 2.5 op

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 autumn

**Learning outcomes:**

Upon successful completion students are able to:

- Describe structure and function of the key cell organelles
- Discuss role of organelles in pathology
- Characterize metabolites transfer and action of channels and transporters
- Assess basic principles of biogenesis of cell organelles

**Contents:**

The course covers basic aspects of cell and membrane biology providing knowledge on structure and function of mitochondria, endoplasmic reticulum (ER) and peroxisomes. More detailed discussion will be on aspects of mitochondrial inheritance, function in health and diseases, mitophagy, role of organelles in aging, lipid synthesis in ER, intra- and extracellular transfer of lipids, structural and functional properties of membrane channels and transporters, soluble metabolite-transfer proteins, integration of different functions in peroxisomes. In addition to lectures (16 h) the course involves two seminars (4 h) where the students should present reports of cellular lipid traffic and isolation of cellular organelles.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

20 h lectures and student presentations in seminars

**Target group:**

Major students/Molecular and cellular biology

**Prerequisites and co-requisites:**

B.Sc. in biochemistry or biology or otherwise adequate knowledge on basic biochemistry, cellular and molecular biology

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Vasily Antonenkov

**Working life cooperation:**

No

**Other information:**

-

**743658S: Cell cycle, DNA replication and repair, 2,5 op**

**Voimassaolo:** 01.08.2010 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Pospiech, Helmut

**Opintokohteen kielet:** English

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

MSc yr1-yr2 spring

**Learning outcomes:**

Upon successful completion students are able to:

- explain why maintenance of genomic stability is required and how is it achieved?
- describe how DNA replication works and how is it studied
- describe how DNA damage is repaired
- summarize how DNA replication and repair is coordinated within the cell cycle, the DNA damage response and cell growth
- predict how DNA replication and repair is associated with disease and cancer

**Contents:**

The genetic information of all organisms is stored in the form of DNA. Since loss of DNA signifies loss of genetic information, DNA has to be maintained. This is in contrast to other biological macromolecules, which can be degraded and replaced by newly synthesised molecules. As a consequence, DNA has also to be copied faithfully during the process of DNA replication that precedes every cell division. Damage inflicted continuously to the DNA has to be repaired. Eucaryotic DNA replication, DNA repair and DNA damage response are tightly coordinated in the context of the cell cycles and the nuclear metabolism.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

16 h lectures

**Target group:**

MSc in molecular and cellular biology

**Prerequisites and co-requisites:**

B.Sc. in Biochemistry or Molecular Biology (or equivalent)

**Recommended optional programme components:**

-

**Recommended or required reading:**

Lecture handouts and review articles

**Assessment methods and criteria:**

Presence at the lectures compulsory, preparatory questions and homework  
Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Helmut Pospiech

**Working life cooperation:**

No

**Other information:**

-

**743657S: Tumor cell biology, 3 op**

**Voimassaolo:** 01.08.2010 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Thomas Kietzmann

**Opintokohteen kielet:** English

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 spring

**Learning outcomes:**

Upon successful completion students are able to:

- name, list and discuss the major aspects including formation of a tumor cell
- present, describe and discuss characteristic aspects of oncogenes and tumor suppressor genes
- use methods to study, examine and to analyse tumor genesis and tumor progression

**Contents:**

The course covers basic aspects of the main pathways inducing formation of a tumor. The main emphasis will be made on the formation of oncogenes, the action of tumor suppressor genes and the induction of tumors by viruses.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

20 h lectures

**Target group:**

MSc / Molecular and cellular biology

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Thomas Kietzmann

**Working life cooperation:**

No

**Other information:**

-

## H325427: Optional courses - MSc, molecular and cellular biology, 9 - 40 op

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Study module

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

### *Optional courses*

#### **744623S: Yeast genetics, 6 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Alexander Kastaniotis

**Opintokohteen kielet:** English

**Leikkaavuudet:**

744616S Yeast genetics and molecular biology 2.5 op

744613S Yeast genetics 1.5 op

**ECTS Credits:**

3-6 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 spring

**Learning outcomes:**

Upon successful completion students are able to:

- tell a basic knowledge of yeast genetics and physiology
- tell the basic principles of using the yeast model organism to address fundamental genetic and cell biological problems
- (practical course) describe variety of genetic and molecular biology techniques commonly used to manipulate baker's yeast in the pursuit of biological questions

**Contents:**

This course is an introduction to *Saccharomyces cerevisiae* as a model organism and the use of classical and molecular genetic approaches in this yeast to study basic cellular processes. We will also focus on genetic screens and selections designed to identify targets of interest. Aspects of transcriptional regulation will be discussed to provide a basic understanding for some of the screens and selections introduced. The lecture part is open to all students that fulfill the enrollment requirements, and equals 3 op. Performance in the course will be assessed by participation in the course review session at the beginning of each lecture



(10% of total grade) and by a final written examination. The practical part of this is a block practical spread over two weeks (2 days – 3 days – 2 days – 3 days) running almost parallel to lecture course. It is designed to provide training in techniques and concepts commonly used in yeast genetics (streaking, spotting, mating, tetrad analysis, transformation, colony-color based assays, carbon source-dependent expression of genes, as well as generation and cloning of mutants). This part of the course has limited enrollment for 16 people.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

16 h lectures, 10 days practical, final exam and oral participation in course review session

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Course review sessions, final exam, experiment reports

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Alexander Kastaniotis

**Working life cooperation:**

No

**Other information:**

-

**743661S: Virology, 3 op**

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Thomas Kietzmann

**Opintokohteen kielet:** English

**Leikkaavuudet:**

740380A Virology 3.0 op

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-2 spring (starts 2015)

**Learning outcomes:**

Upon successful completion students are able to:

- discuss the major groups of viruses and their infection and replication mechanisms

- present and discuss characteristic features of specific viruses and their relation to pathogenesis and immunity
- describe diagnostic methods and antiviral therapy

**Contents:**

The course covers basic aspects of virology. The main emphasis will be made on viral infection, replication, transcription, proteinsynthesis, virological diagnostics, infection kinetics, defense against viruses, ways of infection, vaccination, and antiviral therapy. The course involves lectures 10h and 10h seminars where the students should be able to recapitulate major aspects of the taught material in 5-7 min presentations.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

24 h lectures and student presentations in seminars

**Target group:**

MSc / Molecular and cellular biology

**Prerequisites and co-requisites:**

Cellular biology

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Thomas Kietzmann

**Working life cooperation:**

No

**Other information:**

This module is the same as Virology (740380A)

**743660S: Introduction to immunology, 3 op**

**Voimassaolo:** 01.08.2011 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tuomo Glumoff

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

740379A	Introduction to immunology	3.0 op	
740378A	Basic immunobiology for biochemists	3.0 op	3.0 op
741661S	Immunobiology	3.0 op	
740369A	Immunobiology	3.0 op	

**ECTS Credits:**

3 credits

**Language of instruction:**

Partly Finnish, partly English

**Timing:**

B.Sc. yr3 autumn or M.Sc. yr1-yr2 autumn

**Learning outcomes:**

After the course students will be able to identify, analyze and apply essential cellular molecules, components and mechanisms related to immunology, and complete their previous knowledge of molecular and cellular biology and protein chemistry with immunobiochemistry issues.

**Contents:**

The course handles both unspecific and specific immune response mechanisms, antibody structure and diversity, antibody-based immunodiagnostics, as well as basics of virus biochemistry.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

Lectures (12 h), a written home exercise, and a final exam

**Target group:**

MSc/ molecular and cellular biology

**Prerequisites and co-requisites:**

Preliminary required courses: Molekyylibiologia I, Protein chemistry I and Solun biologia, or equivalent basic molecular biology, protein chemistry and cell biology studies.

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Home exercise, final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Tuomo Glumoff

**Working life cooperation:**

No

**Other information:**

This module is the same as 740379A Introduction to immunology

**743696S: Final examination in molecular and cellular biology, 9 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Thomas Kietzmann

**Opintokohteen kielet:** English

**ECTS Credits:**

9 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2

**Learning outcomes:**

Upon successful completion students (should) be able to:

- discuss the full breadth of the core topics of biochemistry, molecular and cellular biology
- Integrate material from multiple sources

**Contents:**

This examination will test the ability of students to integrate knowledge from BSc and MSc level molecular and cellular biology. The questions will require an understanding of the principles of biochemistry and molecular and cellular biology and will be based on subject specific material from relevant BSc and MSc level modules. The format will be an oral examination.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

Student self-study

**Target group:**

M.Sc./Molecular and cellular biology

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Oral examination

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Thomas Kietzmann

**Working life cooperation:**

No

**Other information:**

-

**744618S: Dissertation, 18 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Lloyd Ruddock

**Opintokohteen kielet:** English

**Leikkaavuudet:**

744631S    Dissertation    15.0 op

**ECTS Credits:**

18 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2

**Learning outcomes:**

Upon successful completion students are able to:

- apply information in the right context, integrate information from a wide range of sources and evaluate it critically

- communicate science in extensive written format and discuss and defend scientific arguments
- demonstrate independent work including self motivation, planning, organizational skills and time management.

**Contents:**

This module is based around the student producing an extensive, in-depth literature report in the style of a scientific review. Students are responsible for finding a suitable supervisor for their dissertation with whom they will discuss the scientific background and relevant literature. Students are strongly encouraged to meet with their supervisor weekly to discuss progress and ideas and to resolve problems. A one-page outline of the dissertation subject area, including details of the supervisor (who need not be from the University of Oulu), must be approved by the module convener before starting this module. While the dissertation subject can be closely linked with the Pro Gradu project subject, students are advised that having distinct topics for these two modules will look better on their CV.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

480 hours of student work

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Written report

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Lloyd Ruddock

**Working life cooperation:**

No

**Other information:**

-

**744625S: Scientific presentation, 1 - 2 op**

**Voimassaolo:** 01.03.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Jari Heikkinen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

1-2 credits

**Language of instruction:**

Finnish and English

**Timing:**

M.Sc.

**Learning outcomes:**

The student makes a presentation and participates in an international scientific conference with their own presentation. The presentation may be a poster, a talk or equivalent. The student uses the skills learned in the B.Sc. or otherwise in planning and realizing the presentation. The student practices communication skills necessary for research work.

**Contents:**

Student participates in a conference and delivers a poster, a talk or equivalent. The contents of which must include student's own results, for example from the Master's Thesis work. The pro gradu supervisor or other suitable person supervises the planning and realization of the presentation.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

A poster, a talk or equivalent is delivered. The workload of the course may vary depending on the extent and the form of presentation.

**Target group:**

Major students (MSc)

**Prerequisites and co-requisites:**

No compulsory preceding courses

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Study diary, a copy of presentation or poster

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Amanuensis

**Working life cooperation:**

No

**Other information:**

The amount of credits is estimated based on the workload of the planning and realization of the presentation, but not the length of the meeting.

