# Table of Contents

1 The Department of Biosciences ...........................................................................................................................................3
  1.1 The Department and decision making......................................................................................................................3
  1.2 The Department’s academic office .............................................................................................................................3
  1.3 The academic neighbourhood .....................................................................................................................................4
  1.4 Registration for the academic year .............................................................................................................................4
  1.5 Course registration ...........................................................................................................................................................4
  1.6 Examinations .....................................................................................................................................................................5
  1.7 Certificates and study transcripts ................................................................................................................................ 5
  1.8 Computers, printers and copying machines ...........................................................................................................6
  1.9 Libraries ................................................................................................................................................................................ 6
  1.10 Career Services ................................................................................................................................................................ 6
  1.11 Student tutor and teacher tutor ................................................................................................................................ 6
  1.12 Student activities ............................................................................................................................................................7
  1.13 Flexible study right: studies at the University of Turku .....................................................................................7

2 Study programme .....................................................................................................................................................................7
  2.1 Academic year ...................................................................................................................................................................7
  2.2 Structure of the studies ..................................................................................................................................................7
  2.4 General information about the studies ........................................................................................................................13
  2.5 Graduation and diploma ................................................................................................................................................14

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 Department and certain procedures, the study programme and the structure of the studies.
1 The Department of Biosciences

1.1 The Department and decision making
The Department of Biosciences is part of the Division for Natural Sciences and Technology at Åbo Akademi University. The other three departments in the same division are: the Department of Natural Sciences, the Department of Chemical Engineering and the Department of Information Technologies.

The Division is lead by a Vice-rector. Vice-rector for the Division for Natural Sciences and Technology is professor Mikko Hupa.

The division is divided into three administrative areas: Financial Administration, Personnel Administration and Education and Research. Each administrative area consists of a manager and a number of employees who take care of matters in the specific administrative area.

All Departments are lead by a Department Council and a Head of Department. Head of Department for the Department of Biosciences is professor J Peter Slotte.

At the Department of Biosciences the subjects Biochemistry, Cell Biology, Environmental and Marine Biology and Pharmacy are gathered. The Department of Biosciences offers one Master’s Degree Programme in English; MDP in Biomedical Imaging.

The decisions at the Department are made by the Department Council, (institutionsrådet), and the Head of Department (prefekten). The members of the Councils, consisting of professors, teachers, researchers and students, are elected for a period of three years. The Head of Department is the chairman of the Department Council.

The Åbo Akademi University Board has decided to transform the existing 12 institutions into four new faculties. The faculties will be operational as of 1 January 2015. The Department of Biosciences will be part of the Faculty of Science and Engineering.

1.2 The Department’s academic office
The Department’s academic office is located in the Gripen-building, 2nd floor, Tavastgatan 13, 20500 Åbo. The office is open Monday-Thursday at 10 am-3 pm.

Head of Academic Affairs, Pia-Maria Kallio, can be met at the academic office from Monday to Thursday by mutual agreement.
Telephone (02) 215 4516, e-mail: biovet-studiechef@abo.fi

Study advisor, Heidi Karlsson can be met at the academic office from Monday to Thursday by mutual agreement.
Telephone (02) 215 3540, e-mail: biovet-studieradgivare@abo.fi

Student Affairs Officer, Jessica Lindroos can be met at the academic office from Monday to Thursday at 10 am-3 pm or by mutual agreement.
Telephone (02) 215 4517, e-mail: jessica.lindroos@abo.fi
It is recommended that you book an appointment with the Head of Academic Affairs 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 Inga Pukonen and Petra Miikkulainen, e-mail tbi-office@bioimaging.fi

Their office is located in the BioCity building (T38), 5th floor, at the Laboratory of Biophysics. Telephone (02) 333 7059, mobile 050 409 6642 (Petra) and 050 411 6682 (Inga).
Mailing address is Turku Centre for Biotechnology, Tykistökatu 6A, 5th floor, 20520 Turku.
Visiting hours for students are Monday-Friday 9:30 – 12:00 or whenever someone is present.

