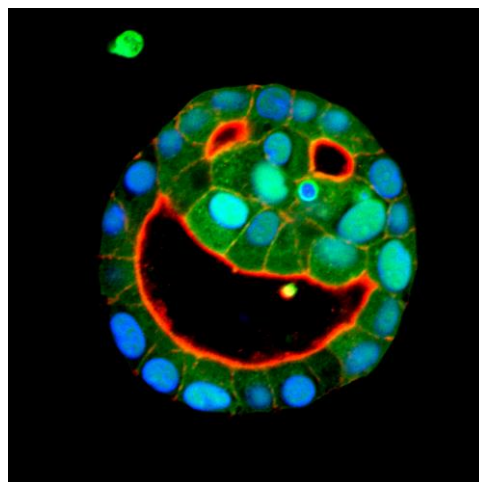




Faculty of Science and Engineering

STUDY GUIDE 2016-2017

MASTER'S DEGREE PROGRAMME IN BIOMEDICAL IMAGING



Contents

1 The Faculty of Science and Engineering.....	3
1.1 The Faculty and decision making.....	3
1.2 The Faculty office.....	3
1.3 The Academic neighbourhood.....	4
2 Studies.....	4
2.1 Academic year	4
2.2 Registration for the academic year.....	4
2.3 MinPlan	4
2.4 Course registration.....	4
2.5 Examinations.....	5
2.6 Flexible study right - JOOPAS: studies at the University of Turku.....	5
2.7 Certificates and study transcripts.....	6
3 Services.....	6
3.1 Computers, printers and copying machines	6
3.2 Libraries.....	6
3.3 Career Services.....	7
3.4 Student tutor and teacher tutor	7
3.5 Student activities	7
4 Master's degree programme in Biomedical Imaging.....	8
4.1 Structure of the studies	8
4.2 General information about the studies.....	13
4.3 Graduation and diploma.....	13

This guidebook has been compiled for students that study at Åbo Akademi University in the Master's Degree Programme in Biomedical Imaging. Its purpose is to give information about the Faculty and certain procedures, the study programme and the structure of the studies.

1 The Faculty of Science and Engineering

The education on undergraduate and graduate levels is organized into five Study Programmes in which several subjects work together. For each study programme, the Dean has appointed a [Head of Education](#) who is responsible for the planning of the syllabus, the preparation of the student admission (e.g. entrance examination) and the pedagogical development in the study programme.

The Study programmes at the Faculty of Science and Engineering are

Biosciences
Chemical Engineering
Information Technology
Natural Sciences
Pharmacy

The subjects in Biosciences are located in the building Biocity, Artillerigatan 6, 20520 Åbo.

1.1 The Faculty and decision making

The governing body of the faculty is the [Faculty Council](#). The [Dean](#), professor Tapio Salmi, chairs the council which has 12 members representing the professors, other employees and students of the faculty in equal numbers.

In organizational terms, subjects are located beneath the faculty and led by a [Head of Subject](#). The Heads of Subject are appointed by the Dean and have both scientific and administrative responsibilities. At the Faculty of Science and Engineering there are 23 subjects.

1.2 The Faculty office

The Faculty office (*fakultetskansliet*) is located in the Axelia-building, 3rd floor, Biskopsgatan 8, 20500 Åbo. The office is open Monday-Thursday at 10.00-15.00, Friday closed.

Academic Affairs Coordinator Ulla Bäckström is available at the Faculty office by mutual agreement. Telephone (02) 215 4516, e-mail: fnt-utbildningskoordinator@abo.fi

The Study Advisors are available at the Faculty office by mutual agreement:

Heidi Karlsson, Telephone (02) 215 3540, e-mail: biovet-studieradgivare@abo.fi
Jessica Lindroos, Telephone (02) 215 4517, e-mail: jessica.lindroos@abo.fi

The rest of the Faculty Office personnel are found here: http://www.abo.fi/fakultet/en/fnt_administration

It is recommended that you book an appointment with the Academic Affairs coordinator or the Study Advisor in advance by e-mail or telephone.

The coordinators' office

The coordinator of the Master's Programme in Biomedical Imaging is
Laura Mairinoja 1.9.2016- (substitute for Joanna Pylvänäinen), e-mail bima-office@bioimaging.fi.

Their office is located in the BioCity building (T38), 5th floor, at the Laboratory of Biophysics.
Mailing address is Turku Centre for Biotechnology, Tykistökatu 6A, 5th floor, 20520 Turku. Please book a meeting by email (bima-office@bioimaging.fi) to ensure that the coordinators are available.

1.3 The Academic neighbourhood

Åbo Akademi University is located in Åbo (Turku in Finnish), the oldest city in Finland, close to the medieval Cathedral and the University of Turku. The Bioscience subjects operate in the Biocity-building, on the street Artillerigatan (Tykistökatu in Finnish), which is a bit further away from the other University buildings. You can find a map over the campus at the following address:

<http://www.abo.fi/public/en/media/2141/campuskartaengelska.pdf>

2 Studies

2.1 Academic year

The academic year is divided into four periods, two during the autumn and two during the spring. These are the dates for the periods for the academic year 2016-2017:

Period I	weeks 36-43	5.9.2016-28.10.2016
Period II	weeks 44-51	31.10.2016-23.12.2016
Period III	weeks 2-11	9.1.2017-17.3.2017
Period IV	weeks 12-21	20.3.2017-26.5.2017

2.2 Registration for the academic year

New students register for their first academic year according to these instructions (*please read the instructions carefully!*) www.abo.fi > Studies > Information for new students:

<http://www.abo.fi/student/en/infofornystud#document3>

In order to be registered as present and have the right to study, receive credits and have your study results registered, you must pay the Student Union fee. The Student Union fee for the academic year **2016-2017 is 116 €**. After registration you should order your student card at www.myfrank.fi/en

2.3 MinPlan

MinPlan is used to make individual study plans and for registering for courses and exams. MinPlan also contains information about all courses. MinPlan is found at <http://www.abo.fi/minplan>.

2.4 Course registration

Course registration at Åbo Akademi University

Course registration is usually required. In these cases registration is done in MinPlan: <http://www.abo.fi/minplan> (ÅA courses). Instructions for course registration are found at the following address: <https://www.abo.fi/student/en/minplanmanualer>. Sometimes registration is done on a registration list found on a notice board. Always check well in advance if registration is required and how it is done.

Course registration at the University of Turku

Course registration might be required. In these cases registration is done in a Virtual Study Register called Nettiopsu: <https://nettiopsu.utu.fi>. More information about Nettiopsu can be found: <https://intranet.utu.fi/en/unit/student-services/systems/Students/Pages/Course-Registration-in-Nettiopsu.aspx>. Accessing these pages requires that the student has a valid user ID issued by the University of Turku Computing Centre.

2.5 Examinations

Examinations at Åbo Akademi University

The general exams take place on Fridays. Students should register for the general exams at least eight days in advance. The registration is done in MinPlan: <http://www.abo.fi/minplan>. Instructions concerning registration for examinations are found at the following address: <https://www.abo.fi/student/en/minplanmanualer>.

In addition to the general exams there are usually one or more course exams arranged at the end of each course. The course exams usually do not require registration in MinPlan. Always check if registration is needed in advance.

Please Note! The registration procedure can vary at different Departments, subjects and courses - you can always check with the teacher or the department secretary.

There are only three opportunities to take an exam in the same course, after that the course lecturer should be contacted and the matter discussed. Registering for an exam counts as one of these three times even if the student does not show up at the actual exam occasion.

Students are usually not allowed to bring the course material with them to the exams, so always check with the course lecturer what material is allowed in each exam. Coats, bags, mobile phones etc. should be left outside the exam room or at the back of the room. If requested by the exam supervisor, students should be prepared to show proof of identification, e.g. a student card.

The results of the ÅAU courses are registered in Åbo Akademi's study register (STURE). If several weeks have passed since the course finished but the result is still not in the register, contact the lecturer of the course.

The general exams can be taken in the same academic year as the course is completed, but also in the following academic year.

Please acquaint yourself with the rules and regulations for examination at Åbo Akademi University. The Åbo Akademi University Examination and Assessment Instructions are found here: <http://www.abo.fi/student/en/regler>

Examinations at the University of Turku

The first course exam is arranged at the end of the course. The course exams do not necessarily require registration. In addition to the course exams there should be 3 general exams arranged for each course every academic year. For general exams, the student should register for the exam.