**300002M: Advanced Information Skills, 1 op**

**Voimassaolo:** 01.08.2009 -

**Opiskelumuoto:** Other Studies

**Laji:** Course

**Vastuuyksikkö:** Faculty of Science

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Sassali, Jani Henrik

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

1 ECTS credit

**Language of instruction:**

Finnish

**Timing:**

Intended for degree students working on their diploma/master's thesis. The course unit is held once in the autumn and once in the spring semester.

**Learning outcomes:**

Students know the different phases of scientific information retrieval process and basic techniques of systematic information search. They will find the most important reference databases of their discipline and know how to evaluate information sources and search results.

**Contents:**

Scientific information retrieval, evaluation of search results and information sources, information search on subject areas of diploma/master's thesis.

**Mode of delivery:**

Blended teaching: lectures, web-based learning material and exercises in Optima environment, personal guidance

**Learning activities and teaching methods:**

Lectures 6-12h, self-study 20h, personal guidance 1h

**Target group:**

The course is optional for students of the Faculty of Science and the Faculty of Technology.

**Prerequisites and co-requisites:**

No

**Recommended optional programme components:**

No

**Recommended or required reading:**

Parts from the following chapters of the Toolbox of Research:

<https://wiki oulu.fi/display/jotut/1.1+Tieteellinen+tiedonhankinta>

<https://wiki oulu.fi/display/jotut/1.3.1+Tieteellisiin+julkaisuihin+pohjautuva+arviointi>

**Assessment methods and criteria:**

Passing the course requires participation in the lectures (6h) and personal guidance and successful completion of the course assignments.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Science and Technology Library Tellus, tellustieto (at) oulu.fi

**Working life cooperation:**

No

**756625S: Genetic transformation of plants, 4 - 8 op**

**Voimassaolo:** - 31.07.2015

**Opiskelumoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Biology

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Häggman, Hely Margaretha

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

756652S Genetic transformation of plants 5.0 op

**ECTS Credits:**

4-8 ECTS credits / 107-212 hours of work.

**Language of instruction:**

Finnish / English.

**Timing:**

M.Sc. 1<sup>st</sup> or 2<sup>nd</sup> autumn, every second year.

**Learning outcomes:**

The student will assess and apply the concept of genetical modification. The student will apply the different techniques of genetic transformation and will judge their pros and cons.

**Contents:**

The lectures will cover gene constructs, marker-genes, different genetic transformation methods, legislation, and commercial cultivations. The exercises will familiarize the students with the most common genetic transformation methods including Agrobacterium-mediated transformation, electroporation, biolistic transformation and VIGS.

**Mode of delivery:**

Face-to-face teaching.

**Learning activities and teaching methods:**

Lab course + demonstrations (45 h) and lectures (20 h), reports, seminar or essay, lecture exam and final conclusions.

**Target group:**

BSb: compulsory MSc studies either course Advanced course in plant biology (752682S) 9 cr or Genetic transformation of plants (756625S) 8 cr.

**Prerequisites and co-requisites:**

Lectures of Advanced course in plant biology (752682S) helps in following the course.

**Recommended optional programme components:**

-

**Recommended or required reading:**

Handout and supplementary reading given in lectures and exercises.

**Assessment methods and criteria:**

Report, seminar and exam.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5 / Fail.

**Person responsible:**

Prof. Hely Häggman.

**Working life cooperation:**

No.

**Other information:**

-

**756627S: Plant hormones, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Biology

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Häggman, Hely Margaretha

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 ECTS credits / 107 hours of work.

**Language of instruction:**

Finnish / English.

**Timing:**



M.Sc. 1<sup>st</sup> or 2<sup>nd</sup> spring, every second year.

**Learning outcomes:**

The students will assess the plant hormone action, understand hormone interactions and the significance of the hormone balance as well as the molecular mechanisms.

**Contents:**

Plant hormones are signalling molecules with profound effects on growth and development at trace quantities. Until quite recently plant development was considered to be regulated by auxins, gibberellins, cytokinins, ethylene and abscisic acid. New analytical and molecular methods have evidenced new plant hormone receptors and signalling pathways. During the lectures the mode of action of the hormones and the latest literature is used to gain the most recent view of the topic.

**Mode of delivery:**

Face-to-face teaching.

**Learning activities and teaching methods:**

20 h and exam.

**Target group:**

Suitable for BSb and ecophysicologists.

**Prerequisites and co-requisites:**

Basics of functional plant biology lectures and exercises (752345A, 756341A).

**Recommended optional programme components:**

-

**Recommended or required reading:**

Chapters concerning plant hormones from Taiz, L. & Zeiger, E. 2010: Plant Physiology. Sinauer Associates Inc. 5. ed. and literature given in the lectures.

The availability of the literature can be checked from [this link](#).

**Assessment methods and criteria:**

Exam.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5 / Fail.

**Person responsible:**

Prof. Hely Häggman.

**Working life cooperation:**

No.

**Other information:**

-

**756618S: Secondary metabolism of plants, 4 op**

**Voimassaolo:** - 31.07.2014

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Biology

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Häggman, Hely Margaretha

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 ECTS credits / 107 hours of work.

**Language of instruction:**

Finnish / English.

**Timing:**

M.Sc. 1<sup>st</sup> or 2<sup>nd</sup> spring, (arranged if resources allow).

**Learning outcomes:**

The students will be able to define the role of plant secondary metabolism/metabolites, and the biosynthetic pathways involved. The possible role of secondary metabolites will be touched upon.

**Contents:**

General introduction to phenolic compounds, terpenoids, sterols, alkaloids; their synthesis and meaning for the plant. The economic importance and potential of plant secondary metabolites as fine chemicals and important traits of plants concerning quality and resistance will be discussed. The technological and economic feasibility of the large-scale culture of plant cells for the production of secondary metabolites are touched. Isolation and processing of useful metabolites will be discussed.

**Mode of delivery:**

Face-to-face teaching.

**Learning activities and teaching methods:**

Lectures 18 h and seminars 4 h, literature, final exam.

**Target group:**

-

**Prerequisites and co-requisites:**

No.

**Recommended optional programme components:**

-

**Recommended or required reading:**

Literature agreed on lectures.

**Assessment methods and criteria:**

Exam.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5 / Fail.

**Person responsible:**

Prof. Hely Häggman.

**Working life cooperation:**

No.

**Other information:**

-

**747605S: Basic aspects of protein crystallographic methods, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Wierenga Rikkert

**Opintokohteen kielet:** English

**Leikkaavuudet:**

744615S Basic aspects of protein crystallographic methods 3.0 op

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 autumn

**Learning outcomes:**

Upon successful completion students are able to:

- describe the key aspects of the protein crystallization methods
- describe the importance of crystals for obtaining the structure of a protein
- describe the importance of the Fourier transform method in the structure determination method
- describe the phase problem
- describe the importance of the anomalous differences

**Contents:**

The course will describe the principles of x-ray diffraction theory. It will focus on aspects used in the field of protein crystallography including following topics: Crystallisation of proteins, symmetry properties of crystals, X-ray sources and detectors, the diffraction pattern and the reciprocal lattice, the phase problem, isomorphous differences and the MIR-method, anomalous differences and the MAD-method.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

20 h lectures and seminars

**Target group:**

M.Sc. in Protein Science and biotechnology

**Prerequisites and co-requisites:**

Biomolecules and Protein chemistry I or Protein production and analysis or equivalent

**Recommended optional programme components:**

-

**Recommended or required reading:**

Drenth, J.: Principles of protein X-ray crystallography (2nd edition); Blow, D.: Outline of crystallography for biologists (1st edition, 2002)

**Assessment methods and criteria:**

Oral presentation

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Rik Wierenga

**Working life cooperation:**

No

**Other information:**

-

**747608S: Biochemical methodologies II, 8 op**

**Voimassaolo:** 01.08.2009 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Ulrich Bergmann

**Opintokohteen kielet:** English

**Leikkaavuudet:**

740365A Biochemical Methodologies II 8.0 op

**ECTS Credits:**

8 credits

**Language of instruction:**

English

**Timing:**

MSc 1st autumn

**Learning outcomes:**

Upon successful completion students are able to:

- describe the theoretical basis of the main biochemical analysis methods for proteins
- identify and use the different instruments
- describe the potential of the different analytical techniques and develop strategies for addressing specific questions in protein & proteome-analysis
- integrate data from multiple sources and evaluate it critically

**Contents:**

During this module students will produce and analyze their own protein samples. The course will cover principles and practical applications of some of the more advanced methodologies used in practical biochemistry, including fluorescence spectroscopy, stopped flow analysis of enzymatic reactions, circular dichroism, surface plasmon resonance, micro-calorimetry, mass spectrometry, and proteomics based on 2D electrophoresis. For assessment each student has to write a research report in the style of a scientific publication. Attendance is compulsory.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

120 h lab., including pre-lab lectures plus exercises

**Target group:**

Obligatory for M.Sc. in Protein Science and biotechnology

**Prerequisites and co-requisites:**

Protein production and analysis (747601S) or Protein chemistry I (740364A)

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Report written in style of a scientific publication

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Ulrich Bergmann

**Working life cooperation:**

No

**Other information:**

-

**747611S: Biochemistry of protein folding, 3 op**

**Voimassaolo:** 01.06.2011 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Lloyd Ruddock

**Opintokohteen kielet:** English

**Leikkaavuudet:**

747602S Biochemistry of protein folding 2.5 op

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc., yr1-yr2 spring

**Learning outcomes:**

Upon successful completion students are able to:

- present and discuss issues presented in the primary literature on a variety of aspects of protein folding.
- display an understanding of the theoretical and practical implications of *in vivo*, *in vitro* and *in silico* studies on protein folding and the integration of results.
- demonstrate the ability to interpret a wide range of data from multiple sources, to critically evaluate and contextualise this data and to solve problems relating to interpretation.

