Faculty of Science

Prospectus 2010 - 2011

Biology
Medical Biology
Master

Radboud University Nijmegen

Preface

This prospectus contains both general as well as detailed information concerning the Educational Institute Biosciences of the Radboud University in Nijmegen and its Master programme Biology and Medical biology.
The **Rules on Teaching and Examination** of the Master Biology and the Master Medical biology can be found in Appendices 2 and 3 and via
http://www.ru.nl/biowetenschappen/onderwijs/onderwijs-_en/
All general information for students regarding the university, accommodations-living-well-being, finances, student grants and loans, admission and registration, services provided, student facilities, associations and organisations for students, student and legal position (students' statute) and moreover, all of the useful addresses and telephone numbers can be found via the homepage of the Radboud University
http://www.ru.nl/english/general/radboud_university/
The Educational Institute Biosciences observes the privacy regulations and will therefore not make any personal particulars public.
The prospectus is mainly meant as an aid for the student. If, upon using this prospectus, something is not clear to you or proves to be incorrect, or if you have any suggestions, please report this to the educational advisor or the Secretariat Biology.
The editors do not accept any liability for any consequences that result from any shortcomings pertaining to this prospectus. Therefore, no rights can be derived from the contents of this prospectus!

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1.1 Important addresses and telephone numbers

Office Biology

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Secretary Programme Committee
Ms. Drs. D. te Boekhorst (Dorri)
d.teboekhorst@science.ru.nl

Secretariat
Ms. J.W.H. Smulders-Klabbers (Anneke)
Ms. E.M.A. de Laat (Elma)
024 - 3653002
secrbiol@science.ru.nl

Study advisor
Secretary Examining Board Master studies
Exchange coördinator (Erasmus-LLLP)
Ms. Drs. C.G.F. Mooren (Conny)
024 - 3652281
c.mooren@science.ru.nl

Visiting and postal address Office Biology
Heijendaalseweg 135, HG00.113-115
6525 AJ Nijmegen

Faculty Students Administration / Examination Department
Ms. C. Hendriks
Ms. Y. Mulder-Nijs
024 - 3652247 of 3653392

Visiting address FSA / ED
Heijendaalseweg 135, HG00.133
6525 AJ Nijmegen

2 General information

2.1 The Educational Institute Biosciences

Educational institute and Research institutions

The Educational Institute Biosciences is responsible for the course of events regarding the training pertaining to the educational programmes that it provides. The university teachers that contribute to the training of biologists can be found both at the various research institutes of the Faculty of Science as well as at the nearby Radboud University Nijmegen Medical Centre.

The research institutes that are directly associated with the Educational Institute Biosciences are the following:

IWWR: Institute for Wetland and Water Research

Donders Institute for Brain, Cognition and Behaviour

NCMLS: Nijmegen Centre for Molecular Life Sciences

The training is furthermore provided for by a number of other departments or institutes, such as the ISIS institute that is responsible for courses in Philosophy of Sciences, Science Communication and Management & Technology.

The Education department

The following persons are associated with this department: The teamleader of the Education department Biology, the educational advisors, the tutors and the secretarial office (generally called 'Secretariat Biology'). The Education department is responsible for the co-ordination and the support of the training courses, the counselling regarding the studying of (Medical) Biology and the study recommendations. The department also has a supportive task concerning the policy of the Educational Institute that is determined by the Managing Director of the Educational Institute, the Faculty Collective Meeting and the Programme committee.

Programme committee

This committee is concerned with all of the aspects pertaining to the training programme, such as the preparations for amendments to the curriculum, scheduling issues, educational programmes, evaluations of the training courses, et cetera. The programme committee is made up of six scientific staff members and six students. You can contact the Programme committee through the secretary ms. drs. D. te Boekhorst, d.teboekhorst@science.ru.nl.

Examining boards

There are two Examining boards who monitor the quality level of the two respectively master exams, Master of Biology and Master of Medical biology. They are concerned with all kinds of issues pertaining to the examination programmes and they establish the results of the exams mentioned above. An additional task of the Examining boards of the Master of Biology and the Master of Medical biology regards granting or not granting its approval to forms that students have submitted concerning 'Details of Master phase' or individual requests from students to deviate from certain training components that have been laid down as part of the curriculum. The Examining board consists of scientific staff members. You can contact the Examining Boards througt the secretary ms. drs. C.G.F. Mooren, c.mooren@science.ru.nl.

2.2 Goal and final attainment levels of the academic programme

Generally speaking, the **goal** of the Master training programmes Biology and Medical Biology at the RU can be formulated as follows: 'the educational programme aims to have the student acquire knowledge, insight and practical skills and to have him/her master a scientific way of thinking, in such a way that he/she can be considered capable of generating solutions for scientific problems - particularly those of a (medical) biological nature - in a manner that is inventively, scientifically and socially sound'.