Please find the examination dates either through NettiOpsu or from the responsible course teacher. Registration for exams held on general examination days of the Faculty of Medicine should also be done through NettiOpsu: <https://nettiopsu.utu.fi/>

Manuals on exam registration can be found at:

<https://intranet.utu.fi/en/unit/student-services/systems/Students/Pages/Exam-Registration-in-Nettiopsu.aspx>

2.6 Flexible study right - JOOPAS: studies at the University of Turku

Åbo Akademi University has an agreement of flexible study right with the University of Turku. According to this agreement students from Åbo Akademi University can take courses that are offered by the University of Turku.

The student sends in an electronic application for flexible study right which has to be approved by Åbo Akademi University as well as by the University of Turku. The application is found at <http://www.joopas.fi> (→ Joopas Application System). Without this application the student does not have the right to study at the University of Turku and will not get the credits registered. With an approved application you will obtain an ÅAU student number and user name.

Credits (study points) from the University of Turku are not transferred automatically to Åbo Akademi University. *The student must get a study transcript from the University of Turku and bring it to the Study Advisor, who will see to it that the study achievements are transferred into the study record at Åbo Akademi University. Please transfer your studies from UTU to ÅAU before January 31 every year. This will allow you to follow your progress and the department also does statistics and obtains funding based on your progress.*

2.7 Certificates and study transcripts

Certificates and copies regarding study achievements and other study related issues can be obtained from the Faculty office in the Axelia-building, 3rd floor (Biskopsgatan 8) or from the Student office of Åbo Akademi University in the Gripen-building, ground floor (Tavastgatan 13). An unofficial transcript can be requested on the Internet at the following address: <http://www.abo.fi/stodenhet/sv/minsture>

Study achievements from other Universities (e.g. the University of Turku) are not transferred automatically to Åbo Akademi University. The student must get a study transcript from the other university and bring it to the Study Advisor, who will see to it that the study achievements are transferred into the study record at Åbo Akademi University. Please transfer your studies each year in January before January 31.

For information about graduation and diplomas see chapter 4.3

3 Services

3.1 Computers, printers and copying machines

The computers in the computer classes located in the University buildings are available for all the students studying at Åbo Akademi University.

A username, password and a license to use the computers are needed. These can be obtained from the Help Desk at the Computing Centre (Datacentralen), Fänriksgatan 3, 20500 Åbo. With the password it is possible to log on to all of the public computers located in any of the University's computer classes. The following page lists all available computer classes: <http://www.abo.fi/stodenhet/en/klasser>. Always remember to log off after use, so that no one else can use your computer domain.

Students can print about 360 pages for free in a six-month period. If this amount is exceeded the student will pay for the pages printed (3.3 cents per page). An invoice is then sent to the student by e-mail.

Copying machines are available in the university buildings. More information about printing and copying can be found at: <http://www.abo.fi/stodenhet/en/utskrifter>

3.2 Libraries

To be able to borrow from the libraries students need to have a library card which they will receive at the library. Student cards (studiekort) that were issued before the autumn semester 2013 can also be used as library cards. The loan time for books is usually 2–4 weeks. More information is found at <http://www.abo.fi/bibliotek/en>

Library books in Bioscience subjects can be found at different departments in the Biocity-building. Books in biochemistry are on the 2nd floor/Biochemistry, on a shelf next to the kitchen. Books in pharmacy are on the 2nd floor/Pharmacy, in the auditorium. Books in cellbiology are on the 1st floor/Cellbiology, near the printing machine in the entrance hall. Books in environmental biology are on the 1st floor/Environmental biology, in the seminar room. Next to all of these book collections there is a form that you can fill in and drop in the box next to it. This is how you borrow books. The lending time is 4 weeks. The books can be returned to a box on the ground floor at Aulapalvelu or at any of the libraries at ÅAU.

The reference books (that you may not borrow, but can read and copy) are always marked REF. The reference books in biology are found in the Dendriticum coffee room (1st floor), the other reference books are found with their collections mentioned here above.

The main library of Åbo Akademi is located in Domkyrkogatan 2-4, 20500 Åbo, telephone (02) 215 4180, e-mail: biblioteket@abo.fi. The main library offers reading facilities and a reference library. Certain books can also be borrowed, but have to be reserved in advance.

The student library, Fänriksgatan 3 A, 20500 Åbo, telephone (02) 215 4192, offers course books, which can be borrowed on site, and reading facilities.

3.3 Career Services

The Career Services at Åbo Akademi University (*Arbetsforum*) are located in the Hanken-building, Henriksgatan 7, 20500 Åbo. They provide information for both graduates and students. Their main task is to help students enter the labour market and to give advice on issues dealing with job-hunting. The Career Services offer employers direct access to highly skilled students and graduates. They work in close co-operation with the Career Services at the University of Turku and the Turku Employment Office. More information can be found at <http://www.abo.fi/stodenhet/en/arbetsforum>.

3.4 Student tutor and teacher tutor

All first-year students are assigned a student tutor and a teacher tutor. The student tutor is an older student who helps the new students adapt to student life in Åbo whereas the teacher tutor gives advice in study-related matters. Student tutors (academic year 2016-2017) for students admitted to the programme at Åbo Akademi University will be Kalpana Parajuli kparajul@abo.fi and Mahyae Rastgoo mrastgoo@abo.fi. Teacher tutor for students admitted to the programme at Åbo Akademi University is Lector Diana Toivola (diana.toivola@abo.fi).

3.5 Student activities

All students at Åbo Akademi University are required to be members of the Student Union (*Åbo Akademis Studentkår*), <https://www.abo.fi/karen>, which takes care of its members' interests in several ways. The annual membership fee of the Student Union is 116 € for the Academic year 2016-2017. By being a member you receive a student card which you can use to obtain student discounts for trains, buses, hostels, students' restaurants, theatres etc. As a member, you are also entitled to use the services of the Student Health Care Centre (*Studenthälsan*) http://www.yths.fi/en/contact_details/units/turku at Kyrkovägen 13, 20540 Åbo.

4 Master's degree programme in Biomedical Imaging

4.1 Structure of the studies

The Master's Degree Programme in Biomedical Imaging has a duration of two academic years and accounts for 120 cr. This means that the student should complete 60 cr each academic year. In addition, students accepted to the programme may be required to compensate courses, depending on their background, with complementary studies (max. 60 ECTS). These additional studies are not included in the Master's degree. The aim of these studies is to bring everyone to approximately compatible skills in terms of their background in biosciences and other topics that are relevant for the area.

The structure of the programme and the courses are available in MinPlan, <http://www.abo.fi/minplan>. The student is required to make his or her own study plan using MinPlan. Furthermore, the registration for courses offered by Åbo Akademi University (if registration is required) and the registration for exams at Åbo Akademi University are done in MinPlan.

The Master of Science degree in the Master's Degree Programme in Biomedical Imaging has the following structure:

Major subject studies in Biomedical imaging, mandatory courses 46 ECTS	
Master's thesis in Biomedical imaging 45 ECTS thesis plan, seminar and practical laboratory part (25 ECTS) written thesis (20 ECTS)	
Selectable studies on different thematic areas and special themes 26 ECTS	Language studies 3 ECTS

4.1.1 Major subject studies in Biomedical imaging, 46 ECTS

These studies consist of mandatory courses of biology, physics, engineering, microscopic applications, image processing, multimedia and ethics. They aim to give the student the required basic knowledge in the field of biomedical imaging. See the details below in the curriculum and annex.

4.1.2 Master's Thesis in Biomedical Imaging, 45 ECTS

The Master's Thesis accounts for 45 ECTS and it is composed of two parts: 1) thesis plan, seminar and practical laboratory part (25 ECTS) and 2) written thesis (20 ECTS). It is recommended that the thesis is written in the last year of study, i.e. during the second academic year. Contact Lecturer Diana Toivola (ÅAU) or professor Pekka Hänninen (UTU) to discuss a possible topic for the thesis.