**Contents:**

This module provides an introduction to protein folding *in vivo*. Topics covered include protein folding and quality control in the endoplasmic reticulum, mechanisms regulating protein folding including the unfolded protein response, the catalysis of native disulphide bond formation, the biochemistry of molecular chaperones and the role of molecular chaperones and protein folding catalysts in other cellular events.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

16 contact hours of lectures and seminars

**Target group:**

M.Sc. in Protein science and biotechnology

**Prerequisites and co-requisites:**

Protein chemistry I (740364A) or Protein production and analysis (747601S) or equivalent

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

The module is assessed based on a report prepared on individual topics and on participation in the seminars.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Lloyd Ruddock

**Working life cooperation:**

No

**747606S: Structural enzymology, 3 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Wierenga Rikkert**Opintokohteen kielet:** English**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 spring

**Learning outcomes:**

Upon successful completion students are able to:

- discuss the methods that are used to crystallize proteins
- describe the basic concepts of the transition state theory
- define the relation between reaction rates and free energy barriers
- describe enzyme reaction mechanisms
- describe the concepts of catalytic bases and acids
- illustrate active site strain
- tell the importance of active site electrostatics
- describe the concept of transition state analogues

**Contents:**

General and specific aspects of the reaction mechanism of several well studied enzymes will be discussed. It will include the serine proteases (such as chymotrypsin and trypsin). The following topics will be addressed: Chemical catalysis, transition state theory, forces stabilizing the enzyme-ligand interaction, structural properties of proteins, enzyme kinetics, crystallization of proteins, general aspects of enzyme catalysed reactions, reaction mechanisms of serine proteases, transition state analogues. The course is aimed at biochemistry and chemistry students.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

20 h lectures and seminars

**Target group:**

M.Sc. in Protein science and biotechnology

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Oral presentation

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Rikkert Wierenga

**Working life cooperation:**

No

**Other information:**

-

**747604S: Introduction to biocomputing, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** André Juffer

**Opintokohteen kielet:** English

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 autumn

**Learning outcomes:**

Upon successful completion students are able to:

- discuss several biocomputing techniques
- decide which method to use under what circumstances
- judge the quality of an analysis of a given problem by means of biocomputing techniques

**Contents:**

An overview is given of commonly employed techniques of biocomputing to study the structural, dynamical, functional and thermodynamical properties of proteins and membranes and their interaction with other molecules. This will include a overview of computer simulation techniques such as molecular dynamics, Monte Carlo and Langevin (stochastic, Brownian) dynamics, but also concepts of continuum electrostatics, statistical thermodynamics, protein modeling techniques, protein-ligand affinity calculations and the computer simulation of the protein folding process and enzyme action. In addition, some topics in the field of Bioinformatics are discussed as well and certain commonly employed protein modeling software is introduced.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

20 h lectures, student tasks

**Target group:**

M.Sc. in Protein science and biotechnology

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Recommended books:

Leach, A.R., *Molecular modelling. Principles and applications*, Second edition, Prentice Hall, New York, 2001

Berendsen, H.J.C *Simulating the physical world. Hierarchical modeling from quantum mechanics to fluid dynamics.*, Cambridge University Press, Cambridge, 2007

**Assessment methods and criteria:**

Presentation, group discussion

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

André Juffer

**Working life cooperation:**

No

**Other information:**

-

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mattila, Sampo Antero

**Opintokohteen kielet:** English

**ECTS Credits:**

3 credits/80 hours of work

**Language of instruction:**

English

**Timing:**

The course is lectured every year.

**Learning outcomes:**

After the course the students have basic knowledge and hands on experience with backbone assignment of small  $^{15}\text{N}$ / $^{13}\text{C}$  labelled protein using most common 3 dimensional triple resonance NMR spectra.

**Contents:**

During the course the students get hands on experience on setting up and acquiring multi dimensional spectra as well as processing and converting data to other formats and assigning protein backbones.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

14 hours of lectures + applications, 30 hours of exercises, 36 hours of self-study

**Target group:**

Chemistry, optional

**Prerequisites and co-requisites:**

No specific prerequisites

**Recommended optional programme components:**

The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**

Zerbe (ed): Bio-NMR in Drug Research, Wiley-VCH and Cavanagh: Protein NMR Spectroscopy, Academic Press, 1995 (partly) ISBN: 0121644901.

**Assessment methods and criteria:**

The seminar at the end of the course, exercises and home assignments  
Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Lecturer Sampo Mattila

**Working life cooperation:**

No

**Other information:**

No

**488304S: Bioreactor Technology, 6 op**

**Voimassaolo:** 01.08.2005 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail



**Opettajat:** Johanna Panula-Perälä

**Opintokohteen kielet:** English

**Leikkaavuudet:**

488321S Bioreactor technology 5.0 op

480431S Bioprocesses II 5.0 op

**ECTS Credits:**

6 cr

**Language of instruction:**

English

**Timing:**

The course is held in autumn semester during period I and II. It is recommended to complete the course in the 4<sup>th</sup> year.

**Learning outcomes:**

After completing this course, the student will be able to verbally describe the most common equipment, materials and methods related to biotechnological processes, microbial growth and cultivation and sterilization. The student will be able to apply different mathematical formulas for biocatalysis and for the bioreactor performance and use those to plan and analyze bioprocesses. The student will also be able to produce, analyze and interpret data from bioprocesses.

**Contents:**

Biotechnological process: General process schemes, batch, fed batch and continuous processes, biocatalysts and raw materials. Reactor design and instrumentation. Sterilization: kinetics of heat inactivation and practical implementation of sterilization methods. Mathematical description and quantification of the function of biocatalysts. Monod and Michaelis-Menten models, reaction rates and their determination. The lag phase of growth, cellular maintenance, cell death. Kinetics of product and by-product formation. Kinetics of oxygen and heat transfer. Oxygen and heat balances: significance and calculations. Power consumption. Scale-up and scale-down.

**Mode of delivery:**

Blended teaching.

**Learning activities and teaching methods:**

Lectures 36 h / exercises 6 h / homework 50 h / self-study 68 h.

**Target group:**

Master students of bioprocess engineering and environmental engineering students in M.Sc. Programme in Green Chemistry and Bioproduction. Master students from process engineering and biochemistry with required prerequisites.

**Prerequisites and co-requisites:**

The bachelor level courses by the Environmental Engineering (especially 488301A Microbiology, 488302A Basics of biotechnology) or respective knowledge.

**Recommended optional programme components:**

-

**Recommended or required reading:**

Lectures: Lecture hand outs; Doran, P. M. Bioprocess engineering principles. Academic Press. London, 2010. Supplementary material: Enfors, S.-O., Häggström, L. . Bioprocess technology fundamentals and applications. Royal Institute of Technology. Stockholm 2011. ; Biotechnology (Vol 2 ): Fundamentals of biochemical engineering. . Toim. H.-J. Rehm and G. Reed, Weinheim, Wiley-VCH. 1991. Villadsen J., Nielsen J., Liden G. Bioreactor engineering principles. Springer Verlag, 2011.

**Assessment methods and criteria:**

Lectures, exercises, final exam, homework. Grade will be composed of final exam, exercises and homework. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**

University teacher Johanna Panula-Perälä, postdoctoral research fellow Sanna Taskila

**Working life cooperation:**

No

**Other information:**

-

**488305S: Advanced Course for Biotechnology, 5 op****Voimassaolo:** 01.08.2005 -**Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Sanna Taskila**Opintokohteen kielet:** English**Leikkaavuudet:**

480450S Bioprocesses III 5.0 op

**ECTS Credits:**

5 cr

**Language of instruction:**

English

**Timing:**

The course is held in autumn and spring semesters during periods III and IV. It is recommended to complete the course in the 4<sup>th</sup> or 5<sup>th</sup> year.

**Learning outcomes:**

After completing this course, the student will be able to describe the most important techniques - both up- and downstream - in protein and metabolite production. Further, the student will be able to present main features of the biotechnology based on renewable raw materials.

**Contents:**

Microbial homologous and heterologous protein production. Physiological and process related items in the production of selected microbial metabolites. Principles and practices in metabolic engineering. Methods for process intensification. Unit operations in product recovery and purification. Specific features of biorefineries.

**Mode of delivery:**

Blended teaching.

**Learning activities and teaching methods:**

Lectures 30 h / exercises 6 h / homework 44 h / self-study 50 h.

**Target group:**

Master students of bioprocess engineering, environmental engineering students in M.Sc. Programme in Green Chemistry and Bioproduction, and process engineering students in Master's degree programme in Biomass, Technology and Management. Master students from process engineering and biochemistry with required prerequisites.

**Prerequisites and co-requisites:**

Prerequisites: The preceding courses by the Bioprocess Engineering Laboratory (especially 488301A Microbiology, 488302A Basics of biotechnology and 488304S Bioreactor technology) or respective knowledge.

**Recommended optional programme components:**

-

**Recommended or required reading:**

Will be announced at the lectures.

**Assessment methods and criteria:**

Lectures and final examination, exercises and the report. Grade will be composed of homework exercises, final examinations and report.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Postdoctoral research fellow Sanna Taskila, university researcher Johanna Panula-Perälä

**Working life cooperation:**

No

**Other information:**

-

**580402S: Biomedical Imaging Methods, 1 - 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Institute of Health Sciences

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Simo Saarakkala

**Opintokohteen kielet:** English

**ECTS Credits:**

4 ECTS

**Language of instruction:**

English

**Timing:**

Master studies. The course is not organized every year.

**Learning outcomes:**

The student knows and can describe the basic principles and main applications of imaging techniques used in biomedical research.

**Contents:**

Differences between in vivo, ex vivo and in vitro imaging. Optical in vivo imaging, optical tomography, magnetic resonance imaging, Fourier transform infrared microspectroscopy, Raman microspectroscopy, micro-computed tomography, basics of image analysis and interpretation.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

Lectures, demonstrations, practical exercise. Final exam.

**Target group:**

Master Students of Medical and Wellness technology and all other who are interest in methods of biomedical imaging.

**Recommended or required reading:**

Required literature is given in the lectures.

**Assessment methods and criteria:**

Exercises. Written exam.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5 or fail

**Person responsible:**

Docent Simo Saarakkala

**Working life cooperation:**

No

**Other information:**

This course is a part of specialization of Biomedical Technology and Medical imaging.

**746601S: Advanced studies in biochemistry in other universities, 0 - 75 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Lloyd Ruddock

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

Ei opintojaksokuvauksia.

**746605S: Advanced studies in biochemistry passed abroad, 0 - 75 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Lloyd Ruddock

**Opintokohteen kielet:** English

**Voidaan suorittaa useasti:** Kyllä

Ei opintojaksokuvauksia.

**H325422: Compulsory courses - MSc, Protein science and biotechnology, 77 op**

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Study module

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

*Compulsory courses***744620S: Protein chemistry II, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Evangelia Kapetaniou

**Opintokohteen kielet:** English

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1 autumn

**Learning outcomes:**

After the course, the students are able to:

- describe professional literature dealing with advanced techniques of protein analysis
- plan and implement the purification of a given protein on a large scale
- present and explain work related to protein purification and analysis

**Contents:**

This module provides a “real-life” approach to practical protein chemistry, including purification, biophysical analysis, enzymatics, etc. It comprises a small number of revision lectures, but it is primarily based on problem solving based exercises with a further level of complexity built in compared with Protein Chemistry I. The module includes a student presentation, but does not include a final examination. The final mark comprises marks from continuous assessment. Attendance of some parts of the course is compulsory.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

12 h seminars, plus exercises and a student report

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Continuous assessment, presentation

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Pass/fail

**Person responsible:**

Evangelia Kapetaniou

**Working life cooperation:**

No

**Other information:**

-

**744621S: Molecular biology II, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Elitsa Dimova, Daniela Mennerich

**Opintokohteen kielet:** English

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1 autumn

**Learning outcomes:**

After the course students are able to:

- discuss the general features of DNA manipulating/amplifying enzymes

- design (on paper or in silico) oligonucleotides for PCR amplification, set up restriction digests and ligation reactions in order to carry out basic and advanced cloning procedures
- use basic tools used in the genetic manipulation of mice

**Contents:**

This module provides a “real-life” approach to practical molecular biology, including DNA cloning strategies, site directed mutagenesis, generation of transgenic mice, etc. It comprises concept overview lectures, but it is primarily based on complex problem solving based exercises including written reports and group student presentations, but does not include a final examination. The final mark comprises marks from continuous assessment. Attendance of the course is required.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

12 h seminars, plus student presentations

**Target group:**

Major students

**Prerequisites and co-requisites:**

The course is designed for students familiar with DNA organization, gene structure & genetic concepts (ORF, codon, heterologous and homologous recombination).