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 many of the University’s buildings. The Department of Biosciences operates in the Biocity-building, on the street Artillerigatan (Tykistönkatu 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

1.4 Registration for the academic year
New students register for their first academic year 25.8-5.9.2014 according to these instructions http://www.abo.fi/student/en/inskrivningnya

The Student Union fee (106 €) is paid into a bank account using the pre-printed payment slips available in the beginning of August. All new students must register during the period defined above and must present an identification card (e.g. passport), receipt of the Student Union fee payment, your original secondary school certificate and your original bachelor’s degree certificate as well as transcripts (or other documents required for eligibility, e.g. Master’s degree certificate), as well as your Letter of admission.

In order to maintain their status as students at the university all students at Åbo Akademi University have to each year notify the Student Office of Åbo Akademi (Studentexpeditionen) whether they are present or absent for the academic year. The Student Office is located in the Gripen-building, Tavastgatan 13, 20500 Åbo. Registration for second-year and older students can be done 1.8-12.9.2014 according to these instructions http://www.abo.fi/student/en/anmalan

1.5 Course registration
Course registration at Åbo Akademi University
Registration to courses might be 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 (scroll down to “For students: information about MinPlan in English). Sometimes registration is done on 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
Registration to courses 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.
1.6 Examinations

Examinations at Åbo Akademi University
Most exams are on Fridays (in Biology). The registration is done in MinPlan: http://www.abo.fi/minplan. Instructions for registration for examinations are found at the following address: https://www.abo.fi/student/en/minplanmanualer (scroll down to “For students: information about MinPlan in English”).

The first course exam is arranged at the end of the course. The course exams do not require registration. In addition to the course exams there are usually 3 general exams arranged for each course every academic year. The general exams can be taken in the same academic year as the course is completed, but also in the following academic year. For general exams, the student should register for the exam in MinPlan.

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

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 to exams held on general examination days of the Faculty of Medicine should be also 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

1.7 Certificates and study transcripts
Certificates and copies regarding study achievements and other study related issues can be obtained from the Student office in Gripen (Tavastgatan 13) or from the Department’s academic office also located

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 or Student Affairs Officer who will see to it that the study achievements are transferred into the study record at Åbo Akademi University.

### 1.8 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](http://www.abo.fi/stodenhet/en/klasser). Remember always to log off after use, so that no one else can use your computer domain.

Students can print about 180 pages for free in a three-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 via e-mail. Copying machines are available e.g. in the libraries and in the Student Office in the Gripen-building. Copying cards can be bought e.g. at the Student Office.

### 1.9 Libraries

To be able to borrow from the libraries students need to have a student card (studiekort). The loan time for books is usually 2–4 weeks. More information is found at [http://www.abo.fi/bibliotek/en](http://www.abo.fi/bibliotek/en). The Department has its own library on the ground floor in the Biocity-building, Tykistökatu 6, 20500 Åbo. It is open during the semesters from Monday to Friday 9 am – 4 pm.

The main library of Åbo Akademi is located in Domkyrkogatan 2-4, 20500 Åbo, telephone (02) 215 4180, e-mail: hblan@abo.fi. It is open during the semesters from Monday to Thursday 9am – 8 pm, Friday 9 am - 5 pm and Saturday 11 am – 3 pm. 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. It is open during the semesters from Monday to Thursday 9 am – 20 pm and Friday 9 am - 4 pm.

### 1.10 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](http://www.abo.fi/stodenhet/en/arbetsforum).

### 1.11 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 2014-15) for students admitted to the
programme at Åbo Akademi University will be Adeleke Amoda: aamoda@abo.fi and Arun Venu: apoonthu@abo.fi and Ezgi Özliseli: eozlisel@abo.fi. Teacher tutor for students admitted to the programme at Åbo Akademi University is Lector Diana Toivola (diana.toivola@abo.fi).

1.12 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 106 € for the Academic year 2014-15. By being a member you receive a student card with which you 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 Kirkkotie 13, 20540 Åbo, telephone 043 710 1002.

1.13 Flexible study right: 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 of 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.

2 Study programme

Åbo Akademi follows the so called Bologna reform concerning studies and credits. According to the new degree structure starting in 2005, the studies will be measured in credits (CR/ECTS).