The guidebook for writing the Master's thesis is found here:

<http://www.abo.fi/fakultet/en/biovetstudyinfo>

Specialization at Thesis Level in one of the four topics (Main Examiner/Professor):

- Light microscopy imaging (Kid Törnquist)
- In vivo & Clinical Imaging (Anne Roivainen)
- Imaging in Nanotechnology and Material Sciences (Jessica Rosenholm)
- Microscopy techniques and instrument design (Pekka Hänninen)

4.1.3 Selectable studies on different thematic areas and special themes, 26 ECTS

These studies consist of selectable courses giving a cutting-edge insight into different fields of bioimaging and imaging-related applications. The students may design their selectable advanced studies depending on their preferences. The courses are offered by Åbo Akademi University (ÅAU), University of Turku (UTU), Turku PET Centre, Turku Center for Disease Modeling (TCDM), Turku Centre for Biotechnology (BTK) and Turku Postgraduate School of Health Sciences (PGS). See below in Annex.

4.1.4 Mandatory English language studies, 3 ECTS

A course in Academic Skills in English for Masters Students I (3 ECTS) is mandatory for the students studying in the programme. Language courses are offered by the Centre for Language and Communication (*språkcentret*), www.abo.fi/stodenhet/en/cskenglish

923800.0	Academic writing skills in English for masters students	3 ECTS
----------	---	--------

Course structure for studies in Biomedical imaging

MANDATORY COURSES		94 ECTS
<i>Course code and Title</i>		<i>Credits</i>
<u>Major subject studies</u>		<u>91 ECTS</u>
Complementary courses depending on the previous studies		5 ECTS
221006.0	Introduction to Cell Biology ÅAU	3 ECTS
221008.0	Laboratory Basics ÅAU	2 ECTS
AND/OR		
232017.0	Introduction to Biophysics ÅAU	5 ECTS
ANAT5101	Physical Basis of Medical Imaging UTU	4 ECTS
ANAT5103	Biomedical Instrumentation UTU	5 ECTS
ANAT5105	Fluorescence in Bioanalytical Research UTU	4 ECTS
BIMA2101	Digital Image Processing I, UTU/ÅA	5 ECTS
BIMA2102	Presenting Science by Means of Multimedia UTU/ÅA	10 ECTS
222052.0	Bioimaging and microscopy, ÅAU	5 ECTS
BIMA2104	Nanosopic Imaging in Biomedical research, UTU	2 ECTS
BIMA2105	Biomedical Ethics UTU	1 ECTS
BKEM1012	Bionanoscience, UTU	3 ECTS
BIMA2103	Mandatory participation in seminar series (20h) and writing a seminar diary	2 ECTS
	<ul style="list-style-type: none"> - BioCity Turku seminars (FoS seminars) - Seminar series of Turku BioImaging - PET Monday Seminars and PET Basics I and II seminars - TCDM Seminar program - CoE seminar program - Other seminar series 	
Master's Thesis		45 ECTS
220096.0	Thesis plan, seminar and practical laboratory work	25 ECTS
220097.0	Writing the Master's thesis	20 ECTS
<i>Also a possibility to international internships as a part of the Master's thesis</i>		
Specialization at Thesis Level in one of four topics major themes		
	<ul style="list-style-type: none"> - Light Microscopy Imaging - In vivo & Clinical Imaging - Imaging in Nanotechnology and Material Sciences - Microscopy Techniques and Instrument Design 	
<u>Mandatory Language Studies</u>		<u>3 ECTS</u>
923800.0	Academic writing skills in English for masters students	3 ECTS

SELECTABLE COURSES**26 ECTS***Course code and Title**Credits***Advanced cell biology**

283007.0	Cell signaling ÅAU	10 ECTS
223068.0	Structure and function of the cytoskeleton ÅAU	10 ECTS
222054.0	Histology and histopathology, ÅAU	5 ECTS

Advanced microscopy and imaging techniques

223038.0	Advanced Microscopy I ÅAU	5 ECTS
----------	---------------------------	--------

Laboratory animal models and in vivo imaging techniques

PGS1024	Competence on use and care of laboratory animals UTU	6 ECTS
TCDM3101	Practical training in <i>in vivo</i> imaging techniques UTU	4 ECTS

Biophysics

233004.0	Electronic properties of organic materials ÅAU	10 ECTS
233035.0	Biophysics ÅAU	10 ECTS
ANAT5102	Medical Imaging Project Work UTU	5 ECTS

Information technology and image processing

BIOI2250	Introduction to programming UTU	6 ECTS
BIOI2290	Math and CS for bioinformatics UTU	3 ECTS
TKO_2082	Introduction to Information Technology I UTU	2 ECTS
TKO_2083	Introduction to Information technology II UTU	3 ECTS
TKO_5094	Basics of Digital Image Processing UTU	5 ECTS
TKO_5109	Basics of Digital Video Processing UTU	5 ECTS
TKO_2011	Data Structure and Algorithms UTU	5 ECTS
TKO_5436	Multimedia databases UTU	5 ECTS
TKO_5110	Web programming UTU	5 ECTS
BIOI4290	Tools for intelligent Data Analysis UTU	4 ECTS
TKO_5437	Data mining UTU	5 ECTS
BIMA2108	Digital Image processing II ÅAU	4 ECTS

Mathematics

MATE5258	Image and Video Compression UTU	10 ECTS
SMAT5216	Modelling Project UTU	10 ECTS
MATE5275	Scientific Computing UTU	4 ECTS
MATE5276	Scientific Computing 2 UTU	4 ECTS

Nanotechnology

263115.1	Technical Surface and Colloid Chemistry ÅAU	3 ECTS
263104.0	Colloidal Sol-Gel Processing of Nanomaterials ÅAU	5 ECTS
263121.0	Nanomaterials in Energy Technology ÅAU	5 ECTS

Drug Development

FALL4067	Drug Target Identification and Validation UTU	5 ECTS
FYGE3209	Genetics, methods and models in drug development UTU	3 ECTS
213017.0	Computer aided drug design ÅAU	4 ECTS
212021.0	Structural biology ÅAU	5 ECTS

Other

223094.0	Laboratory internship to learn basic research methods	5-15 ECTS
222056.0	on biology and/or physics UTU/ÅAU	
130023.1	Visuality and visualization of information ÅAU	5 ECTS
130000.0	Image Perception and Cognition ÅAU	5 ECTS

SPECIAL THEMES

Courses given upon interest/by visiting lecturers/by graduate schools.
Not available every year.

Course code and Title	Credits
<u>Flow cytometry</u>	
BIMA3103 Flow-cytometry basics	2 ECTS
BIMA3104 Laboratory course on flow-cytometry	2 ECTS
<u>PET Imaging</u>	
PETC2101 PET Basics	2 ECTS
PETC3101 International PET symposium	
PETC3102 International courses on advanced PET imaging	
<u>Statistics</u>	
TILM3533 Introduction to statistics in experimental research	2 ECTS
<u>Neuroscience study program</u>	
PSKT2001 Invitation to neuroscience	5 ECTS
PSKTXXX Neurology	5 ECTS
PSKTXXX Cognitive neuroscience	5 ECTS
PSKTXXX Neuropharmacology	5 ECTS
 BIMAXXXX International laboratory courses and visits	 x ECTS

MSc Degree Programme in Biomedical Imaging – recommended schedule for studies, academic years 2016-2018

1. study year	Autumn 2016	<p>Complementary studies depending on student's background 221006.0 Introduction to Cell Biology 3 ECTS 221008.0 Laboratory Basics 2 ECTS AND/OR 232017.0 Introduction to Biophysics 5 ECTS</p> <p>Major subject studies in Biomedical Imaging, mandatory courses BIMA2105 Biomedical Ethics 1 ECTS ANAT5105 Fluorescence in Bioanalytical Research 4 ECTS 222052.0 Bioimaging and microscopy 5 ECTS BIMA2101 Digital Image Processing I 5 ECTS ANAT5103 Biomedical Instrumentation 5 ECTS BIMA2103 Mandatory participation in seminar series 2 ECTS</p> <p>Mandatory Language Studies 923800.0 Academic writing skills in English for masters students 3 ECTS</p>
	Spring 2017	<p>Major subject studies in Biomedical Imaging, mandatory courses (continues) BIMA2100 Presenting Science by means of multimedia 10 ECTS ANAT5101 Physical Basis of Medical Imaging 4 ECTS BIMA2104 Nanoscopic Imaging in Biomedical Research 2 ECTS BKEM1012 Bionanoscience 3 ECTS ANAT5103 Biomedical Instrumentation 5 ECTS (continues) BIMA2103 Mandatory participation in seminar series 2 ECTS (continues)</p> <p>Selectable/elective studies</p>

2. study year	Autumn 2017	Selectable/elective studies (continues) Optional Language studies KIFF0003 Finnish for Foreigners, Intensive Beginners Course, 5 ECTS Master's Thesis in Biomedical Imaging (thesis plan + seminar), 45 ECTS
	Spring 2018	Master's Thesis in Biomedical Imaging (continues) Selectable/elective studies (continues)

4.2 General information about the studies

General information about the studies at Åbo Akademi University can be found in this Study guidebook, the Teaching Programme (*Undervisningsprogram*), MinPlan and the Biomedical Imaging web pages.