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Written report, student presentation

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Elitsa Dimova

**Working life cooperation:**

No

**Other information:**

-

**747608S: Biochemical methodologies II, 8 op**

**Voimassaolo:** 01.08.2009 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Ulrich Bergmann

**Opintokohteen kielet:** English

**Leikkaavuudet:**

740365A Biochemical Methodologies II 8.0 op

**ECTS Credits:**

8 credits

**Language of instruction:**

English

**Timing:**

MSc 1st autumn

**Learning outcomes:**

Upon successful completion students are able to:

- describe the theoretical basis of the main biochemical analysis methods for proteins
- identify and use the different instruments
- describe the potential of the different analytical techniques and develop strategies for addressing specific questions in protein & proteome-analysis
- integrate data from multiple sources and evaluate it critically

**Contents:**

During this module students will produce and analyze their own protein samples. The course will cover principles and practical applications of some of the more advanced methodologies used in practical biochemistry, including fluorescence spectroscopy, stopped flow analysis of enzymatic reactions, circular dichroism, surface plasmon resonance, micro-calorimetry, mass spectrometry, and proteomics based on 2D electrophoresis. For assessment each student has to write a research report in the style of a scientific publication. Attendance is compulsory.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

120 h lab., including pre-lab lectures plus exercises

**Target group:**

Obligatory for M.Sc. in Protein Science and biotechnology

**Prerequisites and co-requisites:**

Protein production and analysis (747601S) or Protein chemistry I (740364A)

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Report written in style of a scientific publication

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Ulrich Bergmann

**Working life cooperation:**

No

**Other information:**

-

**902101Y: English for Biochemists 2, 3 op**

**Voimassaolo:** 01.08.2005 - 31.08.2016

**Opiskelumuoto:** Language and Communication Studies

**Laji:** Course

**Vastuuyksikkö:** Language Centre

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** English

**Leikkaavuudet:**

ay902101Y English for Biochemists 2 (OPEN UNI) 3.0 op

**Proficiency level:**

C1 on the CEFR scale

**Status:**

Compulsory for all biochemistry master's degree students (starting academic year 2015-16).

**Required proficiency level:**

Participants are expected to have studied English as an A1 or A2 language at school or to have acquired equivalent skills elsewhere.

**ECTS Credits:**

3 ECTS credits

**Language of instruction:**

English

**Timing:**

Next offered academic year 2015-16 – timing to be announced later

**Learning outcomes:**

The course aims to help you acquire understanding of the conventions and expectations of the academic community of biochemists for scientific reporting, and develop presentation and writing skills for your future professional life.

**Learning outcomes:**

By the end of the course, you are expected to be able to

1. write a research article that follows the main discourse conventions of biochemistry
2. prepare and deliver an oral scientific presentation supported by an effective slideshow
3. apply the rules of referencing
4. use a sufficient range of appropriate academic vocabulary relevant to your discipline
5. write with a good level of linguistic accuracy and correct punctuation
6. structure your work for optimal clarity and impact
7. make good use of feedback from peers and teachers to improve your own scientific production

**Contents:**

This course will cover presentation skills (1 ECTS credit) and writing for scientific purposes (2 ECTS credits).

**Mode of delivery:**

Contact teaching and web-supported feedback

**Learning activities and teaching methods:**

Contact teaching 24 hours / optional tutorials / independent work 56 hrs. Attendance at all classroom sessions is **compulsory**.

**Target group:**

4th year biochemistry students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

902100Y English for Biochemists 1 must be completed

**Recommended or required reading:**

Course materials will be provided by the teachers and a copy fee will be charged.

**Assessment methods and criteria:**

Assessment is based on regular completion and quality of course tasks, with particular emphasis on the final product of each part of the course: the final presentation and the final draft of a research article in biochemistry.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Pass/Fail

**Person responsible:**

Heather Kannasmaa (presentation skills) and Suzy McAnsh (scientific writing)

**Working life cooperation:**

-

**Other information:**



**747691S: Pro gradu experimental work in protein science and biotechnology, 28 op****Opiskelumuoto:** Advanced Studies**Laji:** Practical training**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Lloyd Ruddock**Opintokohteen kielet:** English**ECTS Credits:**

28 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2

**Learning outcomes:**

After the experimental work students is able to:

- undertake scientific research with supervision using typical methods in biochemistry
- plan and perform experiments in laboratory, perform efficient time management, consider his motivation and how to improve that, work independently and as part of a team
- identify and solve practical problems, record and critically evaluate data

**Contents:**

This module provides an extensive, 6 month, project in a research group. The experimental work can be started after 30 op of Master studies have been completed. Students are responsible for finding a suitable research group in which they wish to undertake the Pro Gradu work. Students should produce a short (typically 2 page) study plan detailing the proposed content of their Pro Gradu work, supervisor(s) and start date which must be approved before they start work. The Pro Gradu thesis is based only on the work done during the first 6 months of work by the student on the project, except in cases of mitigating circumstances. The work may be undertaken in the research groups of department of Biochemistry or in any other suitable research group in Finland or abroad.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

Independent work

**Target group:**

M.Sc. in Protein science and biotechnology

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Laboratory work of six months

Read more about [assessment criteria](#) at the University of Oulu webpage.**Grading:**

pass/fail

**Person responsible:**

Lloyd Ruddock

**Working life cooperation:**

Yes

**Other information:**

-

**747692S: Pro gradu thesis in protein science and biotechnology, 20 op****Opiskelumuoto:** Advanced Studies**Laji:** Diploma thesis**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Tuomo Glumoff**Opintokohteen kielet:** English**ECTS Credits:**

20 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr2

**Learning outcomes:**

On successful completion of this course, the student is able to:

- retrieve and appraise information critically and integrate information to new entity
- communicate in science and make and defend scientific arguments.

**Contents:**

The Pro gradu thesis (typically around 50-60 pages long) is based on the experimental work undertaken by the student and the contextualization of the research and the results based on the published literature in the field. For detailed instructions see <http://www.biochem oulu.fi/>.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

-

**Target group:**

M.Sc. in Protein science and biotechnology

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Written thesis

Read more about [assessment criteria](#) at the University of Oulu webpage.**Grading:**

1-5/fail

**Working life cooperation:**

No

**Other information:**

-

**740672S: Maturity test (M.Sc. degree), 0 op****Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

0 credits

**Language of instruction:**

Finnish / English

**Timing:**

M.Sc. yr2

**Learning outcomes:**

-

**Contents:**

Will be written in context to Pro gradu thesis. In the test student must show a good command of both language skills and their field of Pro gradu thesis. If student's native language is not Finnish or Swedish Faculty of Science will define language in the test.

**Target group:**

Majos students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Written abstract of Pro Gradu thesis

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Working life cooperation:**

No

**Other information:**

-

*Orientation to research work: work done in an academic or industrial research group. Orientation to biochemical work: work done in a non research group environment. The sum of credits of both courses must be 12-20 ECTS.*

#### **744617S: Orientation to research work, 0 - 20 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Practical training

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Jari Heikkinen

**Opintokohteen kielet:** English

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

12 - 20 credits (see Other information)

**Language of instruction:**

English

**Timing:**

MSc yr 1

**Learning outcomes:**

After this course student has gained experience of practical work done in research groups. Student is able to:

- demonstrate goal-oriented teamwork
- apply methods used in proper environment
- discuss the practical work done and reflect his knowledge

**Contents:**

This module provides an introduction to research work via the active integration of students into research groups and/or via one to two week advanced practical courses. The integration into groups can be either full-time or part-time research work, with 1.5op being awarded for each full-time week equivalent worked. A maximum of 6op can be awarded for working in one research group. The research groups do not need to be in the Department of Biochemistry, University of Oulu, but advance permission should be sought if the research group is not part of the University of Oulu.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

Independent work

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Research work

Read more about [assessment criteria](#) at the University of Oulu webpage.**Grading:**

pass/fail

**Person responsible:**

Jari Heikkinen

**Working life cooperation:**

Yes

**Other information:**

The sum of credits from courses 744624S and 744617S must be 12-20 credits (for Int MSc in protein science line 12-18 credits)

**744624S: Orientation to biochemical work, 0 - 20 op****Voimassaolo:** 01.08.2011 -**Opiskelumuoto:** Advanced Studies**Laji:** Practical training**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Jari Heikkinen**Opintokohteen kielet:** English**Leikkaavuudet:**

744629S Orientation to biochemical work 0.0 op

744617S Orientation to research work 0.0 op

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

12-20 credits (see Other information)

**Language of instruction:**

English/Finnish

**Timing:**

M.Sc. yr1

**Learning outcomes:**

After this course student has gained experience of practical work done in non-research group environment. Student is able to:

- demonstrate goal-oriented teamwork
- apply methods used in proper environment
- discuss the practical work done and reflect his knowledge

**Contents:**

This module provides an introduction to non-research work in companies or other suitable environment. The work can be either full-time or part-time work, with 1.5op being awarded for each full-time week equivalent worked. A maximum of 6op can be awarded for working in one work placements. Each placement must be agreed in advance with the responsible person.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

Independent work

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

non-research work

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Pass/fail

**Person responsible:**

Jari Heikkinen

**Working life cooperation:**

Yes

**Other information:**

The sum of credits from courses 744624S and 744617S must be 12-20 credits (for Int MSc in protein science line 12-18 credits)

## **H325425: Optional specialist courses - MSc / Int MSc, Protein science and biotechnology, 11,5 - 21,5 op**

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Study module

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

*Optional specialist courses (a minimum of 4 of these courses must be taken)*

**747605S: Basic aspects of protein crystallographic methods, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Wierenga Rikkert

**Opintokohteen kielet:** English

**Leikkaavuudet:**

744615S Basic aspects of protein crystallographic methods 3.0 op

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 autumn

**Learning outcomes:**

Upon successful completion students are able to:

- describe the key aspects of the protein crystallization methods
- describe the importance of crystals for obtaining the structure of a protein
- describe the importance of the Fourier transform method in the structure determination method
- describe the phase problem
- describe the importance of the anomalous differences

**Contents:**

The course will describe the principles of x-ray diffraction theory. It will focus on aspects used in the field of protein crystallography including following topics: Crystallisation of proteins, symmetry properties of crystals, X-ray sources and detectors, the diffraction pattern and the reciprocal lattice, the phase problem, isomorphous differences and the MIR-method, anomalous differences and the MAD-method.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

20 h lectures and seminars

**Target group:**

M.Sc. in Protein Science and biotechnology

**Prerequisites and co-requisites:**

Biomolecules and Protein chemistry I or Protein production and analysis or equivalent