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 2013-2014:

- Period III: weeks 2-11, 7.1.2015-13.3.2015
- Period IV: weeks 12-22, 16.3.2015-29.5.2015

Easter holidays: 1.4.2015-6.4.2015
Summer holidays: 1.6.2015-28.8.2015

2.2 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](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>
<thead>
<tr>
<th>Major subject studies in Biomedical imaging, mandatory courses</th>
<th>44 ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master’s thesis in Biomedical imaging</td>
<td>45 ECTS</td>
</tr>
<tr>
<td>thesis plan, seminar and practical laboratory part (25 ECTS)</td>
<td></td>
</tr>
<tr>
<td>written thesis (20 ECTS)</td>
<td></td>
</tr>
<tr>
<td>Selectable/elective studies on different thematic areas and special themes</td>
<td>23 ECTS</td>
</tr>
<tr>
<td>Finnish and English language studies</td>
<td>8 ECTS</td>
</tr>
</tbody>
</table>

2.2.1 Major subject studies in Biomedical imaging, 44 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.

2.2.2 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 professor John Eriksson (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: [https://www.abo.fi/institution/en/biovetstudyguide](https://www.abo.fi/institution/en/biovetstudyguide)

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

- Light microscopy imaging (John Eriksson)
- In vivo & Clinical Imaging (Anne Roivainen)
- Imaging in Nanotechnology and Material Sciences (Jouko Peltonen)
- Microscopy techniques and instrument design (Pekka Hänninen)

2.2.3 Selectable/elective studies on different thematic areas and special themes, 23 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 (ÅA), 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.
2.2.4 Mandatory Swedish and English language studies, 8 ECTS

A language courses in Swedish is mandatory for all foreign students studying at Åbo Akademi University. Also 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/stodenhett/en/cskenenglish

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>909970.0</td>
<td>Swedish as a foreign language, level 1</td>
<td>5 ECTS</td>
</tr>
<tr>
<td>903840.0</td>
<td>Academic Skills in English for Masters Students I</td>
<td>3 ECTS</td>
</tr>
</tbody>
</table>
### Course structure for studies of Biomedical imaging

Color codes for thematic areas:
- Advanced cell biology
- Biophysics
- Information technology and image processing
- Advanced microscopy and imaging techniques
- Nanotechnology
- Laboratory animal models and in vivo imaging techniques
- Mathematics
- Other

### MANDATORY COURSES

<table>
<thead>
<tr>
<th>Course code and Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="#"><strong>Complementary courses depending on the previous studies</strong></a></td>
<td></td>
</tr>
<tr>
<td><strong>221006.0</strong> Introduction to Cell Biology ÅAU</td>
<td>3 ECTS</td>
</tr>
<tr>
<td><strong>221008.0</strong> Laboratory Basics ÅAU</td>
<td>2 ECTS</td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td><strong>232017.0</strong> Introduction to Biophysics ÅAU</td>
<td>5 ECTS</td>
</tr>
<tr>
<td><strong>NOTE:</strong> If the student has studied both physics and biology before, he/she can select 5 ECTS of other studies.</td>
<td></td>
</tr>
</tbody>
</table>

