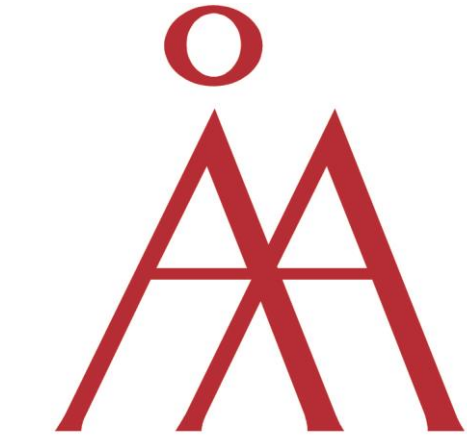

Faculty of Science and Engineering

STUDY GUIDE
2017-2018

MASTER'S PROGRAMME IN BIOMEDICAL IMAGING

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

Contents

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 (Cell Biology, Biochemistry, Environmental and Marine Biology)
Chemical Engineering
Information Technology (Computer Science, Computer Engineering)
Natural Sciences (Mathematics, Physics, Chemistry, Geology)
Pharmacy

The subjects in within Biosciences, which the Master's Degree Programme in Biomedical Imaging is part of, are located in the BioCity-building, Artillerigatan 6, 20520 Åbo. Building Å25 on the campus map:
http://www.abo.fi/public/en/media/2141/campuskartaengelska.pdf.

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 Subjects are appointed by the Dean and have both scientific and administrative responsibilities.

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 Heidi Karlsson is available at the Faculty office by mutual agreement. Telephone (02) 215 3540, e-mail: fnt-utbildningskoordinator@abo.fi

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

Jessica Lindroos, Telephone (02) 215 4517, e-mail: fnt-studieradgivare@abo.fi
Kerstin Fagerström, Telephone (02) 215 3321, e-mail: fnt-studieradgivare@abo.fi
Simon Berg, Telephone (02) 215 4600, e-mail: fnt-studieradgivare@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 coordinators of the Master´s Programme in Biomedical Imaging are Laura Mairinoja and Joanna Pylväinen, 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.

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 2017-2018:

Period I	weeks 36-43	4.9.2017-27.10.2017
Period II	weeks 44-51	30.10.2017-22.12.2017
Period III	weeks 2-11	8.1.2018-16.3.2018
Period IV	weeks 12-21	19.3.2018-25.5.2018

Week 35, 28.8-1.9.2017, is reserved for student orientation for new students.

2.2 Registration for the academic year

New students register for their first academic year according to these instructions (*please read the instructions carefully!*):
http://www.abo.fi/student/infofornyastud/en.

You must pay the Student Union fee in order to be registered as present. By registering as present, you have the right to study, receive credits, have your study results registered, and receive student benefits. The Student Union fee for the academic year **2017-2018 is 116 €.** After you have registered, you should order your student card at www.frank.fi/en. You can also use the free student card app, Frank, which is available for Android and iOS.

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. Log in to MinPlan here: http://www.abo.fi/minplan. You can find tutorials on how to use MinPlan here: https://www.abo.fi/student/en/minplanmanualer.

2.4 Course registration

Course registration at Åbo Akademi University

Course registration is usually required. In most cases registration is done in MinPlan: http://www.abo.fi/minplan. 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 here: 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. In order to get the student ID at the University of Turku the student should first apply for a study right through http://www.joopas.fi.

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. are to 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 examinations are typically given within 10 days after the examinations are taken. 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.

Please note that students at the Master's programme in Biomedical Imaging are automatically assigned a JOO study right at the University of Turku for studies ***within their own field of study (BIMA).*** *You still have to apply for a JOO study right for studies outside of your own field of study.*

To apply for studies outside of the field of study, 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).

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 Faculty Office in Axelia, 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. 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 ordered online 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.

2.8 Plagiarism

Åbo Akademi University takes cheating and plagiarism seriously. Please find more info about correct referencing in http://www.abo.fi/bibliotek/en/bibrefhantering and on the BIMA Moodle page:
https://moodle.utu.fi/mod/page/view.php?id=458286.