**Recommended optional programme components:**

-

**Recommended or required reading:**

Drenth, J.: Principles of protein X-ray crystallography (2nd edition); Blow, D.: Outline of crystallography for biologists (1st edition, 2002)

**Assessment methods and criteria:**

Oral presentation

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Rik Wierenga

**Working life cooperation:**

No

**Other information:**

-

**747606S: Structural enzymology, 3 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Wierenga Rikkert**Opintokohteen kielet:** English**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 spring

**Learning outcomes:**

Upon successful completion students are able to:

- discuss the methods that are used to crystallize proteins
- describe the basic concepts of the transition state theory
- define the relation between reaction rates and free energy barriers
- describe enzyme reaction mechanisms
- describe the concepts of catalytic bases and acids
- illustrate active site strain
- tell the importance of active site electrostatics
- describe the concept of transition state analogues

**Contents:**

General and specific aspects of the reaction mechanism of several well studied enzymes will be discussed. It will include the serine proteases (such as chymotrypsin and trypsin). The following topics will be addressed: Chemical catalysis, transition state theory, forces stabilizing the enzyme-ligand interaction, structural properties of proteins, enzyme kinetics, crystallization of proteins, general aspects of enzyme catalysed reactions, reaction mechanisms of serine proteases, transition state analogues. The course is aimed at biochemistry and chemistry students.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

20 h lectures and seminars

**Target group:**

M.Sc. in Protein science and biotechnology

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Oral presentation

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Rikkert Wierenga

**Working life cooperation:**

No

**Other information:**

-

**747611S: Biochemistry of protein folding, 3 op**

**Voimassaolo:** 01.06.2011 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Lloyd Ruddock

**Opintokohteen kielet:** English

**Leikkaavuudet:**

747602S Biochemistry of protein folding 2.5 op

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc., yr1-yr2 spring

**Learning outcomes:**

Upon successful completion students are able to:

- present and discuss issues presented in the primary literature on a variety of aspects of protein folding.
- display an understanding of the theoretical and practical implications of *in vivo*, *in vitro* and *in silico* studies on protein folding and the integration of results.
- demonstrate the ability to interpret a wide range of data from multiple sources, to critically evaluate and contextualise this data and to solve problems relating to interpretation.

**Contents:**

This module provides an introduction to protein folding *in vivo*. Topics covered include protein folding and quality control in the endoplasmic reticulum, mechanisms regulating protein folding including the unfolded protein response, the catalysis of native disulphide bond formation, the biochemistry of molecular chaperones and the role of molecular chaperones and protein folding catalysts in other cellular events.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

16 contact hours of lectures and seminars

**Target group:**

M.Sc. in Protein science and biotechnology

**Prerequisites and co-requisites:**

Protein chemistry I (740364A) or Protein production and analysis (747601S) or equivalent

**Recommended optional programme components:**

-

**Recommended or required reading:**



-

**Assessment methods and criteria:**

The module is assessed based on a report prepared on individual topics and on participation in the seminars.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Lloyd Ruddock

**Working life cooperation:**

No

**744619S: Systems biology, 4 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tuomo Glumoff

**Opintokohteen kielet:** English

**ECTS Credits:**

4 credits

**Language of instruction:**

English

**Timing:**

M.Sc. 1st-2nd autumn

**Learning outcomes:**

After the course student is able to define the cell as an ensemble of structural and functional parts. He is also able to connect and describe their current knowledge on cellular, molecular and structural biology into a general view. The student is also able to assess scientific information critically on novel research findings and the problems associated with massive amounts of novel scientific information.

**Contents:**

The module aims to give a holistic picture of the cell as a system. Cells contain numerous molecules and complex structures that interact with each other to form complex interaction networks such that when taken together they form a new whole, which cannot be understood by just investigating the parts. Methods to collect and assemble biological/biochemical information for systems analysis will be introduced.

Possibilities of systems approach will be critically discussed in relation to available research techniques, techniques of the future, applications, research targets, as well as from the philosophical and ethical point of view including applicability of the systems theory in biosciences.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

The module consists of 22 h of lectures, discussions and case studies, ca. 5h of computing exercises

**Target group:**

Major students

**Prerequisites and co-requisites:**

B.Sc. in biochemistry or a related subject or otherwise adequate knowledge on cellular, molecular and structural biology.

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Study diaries will be assessed for a mark on scale 1 to 5 upon request. Otherwise marking will be Pass/fail. There is no exam and thus presence on certain amount of the course is compulsory. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Tuomo Glumoff

**Working life cooperation:**

No

**Other information:**

-

**747603S: Bioinformatics, 2,5 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Ari-Pekka Kvist**Opintokohteen kielet:** English**ECTS Credits:**

2.5 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 spring

**Learning outcomes:**

Upon successful completion student are able to:

- use web-based bioinformatics tools.
- process the information and find solutions to various problems
- analyse and present the findings in the form of a report

**Contents:**

This course introduces basic concepts and methodology in bioinformatic research. Basic computational methods of DNA and protein handling and database searches are introduced. Other methods may include joining database and proteomic searches and evolutionary views of biocomputing. After this course a student has insight of basic methodology of bioinformatics. Attendance to practicals is compulsory.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

8 hr lectures, 30 h practicals

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Ari-Pekka Kvist

**Working life cooperation:**

No

**Other information:**

-

**784637S: Biological NMR Spectroscopy, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mattila, Sampo Antero

**Opintokohteen kielet:** English

**ECTS Credits:**

3 credits/80 hours of work

**Language of instruction:**

English

**Timing:**

The course is lectured every year.

**Learning outcomes:**

After the course the students have basic knowledge and hands on experience with backbone assignment of small  $^{15}\text{N}$ / $^{13}\text{C}$  labelled protein using most common 3 dimensional triple resonance NMR spectra.

**Contents:**

During the course the students get hands on experience on setting up and acquiring multi dimensional spectra as well as processing and converting data to other formats and assigning protein backbones.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

14 hours of lectures + applications, 30 hours of exercises, 36 hours of self-study

**Target group:**

Chemistry, optional

**Prerequisites and co-requisites:**

No specific prerequisites

**Recommended optional programme components:**

The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**

Zerbe (ed): Bio-NMR in Drug Research, Wiley-VCH and Cavanagh: Protein NMR Spectroscopy, Academic Press, 1995 (partly) ISBN: 0121644901.

**Assessment methods and criteria:**

The seminar at the end of the course, exercises and home assignments  
Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Lecturer Sampo Mattila

**Working life cooperation:**

No

**Other information:**

No

**747604S: Introduction to biocomputing, 3 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** André Juffer**Opintokohteen kielet:** English**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 autumn

**Learning outcomes:**

Upon successful completion students are able to:

- discuss several biocomputing techniques
- decide which method to use under what circumstances
- judge the quality of an analysis of a given problem by means of biocomputing techniques

**Contents:**

An overview is given of commonly employed techniques of biocomputing to study the structural, dynamical, functional and thermodynamical properties of proteins and membranes and their interaction with other molecules. This will include a overview of computer simulation techniques such as molecular dynamics, Monte Carlo and Langevin (stochastic, Brownian) dynamics, but also concepts of continuum electrostatics, statistical thermodynamics, protein modeling techniques, protein-ligand affinity calculations and the computer simulation of the protein folding process and enzyme action. In addition, some topics in the field of Bioinformatics are discussed as well and certain commonly employed protein modeling software is introduced.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

20 h lectures, student tasks

**Target group:**

M.Sc. in Protein science and biotechnology

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Recommended books:

Leach, A.R., *Molecular modelling. Principles and applications*, Second edition, Prentice Hall, New York, 2001Berendsen, H.J.C *Simulating the physical world. Hierarchical modeling from quantum mechanics to fluid dynamics.*, Cambridge University Press, Cambridge, 2007**Assessment methods and criteria:**

Presentation, group discussion

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

André Juffer

**Working life cooperation:**

No

**Other information:**

-

## H325428: Optional courses - MSc, Protein science and biotechnology, 1,5 - 31,5 op

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Study module

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

### *Optionall courses*

#### **744618S: Dissertation, 18 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Lloyd Ruddock

**Opintokohteen kielet:** English

**Leikkaavuudet:**

744631S    Dissertation    15.0 op

**ECTS Credits:**

18 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2

**Learning outcomes:**

Upon successful completion students are able to:

- apply information in the right context, integrate information from a wide range of sources and evaluate it critically
- communicate science in extensive written format and discuss and defend scientific arguments
- demonstrate independent work including self motivation, planning, organizational skills and time management.

**Contents:**

This module is based around the student producing an extensive, in-depth literature report in the style of a scientific review. Students are responsible for finding a suitable supervisor for their dissertation with whom they will discuss the scientific background and relevant literature. Students are strongly encouraged to meet with their supervisor weekly to discuss progress and ideas and to resolve problems. A one-page outline of the dissertation subject area, including details of the supervisor (who need not be from the

University of Oulu), must be approved by the module convener before starting this module. While the dissertation subject can be closely linked with the Pro Gradu project subject, students are advised that having distinct topics for these two modules will look better on their CV.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

480 hours of student work

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Written report

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Lloyd Ruddock

**Working life cooperation:**

No

**Other information:**

-

**744625S: Scientific presentation, 1 - 2 op**

**Voimassaolo:** 01.03.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Jari Heikkinen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

1-2 credits

**Language of instruction:**

Finnish and English

**Timing:**

M.Sc.

**Learning outcomes:**

The student makes a presentation and participates in an international scientific conference with their own presentation. The presentation may be a poster, a talk or equivalent. The student uses the skills learned in the B.Sc. or otherwise in planning and realizing the presentation. The student practices communication skills necessary for research work.

**Contents:**

Student participates in a conference and delivers a poster, a talk or equivalent. The contents of which must include student's own results, for example from the Master's Thesis work. The pro gradu supervisor or other suitable person supervises the planning and realization of the presentation.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

A poster, a talk or equivalent is delivered. The workload of the course may vary depending on the extent and the form of presentation.

**Target group:**

Major students (MSc)

**Prerequisites and co-requisites:**

No compulsory preceding courses

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Study diary, a copy of presentation or poster

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Amanuensis

**Working life cooperation:**

No

**Other information:**

The amount of credits is estimated based on the workload of the planning and realization of the presentation, but not the length of the meeting.

**747693S: Final examination in protein science and biotechnology, 9 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Lloyd Ruddock

**Opintokohteen kielet:** English

**ECTS Credits:**

9 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2

**Learning outcomes:**

Upon successful completion students should be able to:

- discuss the full breadth of the core topics of biochemistry, protein science and biotechnology
- Integrate material from multiple sources

**Contents:**

This examination will test the ability of students to integrate knowledge from BSc and MSc level protein science and biotechnology. The questions will require an understanding of the principles of biochemistry and protein science and will be based on subject specific material from relevant BSc and MSc level modules. The format will be an oral examination.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

Student self-study

**Target group:**

M.Sc. in Protein science and biotechnology

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Oral examination

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Lloyd Ruddock

**Working life cooperation:**

No

**Other information:**

-

**30002M: Advanced Information Skills, 1 op**

**Voimassaolo:** 01.08.2009 -

**Opiskelumuoto:** Other Studies

**Laji:** Course

**Vastuuyksikkö:** Faculty of Science

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Sassali, Jani Henrik

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

1 ECTS credit

**Language of instruction:**

Finnish

**Timing:**

Intended for degree students working on their diploma/master's thesis. The course unit is held once in the autumn and once in the spring semester.