### Major subject studies

<table>
<thead>
<tr>
<th>Course code and Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANAT5101 Physical Basis of Medical Imaging UTU</td>
<td>4 ECTS</td>
</tr>
<tr>
<td>ANAT5103 Biomedical Instrumentation UTU</td>
<td>5 ECTS</td>
</tr>
<tr>
<td>ANAT5105 Fluorescence in Bioanalytical Research UTU</td>
<td>4 ECTS</td>
</tr>
<tr>
<td>BIMA2101 Digital Image Processing I BTK</td>
<td>5 ECTS</td>
</tr>
<tr>
<td>BIMA2102 Presenting Science by Means of Multimedia UTU/ÅA</td>
<td>10 ECTS</td>
</tr>
<tr>
<td><strong>221007.0</strong> Microscopy and Microtechniques ÅAU</td>
<td>3 ECTS</td>
</tr>
<tr>
<td><strong>BIMA2104</strong> Nanoscopic Imaging in Biomedical Research - basics UTU</td>
<td>2 ECTS</td>
</tr>
<tr>
<td><strong>BKEM1012</strong> Bionano Lecture Course UTU</td>
<td>3 ECTS</td>
</tr>
<tr>
<td><strong>BIMA2103</strong> Mandatory participation in seminar series (20h) and writing a seminar diary</td>
<td>2 ECTS</td>
</tr>
<tr>
<td>- BioCity Turku seminars (FoS seminars)</td>
<td></td>
</tr>
<tr>
<td>- Seminar series of Turku BioImaging</td>
<td></td>
</tr>
<tr>
<td>- PET Monday Seminars and PET Basics I and II seminars</td>
<td></td>
</tr>
<tr>
<td>- TCDM Seminar program</td>
<td></td>
</tr>
<tr>
<td>- CoE seminar program</td>
<td></td>
</tr>
<tr>
<td>- Other seminar series</td>
<td></td>
</tr>
<tr>
<td><strong>BIMA2105</strong> Biomedical Ethics UTU</td>
<td>1 ECTS</td>
</tr>
</tbody>
</table>

### MASTER’S THESIS

<table>
<thead>
<tr>
<th>Course code and Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>220096.0</strong> Thesis plan, seminar and practical laboratory work</td>
<td>25 ECTS</td>
</tr>
<tr>
<td><strong>220097.0</strong> Writing the Master’s thesis</td>
<td>20 ECTS</td>
</tr>
<tr>
<td><strong>Also a possibility to international internships as a part of the Master’s thesis</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Specialization at Thesis Level in one of four topics major themes

- Light Microscopy Imaging
- In vivo & Clinical Imaging
- Imaging in Nanotechnology and Material Sciences
- Microscopy Techniques and Instrument Design
## SELECTABLE STUDIES ON DIFFERENT THEMATIC AREAS

**Course code and Title** | **Credits**
---|---
**Advanced cell biology**<br>283007.0 | Cell signaling ÅAU | 8 ECTS<br>223068.0 | Structure and function of the cytoskeleton ÅAU | 6 ECTS

**Biophysics**<br>233004.0 | Electronic properties of organic materials ÅAU | 10 ECTS<br>233035.0 | Biophysics ÅAU | 10 ECTS<br>ANAT5102 | Medical Imaging Project Work UTU | 5 ECTS

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

**Advanced microscopy and imaging techniques**<br>222038.0 | Advanced Microscopy I ÅAU | 5 ECTS<br>222048.0 | Practical microscopy and microtechniques ÅAU | 2 ECTS<br>222041.0 | Histology, ÅAU | 4 ECTS

**Laboratory animal models and in vivo imaging techniques**<br>PGS1024 | Competence on use and care of laboratory animals UTU | 6 ECTS<br>TCDM3101 | Practical training in *in vivo* imaging techniques UTU | 4 ECTS

**Mathematics**<br>MATE5258 | Image and Video Compression UTU | 10 ECTS<br>SMAT5216 | Modelling Project UTU | 10 ECTS<br>MATE5275 | Scientific Computing UTU | 4 ECTS<br>MATE5276 | Scientific Computing 2 UTU | 4 ECTS

**Other**<br>BIMA3116 | Laboratory internship to learn basic research methods on biology and/or physics | 6-14 ECTS<br>130023.1 | Visuality and visualization of information ÅAU | 5 ECTS<br>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.

<table>
<thead>
<tr>
<th>Course code and Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>XXXXXXXX Courses on animal physiology, anatomy, immunology, microbiology etc.</td>
<td>1-5 ECTS</td>
</tr>
<tr>
<td>BIMA3103 Flow-cytometry basics</td>
<td>1 ECTS</td>
</tr>
<tr>
<td>BIMA3104 Laboratory course on flow-cytometry</td>
<td>2 ECTS</td>
</tr>
<tr>
<td>PETC3101 International PET symposium</td>
<td></td>
</tr>
<tr>
<td>PETC3102 International courses on advanced PET imaging</td>
<td></td>
</tr>
<tr>
<td>BTK/CIC Digital Image processing II</td>
<td>2 ECTS</td>
</tr>
<tr>
<td>213019.0 Protein structure, informatics and modeling</td>
<td>6 ECTS</td>
</tr>
<tr>
<td>BIMAXXXX International laboratory courses and visits</td>
<td></td>
</tr>
</tbody>
</table>

LANGUAGE STUDIES
Course code and Title | Credits

Mandatory Language Studies (8 ECTS)
The studies include a mandatory course in Finnish (5 ECTS) for the students of the University of Turku.