All examination theses should go through a check for plagiarism, form more information about this please see chapter 4.3.

You can find more info about plagiarism here:
https://www.abo.fi/student/en/etik_plagiat.

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 ICT Services, 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 400 black-and-white pages for free in a six-month period. If this amount is exceeded the student will pay for the pages printed. Top-up codes for more quota may be bought via Åbo Akademi's webshop: https://shop.abo.fi/c/13-ict-servicens-avgifter/en/, you will have to log on using your ÅA-username). 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

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. Books that can be borrowed from the main library 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.

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.

3.3 Career Services

The Career Services at Åbo Akademi University *(Arbetsforum)* are located in Åhuset, Gezeliusgatan 2A, 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 here:
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 2017-2018) for students admitted to the programme at Åbo Akademi University are Niloofar Hashempour (niloofar.hashempour@abo.fi) and Leon Riehakainen (leon.riehakainen@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*), http://www.studentkaren.fi/en, which takes care of its members' interests in several ways. The membership fee of the Student Union for the Academic year 2017-2018 is 116€. By being a member, you receive a student card that 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*) at Kyrkovägen 13, 20540 Åbo. http://www.yths.fi/en/contact_details/units/turku.

4 Master's degree programme in Biomedical Imaging

The studies at Åbo Akademi are measured in *credits* (shortened cr, studiepoäng/sp in Swedish). These are comparable to ECTS in accordance with the common European system.

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 ECTS. This means that the student should complete 60 ECTS 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:

<table>
<tr><td colspan="2">Major subject studies in Biomedical imaging, mandatory courses: 41 ECTS</td></tr>
<tr><td colspan="2">Master´s thesis in Biomedical imaging: 40 ECTS
Thesis plan, seminar and practical laboratory part (20 ECTS)
Written thesis (20 ECTS)</td></tr>
<tr><td>Selectable studies on different thematic areas and special themes: 36 ECTS</td><td>Mandatory English language studies: 3 ECTS</td></tr>
</table>

4.1.1 Major subject studies in Biomedical imaging (41 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 (40 ECTS)

The Master's Thesis accounts for 40 ECTS and it is composed of two parts: 1) thesis plan, seminar and practical laboratory part (20 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:

- Light microscopy imaging
- In vivo & Clinical Imaging
- Nanotechnology in Imaging
- Microscopy techniques and instrument design

For more information on the thesis and graduation, please see chapter 4.3.

4.1.3 Selectable studies on different thematic areas and special themes (36 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 (chapter 5).

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

4.1.5 Course structure for studies in Biomedical imaging

Mandatory courses — 94 ECTS

Course code and Title — *Credits*

Major subject studies — 91 ECTS

Complementary courses depending on the previous studies — 5-10 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
BIMAxxxx	Bioimage Informatics I, UTU/ÅA	5 ECTS
BIMAxxxx	Presenting Science by Means of Multimedia 1 UTU/ÅA	5 ECTS
222052.0	Bioimaging and microscopy, ÅAU	5 ECTS
BIMAxxxx	Nanoscopic 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 - 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	2 ECTS

Master's Thesis — 40 ECTS

220099.0	Thesis plan, seminar and practical laboratory work	20 ECTS
220097.0	Writing the Master´s thesis	20 ECTS

Also a possibility to international internships as a part of the Master´s thesis

Specialization at Thesis Level in one of four topics major themes

- Light Microscopy Imaging
- In vivo & Clinical Imaging

- Nanotechnology in Imaging
- Microscopy Techniques and Instrument Design

Mandatory Language Studies		**3 ECTS**
923800.0	Academic writing skills in English for masters students	3 ECTS

Selectable courses — 36 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 in vivo 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
BIMAxxxx	Bioimage informatics 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