**Learning outcomes:**

Students know the different phases of scientific information retrieval process and basic techniques of systematic information search. They will find the most important reference databases of their discipline and know how to evaluate information sources and search results.

**Contents:**

Scientific information retrieval, evaluation of search results and information sources, information search on subject areas of diploma/master's thesis.

**Mode of delivery:**

Blended teaching: lectures, web-based learning material and exercises in Optima environment, personal guidance



**Learning activities and teaching methods:**

Lectures 6-12h, self-study 20h, personal guidance 1h

**Target group:**

The course is optional for students of the Faculty of Science and the Faculty of Technology.

**Prerequisites and co-requisites:**

No

**Recommended optional programme components:**

No

**Recommended or required reading:**

Parts from the following chapters of the Toolbox of Research:

<https://wiki oulu.fi/display/jotut/1.1+Tieteellinen+tiedonhankinta>

<https://wiki oulu.fi/display/jotut/1.3.1+Tieteellisiin+julkaisuihin+pohjautuva+arviointi>

**Assessment methods and criteria:**

Passing the course requires participation in the lectures (6h) and personal guidance and successful completion of the course assignments.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

pass/fail

**Person responsible:**

Science and Technology Library Tellus, tellustieto (at) oulu.fi

**Working life cooperation:**

No

**488304S: Bioreactor Technology, 6 op**

**Voimassaolo:** 01.08.2005 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Johanna Panula-Perälä

**Opintokohteen kielet:** English

**Leikkaavuudet:**

488321S Bioreactor technology 5.0 op

480431S Bioprocesses II 5.0 op

**ECTS Credits:**

6 cr

**Language of instruction:**

English

**Timing:**

The course is held in autumn semester during period I and II. It is recommended to complete the course in the 4<sup>th</sup> year.

**Learning outcomes:**

After completing this course, the student will be able to verbally describe the most common equipment, materials and methods related to biotechnological processes, microbial growth and cultivation and sterilization. The student will be able to apply different mathematical formulas for biocatalysis and for the bioreactor performance and use those to plan and analyze bioprocesses. The student will also be able to produce, analyze and interpret data from bioprocesses.

**Contents:**

Biotechnological process: General process schemes, batch, fed batch and continuous processes, biocatalysts and raw materials. Reactor design and instrumentation. Sterilization: kinetics of heat

inactivation and practical implementation of sterilization methods. Mathematical description and quantification of the function of biocatalysts. Monod and Michaelis-Menten models, reaction rates and their determination. The lag phase of growth, cellular maintenance, cell death. Kinetics of product and by-product formation. Kinetics of oxygen and heat transfer. Oxygen and heat balances: significance and calculations. Power consumption. Scale-up and scale-down.

**Mode of delivery:**

Blended teaching.

**Learning activities and teaching methods:**

Lectures 36 h / exercises 6 h / homework 50 h / self-study 68 h.

**Target group:**

Master students of bioprocess engineering and environmental engineering students in M.Sc. Programme in Green Chemistry and Bioproduction. Master students from process engineering and biochemistry with required prerequisites.

**Prerequisites and co-requisites:**

The bachelor level courses by the Environmental Engineering (especially 488301A Microbiology, 488302A Basics of biotechnology) or respective knowledge.

**Recommended optional programme components:**

-

**Recommended or required reading:**

Lectures: Lecture hand outs; Doran, P. M. Bioprocess engineering principles. Academic Press. London, 2010. Supplementary material: Enfors, S.-O., Häggström, L. . Bioprocess technology fundamentals and applications. Royal Institute of Technology. Stockholm 2011. ; Biotechnology (Vol 2 ): Fundamentals of biochemical engineering. . Toim. H.-J. Rehm and G. Reed, Weinheim, Wiley-VCH. 1991. Villadsen J., Nielsen J., Liden G. Bioreactor engineering principles. Springer Verlag, 2011.

**Assessment methods and criteria:**

Lectures, exercises, final exam, homework. Grade will be composed of final exam, exercises and homework. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**

University teacher Johanna Panula-Perälä, postdoctoral research fellow Sanna Taskila

**Working life cooperation:**

No

**Other information:**

-

**488305S: Advanced Course for Biotechnology, 5 op**

**Voimassaolo:** 01.08.2005 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Sanna Taskila

**Opintokohteen kielet:** English

**Leikkaavuudet:**

480450S Bioprocesses III 5.0 op

**ECTS Credits:**

5 cr

**Language of instruction:**

English

**Timing:**

The course is held in autumn and spring semesters during periods III and IV. It is recommended to complete the course in the 4<sup>th</sup> or 5<sup>th</sup> year.

**Learning outcomes:**

After completing this course, the student will be able to describe the most important techniques - both up- and downstream - in protein and metabolite production. Further, the student will be able to present main features of the biotechnology based on renewable raw materials.

**Contents:**

Microbial homologous and heterologous protein production. Physiological and process related items in the production of selected microbial metabolites. Principles and practices in metabolic engineering. Methods for process intensification. Unit operations in product recovery and purification. Specific features of biorefineries.

**Mode of delivery:**

Blended teaching.

**Learning activities and teaching methods:**

Lectures 30 h / exercises 6 h / homework 44 h / self-study 50 h.

**Target group:**

Master students of bioprocess engineering, environmental engineering students in M.Sc. Programme in Green Chemistry and Bioproduction, and process engineering students in Master's degree programme in Biomass, Technology and Management. Master students from process engineering and biochemistry with required prerequisites.

**Prerequisites and co-requisites:**

Prerequisites: The preceding courses by the Bioprocess Engineering Laboratory (especially 488301A Microbiology, 488302A Basics of biotechnology and 488304S Bioreactor technology) or respective knowledge.

**Recommended optional programme components:**

-

**Recommended or required reading:**

Will be announced at the lectures.

**Assessment methods and criteria:**

Lectures and final examination, exercises and the report. Grade will be composed of homework exercises, final examinations and report.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Postdoctoral research fellow Sanna Taskila, university researcher Johanna Panula-Perälä

**Working life cooperation:**

No

**Other information:**

-

**744623S: Yeast genetics, 6 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Alexander Kastaniotis

**Opintokohteen kielet:** English

**Leikkaavuudet:**

744616S Yeast genetics and molecular biology 2.5 op

744613S Yeast genetics 1.5 op

**ECTS Credits:**

3-6 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 spring

**Learning outcomes:**

Upon successful completion students are able to:

- tell a basic knowledge of yeast genetics and physiology
- tell the basic principles of using the yeast model organism to address fundamental genetic and cell biological problems
- (practical course) describe variety of genetic and molecular biology techniques commonly used to manipulate baker's yeast in the pursuit of biological questions

**Contents:**

This course is an introduction to *Saccharomyces cerevisiae* as a model organism and the use of classical and molecular genetic approaches in this yeast to study basic cellular processes. We will also focus on genetic screens and selections designed to identify targets of interest. Aspects of transcriptional regulation will be discussed to provide a basic understanding for some of the screens and selections introduced. The lecture part is open to all students that fulfill the enrollment requirements, and equals 3 op. Performance in the course will be assessed by participation in the course review session at the beginning of each lecture (10% of total grade) and by a final written examination. The practical part of this is a block practical spread over two weeks (2 days – 3 days – 2 days – 3 days) running almost parallel to lecture course. It is designed to provide training in techniques and concepts commonly used in yeast genetics (streaking, spotting, mating, tetrad analysis, transformation, colony-color based assays, carbon source-dependent expression of genes, as well as generation and cloning of mutants). This part of the course has limited enrollment for 16 people.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

16 h lectures, 10 days practical, final exam and oral participation in course review session

**Target group:**

Major students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Course review sessions, final exam, experiment reports

Read more about [assessment criteria](#) at the University of Oulu webpage.**Grading:**

1-5/fail

**Person responsible:**

Alexander Kastaniotis

**Working life cooperation:**

No

**Other information:**

-

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Thomas Kietzmann

**Opintokohteen kielet:** English

**Leikkaavuudet:**

740380A Virology 3.0 op

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-2 spring (starts 2015)

**Learning outcomes:**

Upon successful completion students are able to:

- discuss the major groups of viruses and their infection and replication mechanisms
- present and discuss characteristic features of specific viruses and their relation to pathogenesis and immunity
- describe diagnostic methods and antiviral therapy

**Contents:**

The course covers basic aspects of virology. The main emphasis will be made on viral infection, replication, transcription, proteinsynthesis, virological diagnostics, infection kinetics, defense against viruses, ways of infection, vaccination, and antiviral therapy. The course involves lectures 10h and 10h seminars where the students should be able to recapitulate major aspects of the taught material in 5-7 min presentations.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

24 h lectures and student presentations in seminars

**Target group:**

MSc / Molecular and cellular biology

**Prerequisites and co-requisites:**

Cellular biology

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Thomas Kietzmann

**Working life cooperation:**

No

**Other information:**

This module is the same as Virology (740380A)

**743660S: Introduction to immunology, 3 op****Voimassaolo:** 01.08.2011 -**Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Tuomo Glumoff**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

740379A	Introduction to immunology	3.0 op
740378A	Basic immunobiology for biochemists	3.0 op
741661S	Immunobiology	3.0 op
740369A	Immunobiology	3.0 op

**ECTS Credits:**

3 credits

**Language of instruction:**

Partly Finnish, partly English

**Timing:**

B.Sc. yr3 autumn or M.Sc. yr1-yr2 autumn

**Learning outcomes:**

After the course students will be able to identify, analyze and apply essential cellular molecules, components and mechanisms related to immunology, and complete their previous knowledge of molecular and cellular biology and protein chemistry with immunobiochemistry issues.

**Contents:**

The course handles both unspecific and specific immune response mechanisms, antibody structure and diversity, antibody-based immunodiagnostics, as well as basics of virus biochemistry.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

Lectures (12 h), a written home exercise, and a final exam

**Target group:**

MSc/ molecular and cellular biology

**Prerequisites and co-requisites:**

Preliminary required courses: Molekyylibiologia I, Protein chemistry I and Solun biologia, or equivalent basic molecular biology, protein chemistry and cell biology studies.