NOTE: If the student already meets these language requirements he/she is exempted and can select 8 ECTS other studies (language or subject related).

<table>
<thead>
<tr>
<th>Course code and Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>909970.0 Swedish as a foreign language, level 1</td>
<td>5 ECTS</td>
</tr>
<tr>
<td>903840.0 Academic skills in English for Masters Students I</td>
<td>3 ECTS</td>
</tr>
</tbody>
</table>

Optional Language studies

<table>
<thead>
<tr>
<th>Course code and Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>902670.0 Finnish as a foreign language, level 1</td>
<td>5 ECTS</td>
</tr>
<tr>
<td>SUKI1258 Knowledge about Finland</td>
<td>3 ECTS</td>
</tr>
</tbody>
</table>

Detailed information on courses (lecture dates and times) is found here: [http://www.bioimaging.fi/program/courses/](http://www.bioimaging.fi/program/courses/)
## MSc Degree Programme in Biomedical Imaging – recommended schedule for studies, academic years 2014-2016

### 1. study year

<table>
<thead>
<tr>
<th>Semester</th>
<th>Courses</th>
</tr>
</thead>
</table>
| **Autumn 2014**| Complementary studies depending on student’s background<br>
221006.0 Introduction to Cell Biology 3 ECTS<br>
221008.0 Laboratory Basics 2 ECTS<br>
OR<br>
232017.0 Introduction to Biophysics 5 ECTS  |
|                | Major subject studies in Biomedical Imaging, mandatory courses<br>
BIMA2101 Digital Image Processing 15 ECTS<br>
BIMA2103 Mandatory participation in seminar series 2 ECTS<br>
ANAT5105 Fluorescence in Bioanalytical Research 4 ECTS<br>
ANAT5103 Biomedical Instrumentation 5 ECTS<br>
BIMA2105 Biomedical Ethics 1 ECTS  |
|                | **Mandatory Language Studies**<br>
KIFF0003 Finnish for Foreigners, Intensive Beginners Course 5 ECTS<br>
KIEN2022 Basic Academic Writing Skills in English 3 ECTS  |
| **Spring 2015**| Major subject studies in Biomedical Imaging, mandatory courses (continues)<br>
221007.0 Microscopy and Microtechniques 3 ECTS<br>
ÅA_0431 Presenting Science by means of multimedia 10 ECTS<br>
ANAT5101 Physical Basis of Medical Imaging 4 ECTS<br>
BIMA2104 Nanoscopic Imaging in Biomedical Research 2 ECTS<br>
BKEM1012 Bionano Lecture Course 3ECTS<br>
BIMA2103 Mandatory participation in seminar series 2 ECTS (continues)  |
|                | Selectable/elective studies  |

### 2. study year

<table>
<thead>
<tr>
<th>Semester</th>
<th>Courses</th>
</tr>
</thead>
</table>
| **Autumn 2015**| Selectable/elective studies (continues)<br>
Optional Language studies  |
|                | Master’s Thesis in Biomedical Imaging (thesis plan + seminar) 45 ECTS<br>
(Possibility to international internship as part of the MSc thesis)  |
| **Spring 2016**| Master’s Thesis in Biomedical Imaging (continues)<br>
Selectable/elective studies (continues)  |

### 2.4 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.

**Study guidebook - Master’s Degree Programme in Biomedical Imaging**

The Study guidebook gives general information about studies at the Department of Biosciences as well as a description of certain procedures. The guidebook also gives information about the structure of the Master’s Degree Programme, the courses that are included in the degree. The Study guidebook is handed out to all new students and can also be found at www.abo.fi/bioimaging

**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/en/undervisningsprogram

The schedule for the Master’s degree programme in Biomedical Imaging is found here: http://www.bioimaging.fi/program/courses/
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.