The Teaching Programme

The Teaching Programme (*Undervisningsprogram*) gives information about all the courses offered by Åbo Akademi University, i.e. lecture dates, times and places as well as information about exam dates for the courses offered by the different departments. The Teaching Programme (only in Swedish) can be found at <https://www.abo.fi/student/undervisningsprogram>

Detailed information on courses (lecture dates and times, calendar) is found here:

<http://www.bioimaging.fi/program/courses/>

Biomedical Imaging web pages

The Biomedical Imaging web pages give general information about the Master's Degree Programme in Biomedical Imaging and also contain study information and guides, e.g. information about the structure of the studies, course descriptions and information about lecture dates and times. Please visit the pages at www.abo.fi/bioimaging. You can also e-mail the coordinator of the programme: bima-office@bioimaging.fi. A common platform for BIMA information such as collection of instructions and forms can be found on the UTU Moodle (<https://moodle.utu.fi/?lang=en>), look for the course "Biomedical imaging Program (BIMA)". You can login here with your ÅAU log in by choosing Åbo Akademi University as your home university under the haka-login.

4.3 Graduation and diploma

In order to graduate, all studies including the thesis have to be noted in the study register.

When your courses are completed and your thesis is sent to the Centre for Language and Communication for language check you can apply for your Master's degree certificate. Fill in the application for certificate form found here http://www.abo.fi/fakultet/en/fnt_slutskedet and bring/send it to the Study Advisor at the Faculty office in Axelia, 3rd floor.

When the thesis (including an English abstract of 2500 characters) is completed and approved by the supervisor it is sent to the Centre for Language and Communication (*språkcentret*) for a language check. A part of the thesis (10 000 characters chosen by the language checker) or the abstract works as a proficiency test.

All examination theses should go through a **check for plagiarism**, by a plagiarism detection software "Urkund". This check is done before the thesis is sent to the Centre for Language and Communication for language check. Information on how to get your thesis checked for plagiarism is found here:

https://www.abo.fi/student/en/etik_plagiat

When the language check for the thesis and the Proficiency test have been approved, the student brings **two hardback copies** of the thesis to the Faculty Office in Axelia. The thesis will then be officially approved by the Dean. After this approval the thesis will be registered in the study register.

Information about the timetables of the language checking is found here:

<http://www.abo.fi/stodenhet/en/csklanguagecheck#document2>

Certificates are issued approximately once a month during the period September-June.

More information about graduating and getting the diploma is found here:

http://www.abo.fi/fakultet/en/fnt_slutskedet

Grading of the Master's thesis

All faculties use the same mode of assessment for evaluating the thesis. The assessment of the Master's thesis evaluation is based on a latin grading scale where Laudatur is the best grade.

Laudatur

Eximia cum laude approbatur

Magna cum laude approbatur

Cum laude approbatur

Non sine laude approbatur

Lubenter approbatur

Approbatur

Course grading

Courses are assessed according to the following scale:

Finnish grading scale Qualitative definition

5	excellent
4	very good
3	good
2	satisfactory
1	sufficient
0	fail

Annex: Course descriptions

Mandatory courses

ÅA_1901 (ÅA course code 221006.0) Introduction to Cell Biology 3 ECTS

Subject: Cell Biology

Persons in Charge: Substitute of John Eriksson

Objectives: To provide the basics of evolution, structure, and function of cells.

Content: The course will introduce the ultra-structure of the cell, the cellular organelles, the relationship between structure and function, the basics of cellular metabolism, the basics of cell signaling. The course will also describe the principles of cell division and differentiation.

Modes of Study: Lectures, demonstrations, exam

Evaluation:

Previous Studies: -

Recommended Year of Study: 1. Year, period I.

Study Materials:

ÅA_1902 (ÅA course code 221008.0) Laboratory Basics 2 ECTS

Subject: Cell Biology

Persons in Charge: Diana Toivola

Objectives: The course is a bridging course for students in MSc programme in Biomedical imaging. The course will teach students basic laboratory techniques, including pipetting, weighing, pH measurements and good laboratory practice. Students will also learn basic laboratory safety issues.

Content:

Modes of Study: Lectures, demonstrations, laboratory work. The course will have exam(s), and reports on the laboratory work.

Evaluation:

Previous Studies: BSc in bio-field and accepted to the MSc programme in biomedical imaging

Recommended Year of Study: 1. Year, period I.

Study Materials:

ÅA_1903 (ÅA course code 232017.0) Introduction to Biophysics 5 ECTS

Subject: Biophysics

Persons in Charge: Harri Aarnio, Ronald Österbacka, Joakim Slotte

Objectives: To teach physics foundations, especially applications in the biophysical sciences.

Content: Energy, wave motion, electric phenomena, radiation, interaction of photons and molecules.

Modes of Study: Lectures (34h), exercises (12h) (50% of given exercises must be solved), exam

Evaluation:

Previous Studies: -

Recommended Year of Study: 1. Year, period I

Study Materials:

ANAT5101 Physical Basis of Medical Imaging 4 ECTS

Persons in Charge: Mika Teräs, Pekka Hänninen

Objectives: Starting from the physical principles of clinical and pre-clinical imaging, the students are introduced to various imaging modalities available at the Turku University Hospital and at the Turku Center for Disease Modelling. Along with the lectures, demonstrations will be arranged to give students a closer look at a functioning medical imaging center.

Content: Atomic and Nuclear Physics and Radiation Protection, X-Ray radiography, Tomography, Gamma imaging, MRI, Ultrasound imaging, PET-imaging

Modes of Study: Lectures, demonstrations, written exam

Evaluation: 1-5

Recommended Year of Study: 1. Year, period III-IV

Study Materials: Chris Guy "Introduction to the Principles of Medical Imaging", Imperial College Press

ANAT5103 Biomedical Instrumentation 5 ECTS

Persons in Charge: Pekka Hänninen, Sami Koho

Objectives: The students are introduced to the physical basics of the different instrumental and physical measurement tools and methods in biosciences. The goal is to build a basis in understanding of the function of different instrumental methods and their use in biosciences. Some examples of instrumental implementations are given.

Content: Biomedical instrumentation and physical measurement tools and methods in biosciences

Modes of Study: Lectures, demonstrations, written exam

Evaluation: 1-5

Recommended Year of Study: 1. Year, period III-IV

Study Materials: Lecture handout

ANAT5105 Fluorescence in Bioanalytical Research 4 ECTS

Persons in Charge: Pekka Hänninen, Elnaz Fazeli

Objectives: Starting from the basics of fluorescence the students are familiarized with fluorescence measurement techniques, instrumentation, related chemistry and biochemistry and applications of fluorescence in bioanalytical research.

Content: Fluorescence basics, Instrumentation and optical components, Spectroscopy, Light detectors and light sources, Labels and label chemistry, Fluorescence applications: FRET, FCS, FRAP, microscopy, cytometry, immunoassays.

Modes of Study: Lectures, written essay.

Evaluation: 1-5

Recommended Year of Study: 1. Year, period I-II.

Previous studies: ANAT5103

Study Materials: Joseph R. Lakowicz "Principles of Fluorescence Spectroscopy" (Kluwer Academic/Plenum Publishers)

BIMA2101 Digital Image Processing 5 ECTS

Persons in Charge: Pekka Hänninen, Sami Koho, Pasi Kankaanpää

Content: Methods for digital image processing (principles of digital images, formats, editing, modifications), Kernel methods, Segmenting, Particle tracking.

Modes of Study: Lectures, demonstrations, exercises.