213017.0	Computer aided drug design ÅAU	4 ECTS
212021.0	Structural biology ÅAU	5 ECTS

Other

BIMAxxxx	Presenting Science by Means of Multimedia 2 UTU/ÅA	5 ECTS
223094.0	Laboratory internship to learn basic research methods on biology and/or physics UTU/ÅAU	10 ECTS
222056.0	Laboratory internship to learn basic research methods on biology and/or physics UTU/ÅAU *Choose both 223094.0 and 222056.0 for 15 ECTS.*	5 ECTS
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*

Flow cytometry

BIMA3103	Flow-cytometry basics	2 ECTS

PET Imaging

PETC2101	PET Basics	2 ECTS
PETC3101	International PET symposium	
PETC3102	International courses on advanced PET imaging	

Neuroscience study program

PSKT2001	Invitation to neuroscience	5 ECTS
PSKTXXX	Neurology	5 ECTS
PSKTXXX	Cognitive neuroscience	5 ECTS
PSKTXXX	Neuropharmacology	5 ECTS

4.1.6 MSc Degree Programme in Biomedical Imaging: Recommended Schedule for Studies

1. study year	**Autumn 2017**	**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 **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 Bioimage Informatics 5 ECTS ANAT5103 Biomedical Instrumentation 5 ECTS BIMA2103 Mandatory participation in seminar series 2 ECTS **Mandatory Language Studies** 923800.0 Academic writing skills in English for masters students 3 ECTS
	Spring 2018	**Major subject studies in Biomedical Imaging, mandatory courses (continues)** BIMAxxxx Presenting Science by means of multimedia 5-10 ECTS ANAT5101 Physical Basis of Medical Imaging 4 ECTS BIMAxxxx Nanoscopic Imaging in Biomedical Research 2 ECTS BKEM1012 Bionanoscience 3 ECTS ANAT5103 Biomedical Instrumentation 5 ECTS (continuies) BIMA2103 Mandatory participation in seminar series 2 ECTS (continues) ***Selectable/elective studies***
2. study year	**Autumn 2018**	***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), 40 ECTS
	Spring 2019	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

5 Annex: Course descriptions

5.1 Complementary studies

ÅA_1901 (ÅA course code 221006.0) Introduction to Cell Biology 3 ECTS
Subject: Cell Biology
Persons in Charge: Cecilia Sahlgren
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: Markus Lindberg
Objectives: To teach physics foundations, especially applications in the biophysical sciences.
Content: Energy, wave motion, electric phenomena, radiation, ibteraction 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:

5.2 Mandatory courses

ÅA_1901 (ÅA course code 221006.0) Introduction to Cell Biology 3 ECTS
Subject: Cell Biology
Persons in Charge: Cecilia Sahlgren
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:

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
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 Bioimage Informatics 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, new book to be defined

BIMAxxxx Presenting science by means of multimedia 5 ECTS or 10 ECTS
Persons in Charge: BIMA coordinator
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:
You will learn how to present science with modern tools. Concept and terminology, media forms, brainstorming, evaluating the idea, storyboard, basic editing with Adobe Premier Pro. The first part with basics is mandatory. Student can continue their project and make a more advanced video in the part two.
Modes of Study: Lectures, demonstrations, hands-on-training
Evaluation: 1-5
Recommended Year of Study: 1. Year, period III-IV
Previous studies: -
Study Materials:

BIMAxxxx 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: Lectures, 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 practics 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) *http://www.biocity.turku.fi/events/frontiers-of-science-seminars/*
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 Lost in Imaging *http://www.btk.fi/cell-imaging/lost-in-imaging/*
o *Other seminar series* *http://www.biocity.turku.fi/events/*

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.

5.3 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. Aquire 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_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 upp 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: Cecilia Sahlgren
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: Cecilia Sahlgren
Objectives: To provide a thorough insight to different aspect 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 aquire 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 aquires 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:

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:

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: Mandatoty 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

BIMAxxxx Bioimage Informatics 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:

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. Cabapility 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: Litterature 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 backround 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