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: tbi-office@bioimaging.fi.

2.5 Graduation and diploma
When all courses are completed and the Master’s thesis is approved, the student can graduate and get his or her diploma: Master of Science. To obtain the diploma, please contact the Head of Academic Affairs, Pia-Maria Kallio, at the Department academic office, Tavastgatan 13. More information about graduating and getting the diploma is found at http://www.abo.fi/institution/en/biovetnastanfardig (Biosciences → Studies → Almost ready).

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:

<table>
<thead>
<tr>
<th>Finnish grading scale</th>
<th>Qualitative definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>excellent</td>
</tr>
<tr>
<td>4</td>
<td>very good</td>
</tr>
<tr>
<td>3</td>
<td>good</td>
</tr>
<tr>
<td>2</td>
<td>satisfactory</td>
</tr>
<tr>
<td>1</td>
<td>sufficient</td>
</tr>
<tr>
<td>0</td>
<td>fail</td>
</tr>
</tbody>
</table>
Annex: Course descriptions

Course descriptions (mandatory courses)

ÅA_1901 (ÅA course code 221006.0) Introduction to Cell Biology 3 ECTS
Subject: Cell Biology
Persons in Charge: 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: Tom Lönnroth
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 (40h), exercises (20h) (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: 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 I-II
Study Materials: Chris Guy "Introduction to the Principles of Medical Imaging", Imperial College Press

ANAT5103 Biomedical Instrumentation 5 ECTS
Persons in Charge: Juhani Soini, Pekka Hänninen
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, Juhani Soini
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.
Modes of Study: Lectures, written essay.
Evaluation: 1-5
Recommended Year of Study: 1. Year, period I-II.
Previous studies: ANAT5103
Study Materials: Alexander P. Demchenko "Introduction to Fluorescence Sensing", Springer

BIMA2101 Digital Image Processing 5 ECTS
Persons in Charge: Rolf Sara, Perttu Terho
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 I.
Previous studies: 

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
Previous studies: -
Study Materials: 

BIMA2104 Nanoscopic Imaging in Biomedical Research 2 ECTS
Persons in Charge: Lauri Pelliniemi
Objectives: 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

ÅA_2902 (ÅA course code 221007.0) Microscopy and Microtechniques 3 ECTS
Persons in Charge: Diana Toivola
Objectives: Course in light microscopy. The course consists of lectures, web-based exercises, practical microscopy, presentation of microtechniques in report and examination.
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, web-based exercises, laboratory work, report with figures, exam.

Evaluation:

Recommended Year of Study: 1. Year, period IV

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: Laboratory booklet, moodle

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 II

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 Seminar series of Turku Bioimaging http://www.bioimaging.fi/courses.htm
o TCDM Seminar program http://www.tcdm.fi/?id=seminarseries&pm=main|education
o CoE seminar program
o Other seminar series http://www.biocity.turku.fi/index.php?id=860

OBLIGATORY LANGUAGE STUDIES

KIFF0003 Finnish for Foreigners, Intensive Beginners Course 5 ECTS

Persons in Charge: Pirkko Hölttä (autumn semester), Päivi Paukku (spring semester)

General description: This course is intended only for degree students of the University of Turku. The course is integrated in nature and covers all the different areas of linguistic skills. In addition to pronunciation and grammar, the course offers tuition in speaking, written work, and listening and reading comprehension. Special emphasis will be placed on active communicational skills. In addition to attending the classes, participants must also be prepared to study a lot independently.

Objectives: After the course the student can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. He/she can e.g. briefly describe events and activities. The student understands the main points in short messages, announcements and stories. He/she can follow speech which is slow and carefully articulated. The student can write short and simple texts on topics which are familiar or of personal interest. He/she can understand short texts that consist of frequent everyday or job-related language.