Evaluation: 1-5

Recommended Year of Study: 1. Year, period II

Previous studies:

Study Materials: Lecture handout, Gonzalez & Woods: Digital Image Processing, 3rd edition, 2008 (Prentice Hall)

ÅA_0431 Presenting science by means of multimedia 10 ECTS

Persons in Charge: Jonas Mastosalo, Anders Wik (Vaasa MediaCity)

Objectives: To familiarize the students with the basics of multimedia editing. To give the students the required media skills to be able to create coordinated video material from their scientific field of expertise.

Content:

Basics about making videos with Windows MovieMaker and FinalCutPro. Concept and terminology, media forms, brainstorming, evaluating the idea, storyboard, editing with FCP

Modes of Study: Lectures, demonstrations, hands-on-training

Evaluation: 1-5

Recommended Year of Study: 1. Year, period III-IV

Previous studies: -

Study Materials:

BIMA2104 Nanoscopic Imaging in Biomedical Research 2 ECTS

Persons in Charge: Lauri Pelliniemi

Objectives: Familiarize with electron microscopy techniques and applications

Content: You will learn methods for imaging nanostructures in biomedical and biomaterial research using transmission electron microscopy, scanning transmission electron microscopy, and scanning electron microscopy. Special emphasis is on principles of electron optics, image formation, planning of experiment, specimen preparation, image recording, interpretation, and reporting of the results.

Modes of Study: 12 hours lectures (6x 2h), elective practical hands-on project.

Evaluation:

Recommended Year of Study: 1. Year, period III.

Previous studies: -

Study Materials: Lecture handouts

222052.0 Bioimaging and microscopy 5 ECTS

Persons in Charge: Diana Toivola

Objectives: Obtain an overview of modern bioimaging techniques. Learn theoretical and practical light microscopy. Obtain knowledge of the history and development of microscopes, and get an overview of modern imaging techniques. Learn microscope parts, optics, light, light paths and fluorescence. Learn common staining and sectioning techniques. Learn the theory and practice of Köhler-illumination and basics of microphotography and digital image handling.

Content: Theoretical and practical knowledge in light microscopy. This includes knowledge in the development of modern microscopy, the parts of a microscope, optics and illumination pathways, staining techniques and Köhler illumination.

Modes of Study: Lectures, demonstrations, microscopy exercises, posters and poster presentations, quizzes, selfstudies.

Evaluation: By Exam and poster presentation, 1-5

Recommended Year of Study: 1. Year, period II

Previous studies: BSc in bio-field and accepted to master's programme in biomedical imaging. This course is meant for the students in the Master's Programme Biomedical Imaging. The students are enrolled at ÅAU or at TY. Other students may also participate if space allows.

Study Materials: Compendium and new book to be defined.

BIMA2105 Biomedical Ethics 1 ECTS

Persons in Charge: Veikko Launis

Objectives:

Content: Principles of Biomedical Ethics, Risk and Uncertainty in Modern Bioethics, Natural and Unnatural in Biomedicine, Case studies

Modes of Study: Lectures 8h (4x 2h), mini essays

Evaluation:

Previous Studies: -

Recommended Year of Study: 1. Year, period I

Study Materials: Lectures

BKEM1012 Bionanoscience 3 ECTS

Persons in Charge: Jyrki Heino

Objectives: To learn the basics of nanoscience and nanotechnology, with special reference to facts relevant to life science. To understand the opportunities, challenges and putative hazards of nanotechnology.

Content: The lectures cover the basic ideas behind nanoscience and nanotechnology. There is a special focus on the cellular nanomachines, the chemistry of nanoparticles, and the use of nanotechnology in medicine, diagnostics, materials science and imaging (e.g. electron microscopy and atomic force microscopy).

Modes of Study: Lectures. Several lecturers. Written exam.

Evaluation: Accepted / failed. The examination contains several short questions.

Previous Studies: -

Recommended Year of Study: 1./2. Year, period III

Study Materials: The lectures and extra material will be in the Workmates.

BIMA2103 Mandatory participation in seminar series (20h) + writing a seminar diary 2 ECTS

o BioCity Turku seminars <http://www.biocity.turku.fi/>

o Frontiers of Science (FOS) seminars <http://www.biocity.turku.fi/scientific-events/frontiers-of-science-seminars/o> Seminar series of Turku Bioimaging <http://www.bioimaging.fi/courses.htm>

o PET Monday Seminars http://www.pet.fi/index.php?option=com_content&view=article&id=59&Itemid=41&lang=en

o TCDM Seminar program <http://www.tcdm.fi/?id=seminarseries&pm=main|education>

o

o Lost in Imaging <http://www.btk.fi/cell-imaging/lost-in-imaging/>

o Other seminar series <http://www.biocity.turku.fi/index.php?id=860>

903840.0 Academic skills in English for Masters Students I 3 ECTS

Persons in Charge: Colette Gattoni, Tom Björkfors

General description: This course is open to international students who are writing, or will write, their masters thesis in English in Åbo Akademi University in the near future

Objectives: At the end of the course the learners are expected to be able to:

- evaluate and analyse a wide range of authentic academic texts
- locate, evaluate and make use of a wide range of authentic academic skills literature on the web and from other sources
- present and explain aspects of their own work both in oral and written form
- respond orally and in written form to authentic academic texts according to the conventions of academic discourse
- better cope with the demands of research in an international environment.

Contents: Analysis of appropriate academic literature provided by the teacher, together with articles brought by the participants from their own field for structural and linguistic analysis. Development and improvement of the language and structure of participants' own texts in English.

Modes of study: Continuous assessment including a successful presentation, active seminar participation and full attendance are required. Completion of all homework tasks and submission of a piece of recent academic work.

Evaluation and evaluation criteria: Grades will be given on successful completion of course.

Previous studies:

Recommended Year of Study: 1.year, period I

Study materials: Suggested self-study material:

Jordan R.R "Academic Writing Course: Study Skills in English" (1999) Harlow: Pearson Education (available in the course book library in ASA). Additional appropriate authentic materials, provided by the teacher and participants themselves.

Selectable courses

Courses given by Åbo Akademi

ÅA_2380 (223038.0) Advanced microscopy 5 ECTS

Subject: Cell Biology

Persons in Charge: Diana Toivola

Objectives & content: Learn basics, usability and differences in advanced microscopy techniques systems related to fluorescence microscopy and light microscopy, such as confocal microscopy, TIRF, AFM, STED, spinning disc microscopy. Acquire hands on skills in confocal microscopy.

Modes of Study: Lectures, laboratory work in groups. Practical training in confocal microscopy.

Evaluation:

Previous Studies: -

Recommended Year of Study: 1./2. Year, period I (weeks 37-43)

Study Materials:

ÅA_3901 (233004.0) Electronic Processes in organic materials ECTS

Subject: Physics

Persons in Charge: Ronald Österbacka

Objectives: To introduce the electronic properties and processes in disordered organic materials. Participants will gain knowledge of the fundamental electronic properties of disordered organic systems such as electronic structure, energy and charge transfer mechanisms, excitation reactions, charge transport, interactions etc.

Content:

Modes of Study: Homework, written work and exams

Previous Studies: -

Recommended Year of Study: 1./2. Year, period I-II

Study Materials:

ÅA_2832 (233035.0) Biophysics 10 ECTS

Subject: Physics

Persons in Charge: Markus Lindberg

Objectives: The purpose of the course is to provide the student an overview of the physical background of biological phenomena from molecular and cellular level up to structural and dynamical properties of biological species. The relevant theoretical methods are presented together with the topics.

Content: Physical properties of atoms and molecules. Physical properties of small and large molecules in biology. Cell membranes and cellular machines. Light harvesting systems. Propagation of neural impulses. Principles of sensory processes and their relation to environment and biological materials. Support structures and motion of biological bodies.

Modes of Study: Lectures, exercises, written exam

Evaluation:

Previous Studies: -

Recommended Year of Study: 1./2. Year, period III-IV

Study Materials:

ÅA_2830 (283007.0) Cell signaling 8 ECTS

Subject: Cell biology

Persons in Charge: Substitute of John Eriksson

Objectives: To provide a good knowledge platform regarding general cell signaling concepts and terminology, to provide state-of-the-art insight into the molecular mechanisms of major signaling platforms, to utilize this knowledge in medical and pharmacological applications. After completion of the course, the students should be able to grasp articles and reports related to basic and applied questions of signaling.