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Home exercise, final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.**Grading:**

1-5/fail

**Person responsible:**

Tuomo Glumoff

**Working life cooperation:**

No

**Other information:**

This module is the same as 740379A Introduction to immunology

**743604S: Biochemistry of inherited diseases, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Heli Ruotsalainen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish

**Timing:**

M.Sc yr1-yr2 autumn

**Learning outcomes:**

Upon completion the student should understand

- The most common inherited diseases and how they can be analyzed and treated
- Biochemistry behind the inherited diseases
- How to make an understandable presentation from the field of inherited diseases
- how to answer questions raised by the presentation

**Contents:**

This course provides information on mutations behind inherited diseases: how mutations are inherited, how they will be found and how they can be cured by gene therapy. Scientific articles will also be studied by small groups.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

18 h lectures and students' tasks

**Target group:**

M.Sc./Molecular and cellular biology

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Thompson & Thompson, Genetics in Medicine,; Strachan, T., Read, A.P.: Human Molecular Genetics, Bios. Scientific Publishers Limited; Aula *et al.*, Perinnöllisyyslääketiede; the newest editions. Scientific articles.

**Assessment methods and criteria:**

Homeworks, oral presentation, final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Heli Ruotsalainen

**Working life cooperation:**

No

**Other information:**

-

**743655S: Neurobiology, 4 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Heape Martin**Opintokohteen kielet:** English**ECTS Credits:**

4 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 spring

**Learning outcomes:**

The course is intended for students with little, or no prior education in the Neurosciences. At the end of the course, the students are able to:

- describe and define the general structural and functional organisation of the mammalian nervous system, and of the developmental and functional differentiation, and the roles of its cellular components.
- identify the selected areas of the neurosciences in which major research drives are currently undertaken.
- summarize a background knowledge of Neurobiology sufficiently to feel comfortable in undertaking a postgraduate research project in diverse fields of the Neurosciences.

**Contents:**

The course will focus mainly on the cell biology and biochemistry of cellular differentiation and function in the mammalian nervous system. Lectures cover: Embryology and structure of the mammalian nervous system - Cells and the extracellular environment in nervous tissues - Neuronal structure and function - Glial cells of the CNS and PNS - Functional and structural relationships between neurons and glia - Myelin synthesis, maintenance and function in the CNS and PNS - Cellular biochemistry of the transmission of the nervous impulse. The module includes an article analysis in small groups and presentation. Active participation and performance in article analysis exercises will contribute to the final mark.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

8-10 h lectures and 5-7 h group work (depending on number of students: maximum = 30 students).

**Target group:**

M.Sc./ Molecular and cellular biology

**Prerequisites and co-requisites:**

Biomolecules for Biochemists, Cellular Biology (740362A) or equivalent. In addition, the "Cellular communication" course (740366A) is a strong advantage, but not required.

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Presentation, Essay

Read more about [assessment criteria](#) at the University of Oulu webpage.**Grading:**

1-5/fail



**Person responsible:**

Anthony Heape

**Working life cooperation:**

No

**Other information:**

-

**743659S: Biochemistry of cell organelles, 3 op****Voimassaolo:** 01.08.2010 -**Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Kalervo Hiltunen**Opintokohteen kielet:** English**Leikkaavuudet:**

743656S Biochemistry of cell organelles 2.5 op

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 autumn

**Learning outcomes:**

Upon successful completion students are able to:

- Describe structure and function of the key cell organelles
- Discuss role of organelles in pathology
- Characterize metabolites transfer and action of channels and transporters
- Assess basic principles of biogenesis of cell organelles

**Contents:**

The course covers basic aspects of cell and membrane biology providing knowledge on structure and function of mitochondria, endoplasmic reticulum (ER) and peroxisomes. More detailed discussion will be on aspects of mitochondrial inheritance, function in health and diseases, mitophagy, role of organelles in aging, lipid synthesis in ER, intra- and extracellular transfer of lipids, structural and functional properties of membrane channels and transporters, soluble metabolite-transfer proteins, integration of different functions in peroxisomes. In addition to lectures (16 h) the course involves two seminars (4 h) where the students should present reports of cellular lipid traffic and isolation of cellular organelles.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

20 h lectures and student presentations in seminars

**Target group:**

Major students/Molecular and cellular biology

**Prerequisites and co-requisites:**

B.Sc. in biochemistry or biology or otherwise adequate knowledge on basic biochemistry, cellular and molecular biology

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Vasily Antonenkov

**Working life cooperation:**

No

**Other information:**

-

**743658S: Cell cycle, DNA replication and repair, 2,5 op**

**Voimassaolo:** 01.08.2010 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Pospiech, Helmut

**Opintokohteen kielet:** English

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

MSc yr1-yr2 spring

**Learning outcomes:**

Upon successful completion students are able to:

- explain why maintenance of genomic stability is required and how is it achieved?
- describe how DNA replication works and how is it studied
- describe how DNA damage is repaired
- summarize how DNA replication and repair is coordinated within the cell cycle, the DNA damage response and cell growth
- predict how DNA replication and repair is associated with disease and cancer

**Contents:**

The genetic information of all organisms is stored in the form of DNA. Since loss of DNA signifies loss of genetic information, DNA has to be maintained. This is in contrast to other biological macromolecules, which can be degraded and replaced by newly synthesised molecules. As a consequence, DNA has also to be copied faithfully during the process of DNA replication that precedes every cell division. Damage inflicted continuously to the DNA has to be repaired. Eucaryotic DNA replication, DNA repair and DNA damage response are tightly coordinated in the context of the cell cycles and the nuclear metabolism.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

16 h lectures

**Target group:**

MSc in molecular and cellular biology

**Prerequisites and co-requisites:**

B.Sc. in Biochemistry or Molecular Biology (or equivalent)

**Recommended optional programme components:**

-

**Recommended or required reading:**

Lecture handouts and review articles

**Assessment methods and criteria:**

Presence at the lectures compulsory, preparatory questions and homework  
Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Helmut Pospiech

**Working life cooperation:**

No

**Other information:**

-

**743657S: Tumor cell biology, 3 op**

**Voimassaolo:** 01.08.2010 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Thomas Kietzmann

**Opintokohteen kielet:** English

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

M.Sc. yr1-yr2 spring

**Learning outcomes:**

Upon successful completion students are able to:

- name, list and discuss the major aspects including formation of a tumor cell
- present, describe and discuss characteristic aspects of oncogenes and tumor suppressor genes
- use methods to study, examine and to analyse tumor genesis and tumor progression

**Contents:**

The course covers basic aspects of the main pathways inducing formation of a tumor. The main emphasis will be made on the formation of oncogenes, the action of tumor suppressor genes and the induction of tumors by viruses.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

20 h lectures

**Target group:**

MSc / Molecular and cellular biology

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Thomas Kietzmann

**Working life cooperation:**

No

**Other information:**

-

**580402S: Biomedical Imaging Methods, 1 - 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Institute of Health Sciences

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Simo Saarakkala

**Opintokohteen kielet:** English

**ECTS Credits:**

4 ECTS

**Language of instruction:**

English

**Timing:**

Master studies. The course is not organized every year.

**Learning outcomes:**

The student knows and can describe the basic principles and main applications of imaging techniques used in biomedical research.

**Contents:**

Differences between in vivo, ex vivo and in vitro imaging. Optical in vivo imaging, optical tomography, magnetic resonance imaging, Fourier transform infrared microspectroscopy, Raman microspectroscopy, micro-computed tomography, basics of image analysis and interpretation.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

Lectures, demonstrations, practical exercise. Final exam.

**Target group:**

Master Students of Medical and Wellness technology and all other who are interest in methods of biomedical imaging.

**Recommended or required reading:**

Required literature is given in the lectures.

**Assessment methods and criteria:**

Exercises. Written exam.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5 or fail

**Person responsible:**

Docent Simo Saarakkala

**Working life cooperation:**

No

**Other information:**

This course is a part of specialization of Biomedical Technology and Medical imaging.

**756625S: Genetic transformation of plants, 4 - 8 op**

**Voimassaolo:** - 31.07.2015

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Biology

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Häggman, Hely Margaretha

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

756652S Genetic transformation of plants 5.0 op

**ECTS Credits:**

4-8 ECTS credits / 107-212 hours of work.

**Language of instruction:**

Finnish / English.

**Timing:**

M.Sc. 1<sup>st</sup> or 2<sup>nd</sup> autumn, every second year.

**Learning outcomes:**

The student will assess and apply the concept of genetical modification. The student will apply the different techniques of genetic transformation and will judge their pros and cons.

**Contents:**

The lectures will cover gene constructs, marker-genes, different genetic transformation methods, legislation, and commercial cultivations. The exercises will familiarize the students with the most common genetic transformation methods including Agrobacterium-mediated transformation, electroporation, biolistic transformation and VIGS.

**Mode of delivery:**

Face-to-face teaching.

**Learning activities and teaching methods:**

Lab course + demonstrations (45 h) and lectures (20 h), reports, seminar or essay, lecture exam and final conclusions.

**Target group:**

BSb: compulsory MSc studies either course Advanced course in plant biology (752682S) 9 cr or Genetic transformation of plants (756625S) 8 cr.

**Prerequisites and co-requisites:**

Lectures of Advanced course in plant biology (752682S) helps in following the course.

**Recommended optional programme components:**

-

**Recommended or required reading:**

Handout and supplementary reading given in lectures and exercises.

**Assessment methods and criteria:**

Report, seminar and exam.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5 / Fail.

**Person responsible:**

Prof. Hely Häggman.

**Working life cooperation:**

No.

**Other information:**

-

**756618S: Secondary metabolism of plants, 4 op**

**Voimassaolo:** - 31.07.2014

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Biology

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Häggman, Hely Margaretha

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 ECTS credits / 107 hours of work.

**Language of instruction:**

Finnish / English.

**Timing:**

M.Sc. 1<sup>st</sup> or 2<sup>nd</sup> spring, (arranged if resources allow).

**Learning outcomes:**

The students will be able to define the role of plant secondary metabolism/metabolites, and the biosynthetic pathways involved. The possible role of secondary metabolites will be touched upon.

**Contents:**

General introduction to phenolic compounds, terpenoids, sterols, alkaloids; their synthesis and meaning for the plant. The economic importance and potential of plant secondary metabolites as fine chemicals and important traits of plants concerning quality and resistance will be discussed. The technological and economic feasibility of the large-scale culture of plant cells for the production of secondary metabolites are touched. Isolation and processing of useful metabolites will be discussed.

**Mode of delivery:**

Face-to-face teaching.

**Learning activities and teaching methods:**

Lectures 18 h and seminars 4 h, literature, final exam.

**Target group:**

-

**Prerequisites and co-requisites:**

No.

**Recommended optional programme components:**

-

**Recommended or required reading:**

Literature agreed on lectures.

**Assessment methods and criteria:**

Exam.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5 / Fail.

**Person responsible:**

Prof. Hely Häggman.

**Working life cooperation:**

No.

**Other information:**

-

**756627S: Plant hormones, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Biology

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Häggman, Hely Margaretha

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 ECTS credits / 107 hours of work.

**Language of instruction:**

Finnish / English.

**Timing:**

M.Sc. 1<sup>st</sup> or 2<sup>nd</sup> spring, every second year.

**Learning outcomes:**

The students will assess the plant hormone action, understand hormone interactions and the significance of the hormone balance as well as the molecular mechanisms.