Contents:
Themes: greetings, introducing oneself, countries, languages and nationalities; the seasons, months and days of the week; some measures, the points of the compass, time and weather; clothes, colours and other adjectives; home and living; family and relatives; food and eating; shopping: buying and paying; animals; travelling and vehicles; professions and leisure-time activities; parts of the body; visiting a doctor; telling, how do you feel.
Structures: vowel harmony; the most common noun types; the genitive stems and consonant graduation; possessive structure; the verb types and conjugation in the present tense; asking questions and responding to them; the use of auxiliary verbs with the main verbs; partitive singular; possessive suffixes; the local cases in the singular form; the simple past tense.

Modes of Study: English: Participation in classroom work
Finnish: Participation in classroom work and Exercise(s) and Midterm Examination and Written exam

Evaluation and evaluation criteria: Numeric 1-5. Participation, classroom work, exercises, midterm examination and written exam.

Previous Studies: -
Recommended Year of Study: 1. year autumn/1. year spring
Study Materials: Heikkilä, S. & Majakangas, P. Hyvin menee! 1 (Keuruu 2008)

KIEN2022/2024 Basic Academic Writing Skills in English 2 ECTS (for BIMA students the course includes also reporting and the students will receive 3 ECTS)

Persons in Charge: Mike Nelson/ Kelly Raita/Brett Dellinger

General description: Academic writing course designed for Masters' level students to cover the core elements of academic grammar and style.

Objectives: After the course the student should be able to write a short text in an academic style. They should understand the difference between formal and informal language in an academic context and know how academic and other text styles differ. They should have an understanding of the structure of academic paragraphs and be aware of several devices used to make their text flow. They should be able to punctuate well in English.

Contents: Topics covered on the course are academic style and vocabulary, punctuation, paragraph structure, articles, clauses and the format and organization of academic texts. A final assignment of a short academic paper is done by the students.

Modes of study: English: Participation in classroom work and Participation in online teaching and Weekly Exercises and Essay. For credit, min. 80% attendance and active participation.

Evaluation and evaluation criteria: pass/fail
Previous studies: -
Recommended Year of Study: 1.year, periods I-II or III-IV
Study materials: Found online or provided by the teacher

Selectable courses
Courses given by Åbo Akademi

ÂA_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 36-53)
Study Materials:

ÂA_2833 (222048.0) Practical microscopy and microtechniques, 2 ECTS
Subject: Cell Biology
Persons in Charge: Diana Toivola
Objectives & content: Theoretical and practical knowledge in sample preparation for light microscopy. This includes dissection, fixation, sectioning, and staining techniques.
Modes of Study: Demonstrations, laboratory work, and poster presentation.
Evaluation:
Previous Studies: This course is meant for 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. This course can only be taken together with the Microscopy and microtechniques course.
Recommended Year of Study: 1./2. Year, period IV
Study Materials:

ÂA_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.
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: 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 I
Study Materials:

ÅA_2831 (223068.0) Structure and function of the cytoskeleton 8 ECTS
Subject: Cell biology
Persons in Charge: John Eriksson
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:

ÅA_6317 (222041.0) Histology 4 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:

Previous Studies: -

Recommended Year of Study: 2. Year, period II

Study Materials:

ÂÅ_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:

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


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)

ÂÅ_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

**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.


**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 (223073.1 and 223073.2) Laboratory internship to learn basic research methods on biology and/or physics (replaces the ANAT5104 course) 6-14 ECTS

**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, Perttu Terho

**Objectives:** Advanced course for digital image analysis, processing and visualization based mainly on 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 (the course will be organized in Spring 2013)

**Previous studies:** BIMA2101 Digital Image Processing I

**Study Materials:** Getting Started Guide for BioImageXD

BIMA3103 Flow-cytometry basics 2 ECTS (course description will be updated soon)

**Persons in Charge:** Perttu Terho

**Objectives:**

**Content:**

**Modes of Study:**

**Evaluation:**

**Recommended Year of Study:**
Previous studies:

Study Materials:

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.

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.

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/kouluks/KEK_kurssitarjonta/

Previous studies:

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

---

**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


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


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.


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


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
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