Content: The aim is to first give a general overview of signaling modalities and mechanisms and then to go into more specific questions related to individual signaling mechanisms and pathways. A significant part of the course is problem-based and the students will also participate in a team work related to signaling-targeted drug development.

Modes of Study:

Evaluation:

Previous Studies: -

Recommended Year of Study: 1./2. Year, period II

Study Materials:

ÅA_2831 (223068.0) Structure and function of the cytoskeleton 8 ECTS

Subject: Cell biology

Persons in Charge: Substitute of John Eriksson

Objectives: To provide a thorough insight to different aspects of the cytoskeleton.

Content: The course will provide the student with detailed characteristics of the different cytoskeletal systems, their structure and dynamics, and their role in cellular functions, in signal transduction, and their roles in normal homeostasis, development, and pathologies.

Modes of Study: The course will be arranged as a collaboration between Åbo Akademi Univ., Univ. of Helsinki, and Univ. of Turku. The course is comprised of lectures, seminars, and problem-based learning.

Evaluation:

Previous Studies: -

Recommended Year of Study: 1./2. Year, period III

Study Materials:

222054.0 Histology and histopathology 5 ECTS

Subject: Cell Biology

Persons in Charge: Diana Toivola

Objectives: The aim is to learn the histological structures of tissues and organs using main and selected organs from different animal groups with focus on mouse, rat and human.

Content: After passed course, the students are expected to be able to identify different organs from histological microscope slides. Students are expected to identify basic tissue-types and structures, organ specific structures and understand the relationship between structure and function.

Modes of Study: Lectures, demonstrations, self-studies with microscopes and webmicroscope, moodle. Exam, assignments.

Evaluation: 1-5

Previous Studies: -

Recommended Year of Study: 2. Year, period II/III

Note: in 2015-2016 self-studies (222041.0 Histology 4 ECTS), **course will fully start in 2016-2017 with lectures and hands-on-training.**

ÅA_2901 (130000.0) Image perception and cognition 5 ECTS

Persons in Charge: Matti Laine, Lars Berggren

Objectives:

The aim of the course is to familiarize the students with the basic issues in the structure and function of the human visual system. Special emphasis is put on current research findings in visual neuroscience.

Content:

Following the completion of course, the students are expected to be able to:

- o describe the basic neural structure and function of the human visual system from retina to the visual cortex
- o understand the active nature of human vision and how incoming visual information is compressed in the system
- o describe major behavioral phenomena in spatial and color vision, movement perception, object recognition, and visual attention
- o describe some major higher-order visual deficits that have informed us about the structure and function of visual perception

Modes of Study: reading of the course book, introductory lectures. Final written exam based on the course book.

Evaluation:

Recommended Year of Study: 1. Year, period I.

Previous studies: -

Study Materials: Snowden, Robert & al. 2006 Basic vision: an introduction to visual perception (320p)

ÅA_3906 (130023.1) Visuality and visualization of information 5 ECTS

Subject:

Persons in Charge: Lars Berggren/Fred Andersson

Objectives: The course aims at an historical and interdisciplinary understanding of the emerging field of data visualization, especially as regards medicine and the natural sciences. In the course it is demonstrated how data is transmitted with the aid of different techniques and devices of visualization. It is also shown how certain findings of modern psychology and vision science can be practically applied in order to improve the efficiency and accessibility of visualization. Concepts and notions such as visuality, information, cognition, object recognition and text/image interaction are defined and discussed. The course also includes a basic historical orientation in the history of the scientific image in the West from the Middle ages and onwards.

Content: The student will acquire knowledge of how certain findings of modern psychology and vision science can be practically applied in order to improve the efficiency and accessibility of information visualization. The examination is connected to activities in which students from various disciplines can test their ability to visualize data with which they are familiar. In addition, the student also acquires background knowledge of the historical development of techniques for visualization in the West.

After the course the participants will have acquired skills and cognitive tools that improve their ability to visualize data within their specific disciplines

Modes of Study: Lectures, workshop exercises, learning portfolio

Evaluation:

Previous Studies: Passing the course Image Perception and Cognition (130000.0)

Recommended Year of Study: 1./2. Year

Study Materials:

Courses given by the University of Turku (The student must apply for JOO Flexible Study Right)

TCDM3101 Practical Training in *In vivo* Imaging Techniques 4 ECTS

Persons in Charge: Pirjo Pakarinen

Objectives: To get acquainted with the use of various imaging techniques in preclinical research, e.g. to identify disease pathways, to evaluate drug compounds and monitor their effects on disease, to investigate mechanisms of action in a living animal, and to characterize phenotypic properties of genetically modified animals.

Content: A xenocraft mouse model is exploited as an example of preclinical research projects making use of various imaging and other research methods. The techniques include:

- Optical imaging with fluorescence (*in vivo*)

- MicroPET/CT (*in vivo*)
- MicroCT (*ex vivo*)
- Radiography (*ex vivo*)
- Ultrasound (*in vivo*)
- Echo-MRI (*in vivo*)

Modes of Study: Hands-on training in a project format accompanied by lectures and demonstrations
Note: Mandatory participation in all lectures!

Evaluation: A written project report

Previous studies: Basic theory of imaging methods, animal laboratory course recommended

Recommended Year of Study: 2nd year, period I (The course will be organized once a year)

Study Material: Handouts

FALL4067 Drug Target Identification and Validation 5 ECTS

Persons in Charge: Matti Poutanen, Pirjo Pakarinen, Sanna Soini

Objectives: The main goal of the study module is to introduce the terminology, and bioinformatics resources and tools related to drug target identification and validation. The students should be able to name focal areas of bioinformatics databases in research. IN addition, students understand the principles and use of various *in vivo* disease models and applied methodology.

Content: Biological databases and database searching. Bioinformatics tools in drug development. Theory of evolution. Microchips and data analysis. *In vivo* disease models. Bioinformatics for mouse models. Knockout and transgenic techniques. Xenocrafts and models of chemical carcinogenesis. Preparation of microscopic specimens. Applications of PET imaging.

Modes of Study: Lectures, self-study and demonstrations

Evaluation: Active attendance at lectures and demonstrations. Feedback about the study diaries.

Previous studies: B.Sc. in Health Biosciences or other equivalent qualifications

Recommended Year of Study: 1./2. Year

Study Material: Pre-lecture resources and materials, lectures and self-study and computer-assisted materials

BIMA3116 (223094.0 (10 ECTS) and 222056.0 (5 ECTS)) Laboratory internship

Persons in Charge: Kid Törnquist

Objectives: The goal is that the students will learn different basic methods used in cell biological research or physics/engineering. After this course the students know fundamentally a collection of methods used in cell biological research and/or physics/engineering and can write a scientific report of the conducted work.

Content: Laboratory work, written report, laboratory diary

Modes of Study: Laboratory work conducted in research groups according to the agreement with the research group leader.

Evaluation:

Recommended Year of Study: 1./2.year

Previous studies:

Study Materials:

BIMA2108 Digital Image Processing II 4 ECTS

Persons in Charge: Pasi Kankaanpää

Objectives: Advanced course for digital image analysis, processing and visualization based mainly with the BioImage XD software tool for bioimaging (<http://www.bioimagexd.net/>).

Content: The course consists of the following topics: 3D rendering, 3D time lapse, animations, 3D segmentation, 3D image processing and analysis, co-localization analysis, making pictures for publication, and a case study of conducting 3D/4D visualization and analysis work.

Modes of Study: Lectures, demonstrations, exercises

Evaluation: 1-5

Language: English

Recommended Year of Study: 1/2. Year III-IV

Previous studies: BIMA2101 Digital Image Processing I

Study Materials: Getting Started Guide for BioImageXD

BIMA3103 Flow-cytometry basics 2 ECTS

Persons in Charge: TBI coordinators and CIC

Objectives: During this course, you will learn the basics of flow cytometry

Content: The course consists of one lecture and one demonstration session. The lecture (2h) will cover the theoretical background and most used applications as well as software tools for flow cytometry analysis. During the hands-on session (3h), you will be familiarized with a flow cytometer by setting up the instrument and by acquiring data.

Modes of Study: Lecture and hands on

Evaluation: Pass/Fail

Recommended Year of Study: 1/2. year

Previous studies: -

Study Materials: Hands out

SYST1010 Systems Biology 6 ECTS

Default Level: Advanced Studies

Learning outcomes: Student will have knowledge of basic theories and commonly used methods in systems biology.