**Contents:**

Plant hormones are signalling molecules with profound effects on growth and development at trace quantities. Until quite recently plant development was considered to be regulated by auxins, gibberellins, cytokinins, ethylene and abscisic acid. New analytical and molecular methods have evidenced new plant hormone receptors and signalling pathways. During the lectures the mode of action of the hormones and the latest literature is used to gain the most recent view of the topic.

**Mode of delivery:**

Face-to-face teaching.

**Learning activities and teaching methods:**

20 h and exam.

**Target group:**

Suitable for BSb and ecophysicologists.

**Prerequisites and co-requisites:**

Basics of functional plant biology lectures and exercises (752345A, 756341A).

**Recommended optional programme components:**

-

**Recommended or required reading:**

Chapters concerning plant hormones from Taiz, L. & Zeiger, E. 2010: Plant Physiology. Sinauer Associates Inc. 5. ed. and literature given in the lectures.

The availability of the literature can be checked from [this link](#).

**Assessment methods and criteria:**

Exam.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5 / Fail.

**Person responsible:**

Prof. Hely Häggman.

**Working life cooperation:**

No.

**Other information:**

-

**746601S: Advanced studies in biochemistry in other universities, 0 - 75 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Lloyd Ruddock**Opintokohteen kielet:** Finnish**Voidaan suorittaa useasti:** Kyllä

Ei opintojaksokuvauksia.

**746605S: Advanced studies in biochemistry passed abroad, 0 - 75 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Lloyd Ruddock**Opintokohteen kielet:** English**Voidaan suorittaa useasti:** Kyllä

Ei opintojaksokuvauksia.

**Tutkintorakenteisiin kuulumattomien opintokokonaisuuksien ja -jaksojen kuvaukset****740148P: Biomolecules, 5 op****Opiskelumuoto:** Basic Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Lloyd Ruddock**Opintokohteen kielet:** English**Leikkaavuudet:**

ay740157P Basic biochemistry 1: Biomolecules (OPEN UNI) 4.0 op

ay740152P Basic biochemistry 1: Biomolecules (OPEN UNI) 5.0 op

740143P Biomolecules for Biochemists 8.0 op

740147P Biomolecules for Bioscientists 8.0 op

**ECTS Credits:**

5 credits

**Language of instruction:**

English

**Timing:**

autumn-spring

**Learning outcomes:**



Upon successful completion students are able to:

- tell the composition, structure and function of the major groups of biomolecules in cells; nucleic acids, proteins, carbohydrates and lipids and describe the forces that modulate their function.
- apply information in the right context and evaluate it critically

**Contents:**

This module provides an overview of biochemistry, outlining the forces involved in biomolecule structure and the chemical structures and properties of polynucleic acids, proteins, carbohydrates and lipids. There will also be an introduction to prebiotic evolution and a student debate on this subject. The module is arranged into lectures, workshops, a student debate. All of the exercises are in English. Both a final examination and continuous assessment will count towards the final mark and attendance of some parts is compulsory.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

30 h lectures, plus exercises

**Target group:**

Minor subject students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Mathews, van Holde & Ahern: Biochemistry, (3rd edition) , published by Addison Wesley Longman, Inc. or equivalent

**Assessment methods and criteria:**

Continuous assessment, final examination

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Lloyd Ruddock

**Working life cooperation:**

No

**Other information:**

This module is the same as Biomolecules for Biochemists except that it contains no practical component.

## 740147P: Biomolecules for Bioscientists, 8 op

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Lloyd Ruddock

**Opintokohteen kielet:** English

**Leikkaavuudet:**

ay740157P	Basic biochemistry 1: Biomolecules (OPEN UNI)	4.0 op
ay740152P	Basic biochemistry 1: Biomolecules (OPEN UNI)	5.0 op
740143P	Biomolecules for Biochemists	8.0 op
740148P	Biomolecules	5.0 op

**ECTS Credits:**

8 credits

**Language of instruction:**

English

**Timing:**

autumn-spring

**Learning outcomes:**

Upon successful completion students are able to:

- tell the composition, structure and function of the major groups of biomolecules in cells; nucleic acids, proteins, carbohydrates and lipids and describe the forces that modulate their function.
- apply information in the right context and evaluate it critically

- In addition, students on the 8op versions are able to work in the biochemical laboratory, are able to solve calculations and problems and are able to interpret the scientific data they generate

**Contents:**

This module provides an overview of biochemistry, outlining the forces involved in biomolecule structure and the chemical structures and properties of polynucleic acids, proteins, carbohydrates and lipids. There will also be an introduction to prebiotic evolution and a student debate on this subject. The module is arranged into lectures, workshops, a student debate and laboratory work. All of the exercises are in English. Both a final examination and continuous assessment will count towards the final mark and attendance of some parts is compulsory.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

30 h lectures, 48 h lab., plus exercises

**Target group:**

Minor subject students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Mathews, van Holde & Ahern: Biochemistry, (3rd edition), published by Addison Wesley Longman, Inc. or equivalent

**Assessment methods and criteria:**

Continuous assessment, final examination

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Lloyd Ruddock

**Working life cooperation:**

No

**Other information:**

This module is the same as Biomolecules for Biochemists except that there is the option for one of the exercises to be in Finnish.

**747612S: Introduction to structure-based drug discovery, 4 op**

**Voimassaolo:** 01.01.2014 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** English

**Leikkaavuudet:**

747615S Introduction to structure-based drug discovery 5.0 op

**ECTS Credits:**

4 credits

**Language of instruction:**

English

**Timing:**

MSc yr1-yr2 spring

**Learning outcomes:**

After completion of this course student should be able to:

- Find and analyze a protein structure of interest from databases from the point of view of drug discovery
- Critically assess a quality of an experimental protein-small molecule complex structure
- Discuss the process of creating a virtual small molecule library
- Describe the commonly used computational methods for screening of small molecule libraries against a protein target
- Critically judge the results of the computational screening

**Contents:**

The course will consist of assignments, lectures and a project work carried out during the course in study groups. Groups will present their project plans and the results. All students will give feedback and share ideas during the

discussions. The project carried out during the course will be supported by lectures and discussions. The final mark comprises marks from continuous assessment, active participation to the group work and oral exam. Attendance to some parts of the course is compulsory. The course has limited enrollment for 24 students.

**Mode of delivery:**

Face to face and web based teaching

**Learning activities and teaching methods:**

seminar days, practicals, group work, student presentations and discussions

**Target group:**

MSc in Protein science and biotechnology

**Prerequisites and co-requisites:**

BSc in biochemistry or a related subject, Protein Chemistry I or Protein production and analysis

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Continuous assessment, presentations, oral exam

**Grading:**

pass/fail

**Person responsible:**

Lari Lehtiö

**Working life cooperation:**

No

**Other information:**

x

## 740149P: Metabolism I, 4 op

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tuomo Glumoff

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay740158P Basic biochemistry 3: Metabolis (OPEN UNI) 4.0 op

ay740154P Basic biochemistry 3: Metabolis (OPEN UNI) 3.0 op

740146P Metabolism I 6.0 op

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish

**Timing:**

spring

**Learning outcomes:**

Students will be able to explain the main principles of how the metabolism is made up, will get a detailed picture of the energy metabolism, and will be able to organize part of the wholeness of metabolism, particularly how energy metabolism is networked to the synthesis and degradation of biomolecules.

**Contents:**

On this course the central concepts and mechanisms of metabolism, its regulation and the integration of metabolic pathways will be introduced, like anabolism and catabolism, linking of different pathways, and metabolic regulation. Especially the energy metabolism will be studied, concerning carbohydrates, lipids and the respiratory chain. Combined with the course Metabolism II the students will get a good overview on the principles of metabolism, metabolic integration and the methods to study metabolism.

**Learning activities and teaching methods:**

The module is arranged into 30 h of lectures and problem-based exercises

**Target group:**

Minor subject students

**Recommended optional programme components:**

Biomolecules for Biochemists or Biomolecules for Bioscientists or Biomolecules

**Assessment methods and criteria:**

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail. Problem-based exercises and a final exam will count towards the final grade.

**Person responsible:**

Tuomo Glumoff

**Other information:**

This module is the same as Metabolism I (740146P), except that it contains no laboratory component

**740374A: Microbiology, 3 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Pospiech, Helmut

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

740363A Microbiology 6.0 op

740322A Microbiology 3.0 op

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

spring

**Learning outcomes:**

**Learning outcomes:** Upon successful completion students are able to:

- define the typical features of bacteria, archaea, fungi and virus and explain the diversity of different groups of microorganisms
- explain the basic aspects of microbial metabolism
- understand the basics of microbial growth, enrichment, culture and growth control both in the environment and in contained culture
- explain the essential roles of microorganisms in our environment
- apply their knowledge for the growth and its control of standard laboratory microorganisms
- have a basic understanding of the industrial use of microorganisms or microbial compounds.

**Contents:**

This module is an introduction to general and applied microbiology and consists of lecture and laboratory exercises. In the lectures, the diversity and classification of micro organisms, especially bacteria will be introduced. Further topics are the structure and function of the prokaryotic cell, bacterial growth, metabolism and physiology, the importance of bacteria in different ecosystems as well as the industrial use of bacteria.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

24 h lectures

**Target group:**

Minor subject students

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

M. Salkinoja-Salonen (toim.) (2002) Mikrobiologian perusteita, Helsingin yliopisto; M.T. Madigan, J. M. Martinko, J. Parker (2010) Brock biology of microorganisms, 13th ed. Prentice Hall International.

**Assessment methods and criteria:**

Continuous assessment (home works), final exam

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Helmut Pospiech

**Working life cooperation:**

No

**Other information:**

This module is the same as Microbiology (740363A) except that it contains no practical component.

**740373A: Molecular Biology I, 4 op****Opiskelumuoto:** Intermediate Studies**Laji:** Course**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Kaija Autio, Mirva Saaranen**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

740361A Molecular Biology I 8.0 op

740318A Molecular Biology 4.0 op

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish

**Timing:**

autumn

**Learning outcomes:**

After this course students should understand modern molecular biology methods.

**Contents:**

The course covers gene structure, DNA replication, recombination, transcription, translation and the basics of the regulation of gene expression. The student will learn the most common recombinant DNA techniques, such as PCR, use of restriction endonucleases, preparation of recombinant plasmids and DNA sequencing.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

20 h lectures, 4 h computer exercise and homeworks

**Target group:**

Minor subject students

**Prerequisites and co-requisites:**

Cellular biology, Biomolecules for Biochemists, Biochemical methodologies I

**Recommended optional programme components:**

-

**Recommended or required reading:**

Mathews, CK, van Holde KT, Applins DR, Anthony-Cahill SJ: Biochemistry (4th edition, 2012). Optional.

**Assessment methods and criteria:**

Homeworks 50%, final exam 50%

Read more about [assessment criteria](#) at the University of Oulu webpage.**Grading:**

1-5/fail.

**Person responsible:**

Kaija Autio

**Working life cooperation:**

-

**Other information:**

This course is the same as Molecular biology I (740361A) but without practical part