Content: Theoretic background and practical applications of transcriptomics, proteomics, epigenomics metabolomics, bioinformatics and related systems biology analyses.

Recommended year of study: 1./2. year period I. Available for students in the Master's Degree Programmes, other Students, doctoral students, exchange students

Modes of study: Lectures, exam

Evaluation: 0-5.

Study materials: Michael Wink edit. (2011): An introduction to Molecular Biotechnology: Fundamentals, Methods, and Applications (Second, Updated Edition), Wiley-Blackwell

BKEM1046 Molecular Biology (part 1/4) 2 ECTS

Default Level: Advanced Studies

Learning outcomes: To deepen the knowledge in Molecular Biology.

Content: The course covers the molecular details and mechanisms of the following topics: Genome structure, chromatin, and the nucleosome; The replication of DNA; The mutability and repair of DNA; Homologous recombination at the molecular level; Site-specific recombination and transposition of DNA; Mechanism of transcription; RNA splicing; Translation; Genetic code; The origin and early evolution of life; Transcriptional regulation in prokaryotes; Transcriptional regulation in eukaryotes; Regulatory RNAs.

Recommended year of study: 1./2. Year, period I. Available for students in the Master's Degree Programmes, other Students, doctoral students, exchange students

Modes of study: Lectures, exam

Evaluation: 0-5. Scale of grading 1-5. To pass through the course one needs to get 50% of the maximum points of each four examinations.

Study materials: Watson J.D., Baker T.A., Bell S.P., Gann A., Levine M & Losick R. (2014) Molecular Biology of the Gene, 7. edition, Pearson International Edition.

PGS1024 Competence on use and care of laboratory animals 6 ECTS

Persons in Charge: Ulla-Marjut Jaakkola

Objectives: This course has 2 main objectives: 1) To comply with both Finnish (62/2006

Act and 36/2006 Decree) and European regulations (Directive 86/609/EEC, Directive 2010/63/EU, and Convention 1986/ETS 123) for the education of persons using animals for experimental or teaching purposes; and 2) To provide introductory knowledge and skills to persons using experimental animals in order to accomplish good experiments and achieve high scientific standards. After successful completion of this course, students will be considered competent to design animal experiments and to undertake animal work on their own.

Content: Theoretical contents (approx. 70%): 1) Introduction, legislation and ethics in animal research; 2) Animal biology, care and genetics; 3) Basic techniques and procedures in laboratory animals; 4) Animal research issues. Practical contents (approx. 30%): hands-on exercises and group work.

Modes of Study: Lectures, exercises, group work, hands-on

Teaching language: English. This course is usually organized every two years in English, and yearly in Finnish.

Evaluation: pass/fail

Recommended Year of Study: 1. year spring

Check updates at http://animalcenter.utu.fi/kek/koulutus/KEK_kurssitarjonta/

Previous studies:

Study Materials: – The COST Manual of Laboratory Animal Care and Use. Refinement, Reduction and Research. B. Howard, T. Nevalainen and G. Perretta (eds.). CRC Press, 2011. Price: approx. 65 EUR. – Handbook of Laboratory Animal Science (3rd Edition), Vol 1, Essential Principles and Practices. Jann Hau and Steven J Schapiro (eds). CRC Press, 2011.

PETC2101 PET Basics Course: 2 ECTS

Persons in Charge: Heikki Minn, Pirjo Nuutila, O. Solin

Content: Introduction to PET and its Clinical Applications

- PET Physics, radiochemistry and preclinical imaging, Introduction to Research & Medical Applications of PET

- PET in research and diagnostics

Positron emission tomography (PET) is non-invasive and quantitative imaging modality using molecules labelled with positron-emitting radioisotopes in tracer quantities (i.e. without pharmacological effect) to visualize and measure rates of biochemical processes (e.g. enzyme reactions, ligand-receptor interactions, cellular metabolism, cell proliferation, gene

expression) in tissues of living subjects. Therefore, PET is an important tool to elucidate mechanisms associated with diseases and drug actions. The course aims to provide students with a broad and general introduction to the PET imaging. The main purpose of this course is to enable students to understand the interdisciplinary nature of PET imaging. After the course one should have basic knowledge of the PET imaging field of its physics, radiochemistry, and data analysis, research and clinical applications.

Modes of Study: Lectures, PET Centre site visits

Evaluation: pass/fail

Recommended Year of Study: 1./2 Year, period IV

Previous studies: -

Study Materials: Lecture handout

Content:

TILM3533 Introduction to statistics in experimental research 2 ECTS

Persons in Charge: Jaakko Nevalainen

Content: This introductory course intended for post graduate students will cover the basic ideas and concepts in designing experiments, sample size calculations as well as statistical analysis and interpretation of experiments. Themes include the analysis of independent and dependent data, and different outcome types (continuous, binary, count or survival). No prior knowledge is required but a basic course in statistics is no doubt helpful. The emphasis of the course will be on important concepts and ideas, and on concrete examples arising from biomedical fields.

Modes of Study: 12 hours of lectures plus assignments

Evaluation:

Recommended Year of Study: 1./2. Year, period IV

Previous studies:

Study Materials:

KIEN3321 Advanced Academic Writing Skills in English 3 ECTS

Persons in Charge: Michael Nelson

Objectives: This course is intended for those who need to write scientific articles for publication in international journals or their doctoral thesis in English. Subjects will include an explanation of the key features of academic writing, the structure of scientific articles, aspects of text linguistics related to writing and common grammar problems. Students also get a chance to have their own work reviewed and checked. Much of the course is internet-based.

Recommended Year of Study: 1./2. Year

<https://nettiopsu.utu.fi/opas/teaching/course.htm?id=172>

<http://users.utu.fi/micnel/advancedacademic.htm>

SUKI1258 Knowledge about Finland 3 ECTS

Persons in Charge: Leena Maria Heikkola

Aim and contents: This course will give students an insight into social, economic and cultural life in Finland. This course will demand an individual or group work with reference books.

Modes of Study: lectures, required reading, essays, classroom presentation and examination.

Recommended Year of Study: 1./2. Year

BIOI2250 Introduction to Programming 6 ECTS

Subject: Bioinformatics

Person in Charge: Erkki Kaila

Objectives: The course targets students with no prior programming experience. The students will acquire basic skills in algorithm design and programming, learning to write simple, practical programs in the Python programming language. The course is not suitable for students who do have prior programming experience and want to learn Python as an additional language.

Content: Fundamental concepts such as variables, values, types, expressions, control structures, data structures, modularity and classes. Model problems and their typical algorithmic solutions with particular focus on bioinformatics.

Teaching Methods: Lectures (40h).

Modes of Study: Exercises, written exam. One half of the exercises time is devoted to in-class programming assignments.

Evaluation: 1-5

Organization Responsible: Turku IT

Previous Studies: -

Recommended Year of Study: 1./2. year, periods I-II

Study Materials: Lecture notes; Python documentation.

BIOI2290 Math and CS for bioinformatics 3 ECTS

Subject: Bioinformatics

Person in Charge: Tapio Salakoski

Objectives: Mastering basics of probability theory (probability, probability axioms, conditional probability, probability density function, cumulative distribution function, expectation, variance, discrete random variable, continuous random variable) and statistics (statistical experiment, descriptive statistics, inference statistics). Ability to calculate with complex numbers and matrices (also determinant, eigenvalues and eigenvectors), and define extremum values of a given function. Capability to analyze and solve differential equations.

Content: Essential math and CS methods with applications to bioinformatics. The course content includes probability theory, statistics, complex numbers, matrices, ordinary differential equations, extremum values.

Modes of Study: Lectures (12h), exercises (8h), participation in classroom work (50% of home exercises must be completed) and Moodle activity (at least 4 participations at the course discussion forum in Moodle), written exam.

Evaluation: 1-5

Organization Responsible: Turku IT

Previous Studies: Supplementary Math and CS Foundations or equivalent.

Recommended Year of Study: 1./2.year, period II

TKO_2082 Introduction to Information Technology I 2 ECTS

Subject: Computer Science

Person in Charge: Jouni Järvinen

Objectives: The course gives an introductory survey of some key fields of computer science. It gives the fundamentals of information encoding, data storage, and computer architecture. Also operating systems and computer networks are discussed.

Content: Data representation and the storage of data within a computer: the types of data that are considered include text, numeric values, images, audio, and video. Computer architecture: how computer are programmed by means of encoded instructions, called machine language instructions. Operating systems: what operating systems do and how they do it. Networking: construction and operation of networks, applications of networks, and security issues.

Teaching Methods: Self-study course. The course is designated only for non-Finnish speaking students of "International Master's Program for Bioimaging".

Modes of Study: Exam

Evaluation: 0-5

Organization Responsible: University of Turku, Department of Information Technology.

Recommended Year of Study: 1./2., period I

Study Material: J. Glenn Brookshear, Computer Science: An Overview (10th Edition), Pearson Education (2009), Chapters 1-4.

TKO_2083 Introduction to Information Technology II 3 ECTS

Subject: Computer Science

Person in Charge: Jouni Järvinen

Objectives: The course is a continuation for the course Introduction to Information Technology I.

It describes the topics of algorithms, programming languages, and software development. Basics of data structures and database systems are also presented.

Content: Algorithms: algorithm, pseudocode, problem solving, iterative structures, recursive structures, efficiency and correctness. Programming languages: variables and data types, constants, statements, control statements, comments, procedural units, object-oriented programming. Software engineering: issues related the development of large and complex software systems are considered. Data structures: some basic data structures and their implementations. Database systems: database fundamentals, relational model, data mining.

Teaching Methods: Self-study course. The course is designated only for non-Finnish speaking students of "International Master's Program for Bioimaging".

Modes of Study: Exam

Evaluation: 0-5

Organization Responsible: University of Turku, Department of Information Technology.

Previous Studies: Introduction to Information Technology I

Recommended Year of Study: 1./2., period II

Study Material: J. Glenn Brookshear, Computer Science: An Overview (10th Edition), Pearson Education (2009), Chapters 5-9.

TKO_5094 Basics of Digital Image Processing 5 ECTS

Subject: Computer Science

Person in Charge: Jukka Teuhola

Objectives: The students learn the main techniques of representing and manipulating digital images, both in theory and in practice.

Content: Imaging and printing technologies, image coding, color systems, image enhancement, various kinds of filters, edge detection, sharpening, spectral analysis, geometric transformations, morphological operations, and image compression. Practical part: introduction to some image editing software, and a related project.

Teaching Methods: Self-study course. The course is designated only for non-Finnish speaking students of "International Master's Program for Bioimaging".

Modes of Study: Project work, written exam.

Evaluation: 1-5

Organization Responsible: Dept. of IT

Previous Studies: Basics of algorithms and programming.

Recommended Year of Study: 1./2. year, period I.

Study Materials: Nick Efford: Digital Image Processing – A Practical Introduction Using Java, Addison-Wesley 2000.

TKO_5109 Basics of Digital Video Processing 5 ECTS

Subject: Computer Science

Person in Charge: Jukka Teuhola

Objectives: The students learn the main technologies and methods of representing, processing, and delivering of digital video.

Content: Analog vs. digital video, video capture, video signals, video+audio, storage systems and formats, cutting, filtering, transitions and effects, keyframing and animation, text and graphics, resizing, de-interlacing, streaming, transfer protocols, compression, and basics of video processing in Java. Practical part: introduction to video editing software, and a related project.

Teaching Methods: Self-study course. The course is designated only for non-Finnish speaking students of "International Master's Program for Bioimaging".

Modes of Study: Project work, written exam.

Evaluation: 1-5

Organization Responsible: Dept. of IT

Previous Studies: Basics of algorithms and programming.

Recommended Year of Study: 1./2. year, period I.

Study Materials: To be announced.

TKO_2011 Data Structures and Algorithms I 5 ECTS

Subject: Computer Science

Person in Charge: Jouni Järvinen

Objectives: The course considers the most essential sorting and selection algorithms. It gives basic tools for the evaluation of the effectiveness of algorithms. The end of the course is devoted to some basic data structures for dynamic collections and directories.

Content: Asymptotic analysis of algorithms, important sorting and selection algorithms. stacks, queues, priority queues, linked lists, hash tables and binary search trees.

Teaching Methods: Self-study course. The course is designated only for non-Finnish speaking students of "International Master's Program for Bioimaging".

Modes of Study: Exam

Evaluation: 0-5

Organization Responsible: University of Turku, Department of Information Technology.

Previous Studies: Basic Course on Algorithms and Programming

Recommended Year of Study: Second/third year

Study Material: Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein: Introduction to Algorithms (3rd Edition), The MIT Press (2009), Chapters 1-12.

TKO_5436 Multimedia Databases 5 ECTS

Subject: Computer Science

Person in Charge: Jukka Teuhola

Objectives: The student learns the storage and indexing structures, as well as retrieval methods of different media types.

Content: Multimedia data types, management of large objects, text and document databases, multidimensional data structures, spatial databases, image databases, video and audio databases, feature extraction, content-based retrieval, and multimedia standards.

Teaching Methods: Lectures (28 h, in English, every second year).

Modes of Study: Written exam.

Evaluation: 1-5

Organization Responsible: Dept. of IT

Previous Studies: Databases I-II, Data Structures and Algorithms I.

Recommended Year of Study: 2. year, period not fixed.

Study Materials: Lecture notes & miscellaneous sources (to be announced).

TKO_5110 Web Programming 5 ECTS

Subject: Computer Science

Persons in Charge: Pentti Riikonen

Objectives: Students learn to use common frameworks and techniques, their weaknesses and strengths. In web programming project students can focus on certain frameworks and thus achieve deeper knowledge on some methods.

Contents: Modern important methods and frameworks in the field. For example XHTML, CSS, JavaScript, DHTML, Ajax, PHP, ASP.NET, Servlet/JSP, Ruby on Rails, Silverlight and Flash.

Modes of study: Self study of books and web material, exercises, exam and web programming project.

Study materials: Literature and course material on the Internet

Teaching Methods: Independent work.

Evaluation: 0-5

Previous studies: Object Oriented Programming

BIOI4290 Tools for Intelligent Data Analysis 4 ECTS

Subject: Bioinformatics

Person in Charge: Pentti Riikonen

Objectives: The course aims at delivering an intuitive understanding of the fundamentals and thus the power and limitations of various methods like Artificial Neural Network, SOM, genetic and evolutionary algorithms, simulated annealing.

Content: Common algorithmic and AI methods used in data analysis in many fields of research, including but not restricted to bio and medical informatics. Different data analysis methods and applications are included.

Teaching Methods: Independent work.

Modes of Study: Exercises, oral exam.

Study Materials: Course material on the Internet.

Period of Teaching: Period IV.

Evaluation: 0-5

TKO_5437 Data mining 5 ECTS

Subject: Computer Science

Person in Charge: Timo Knuutila

Objectives: This course offers a grounding in machine learning concepts as well as practical advice on applying machine learning tools and techniques in real-world data mining situations. You will learn how to prepare inputs, interpret outputs, evaluate results, and the algorithmic methods at the heart of successful data mining, including both tried-and-true techniques of the past and methods at the leading edge of contemporary research.

Content: We first discuss what kind of input a data mining application assumes and what kind of different outputs it may produce. After this, we represent some basic data mining methods and show how the credibility of their results can be evaluated statistically. Basic algorithms are then extended to state-of-the-art real data mining methods. Finally, we discuss the engineering of the input and output.

Teaching methods: Lectures (52 h).

Modes of study: Exam

Study Materials: Literature: Eibe Frank, Ian Witten: Data Mining: Practical Machine Learning Tools and Techniques (Second Edition), Morgan-Kaufmann Publishers, 2005.

Period of Teaching: The course is given irregularly.

Evaluation: 0-5

Previous studies: Introduction to Artificial Intelligence

MATE5258 Image and Video Compression 10 ECTS (Image and Video Compression)

Subject: Mathematics

Objectives: See content

Content: The course introduces the mathematical background of image compression. Different approaches to image compression are discussed and various algorithms are presented and analysed.

Topics include entropy and information, symbol coding, lossless image compression, lossy compression and rate-distortion theory, scalar and vector quantization, image transformations including discrete cosine transform and wavelet transforms, motion estimation and compensation and image and video compression standards.

Previous Studies: Linear algebra

Modes of Study: exercises, midterms or a final exam

Evaluation: 0-5

Teaching Methods: lectures 56 h, exercises 28 h

Period of Teaching: period III-IV