The practical **final attainment levels** with which the student is to comply were derived from this goal. They therefore make up a 'checklist' of sorts of the quality requirements that you will be expected to meet. Conversely, these final attainment levels for the training programme serve as a guideline for organizing the training that is provided. This means that all of these issues will receive due attention in the course of your studies. Some courses are directly linked to one or more of these final attainment levels, but the majority of the final attainment levels are implicitly interweaved within all of the courses.

Finally, each component has a number of specific **learning goals**. The teacher ascertains whether or not you comply with these learning goals by means of an examination (and sometimes a practical test as well). The learning goals therefore indicate what you can expect of the examination. The learning goals are summarised in a **specific goal** of the course concerned. That specific goal is stated in this prospectus in the section concerning the description of the course; the teacher generally stipulates the learning goals in the summary of the lectures or the lab manual.

Final attainment levels of the Master training programmes Biology and Medical biology

A. General cognitive skills

1. The Master is capable of thinking in a manner that is problem-oriented and that provides insight, with a critical approach to scientific insights.

2. The Master is capable of analysing a scientific problem by reducing the problem to verifiable sub-problems, in which he/she distinguishes between the main issues and the side issues in the analysis.

3. The Master is capable of bringing about a synthesis based on the solutions for the sub-problems, of placing this synthesis within a scientific framework and of contributing to the general development of theories in this fashion.

B. Scientific knowledge and insight

1. The Master has acquired a broad basic knowledge of the Natural Sciences, (Medical) Biology in particular, and has gained insight into the relationships between the components that make up these fields of science.

2. The Master has a thorough knowledge of and insight into the (medical) biological specialisation of his/her choice.

3. The Master is capable of mastering newly acquired scientific knowledge, particularly that of a (medical) biological nature, both inside and outside the specialisation of his/her choice, and to integrate this knowledge within the already acquired knowledge.

C. Scientific research method

1. The Master is capable of formulating new scientific problems and hypotheses.

2. The Master is capable of setting up a scientific experiment with which to test these hypotheses.

3. The Master is capable of selecting the correct approaches to reaching a solution and the appropriate methods of research, taking into account the availability of services and means.

4. The Master is capable of collecting and systematically processing research results.

5. The Master is capable of critically interpreting the research results and can formulate the conclusions that can be derived from these results.

6. The Master is capable of outlining the scientific and social consequences of the research that he/she has (partly) conducted.

D. Acquiring scientific information

1. The Master is capable of formulating which information is needed in order to solve a scientific problem, or more specifically, a (medical) biological problem.

2. The Master is capable of locating relevant sources of information, particularly scientific literature, by making use of the (automated) means that are available for that purpose.

3. The Master is capable of comprehensively reading scientific textbooks in the English language, as well as scientific articles regarding the specialisation of his/her choice.

E. Practical realisation of the research

1. The Master has the practical skills that are required if one is to conduct experimental, scientific, (medical) biological research concerning the specialisation of his/her choice and/or is capable of quickly mastering these skills.

2. The Master is capable of independently planning and conducting (medical) biological research, or part of a research study of that kind, which is carried out in the form of a co-operation.

F. Presentation of the research

1. The Master is capable of writing a report regarding the research or theoretical study that was conducted in accordance with the structure of a scientific article.

2. The Master is capable of giving a clear verbal presentation of the research or theoretical study that was conducted, this for a non-specific expert audience.

2.3 Global structure of the educational programme

All of the faculties of the RU Nijmegen have implemented the bachelor-master structure. As the same structure has been or will be implemented in most European countries, it is much easier to compare the university training programmes. The academic programme for (Medical) Biology is made up of two components:

- Bachelor's programme
- Master's programme

The bachelor takes three years (180 ec), the first of which concerns the foundation course. The bachelor programme is broadly-based and prepares you for the master programme of Biology or Medical Biology. Upon completing the bachelor phase, you will receive the bachelor's degree, at which time you may call yourself 'Bachelor of Science' (Bsc).

The master takes two years (120 ec). This is the phase in which you will specialize in one of four main orientations: the research orientation, the communications orientation, the educational orientation or the management and technology orientation. You will also take a series of lectures during this period (so-called mastercourses (lectures on certain subjects pertaining to biology or medical biology) and free space subjects). You already somewhat defined your future specialism during the bachelor phase, but you will fill in the details during your master phase. Within your specialism(s), you will be prepared for holding a social position such as a fully qualified teacher of Biology, consultant, policy staff member, journalist or otherwise, or to follow a post-master subsequent training programme, such as doctoral research (PhD) for example.

Upon completing your studies, you will receive your master's degree and you may call yourself 'Master of Science' (Msc).

2.4 Admission to the Master's programme Biology or Medical biology

Regular admission
Everyone who has successfully completed the final examinations of the bachelor programme Biology at the RU Nijmegen will be admitted to the master's programme in Biology. Admission to the master in Medical biology requires the bachelor exam in Biology including a minor in Medical biology.

The Examining board will consider whether or not students with a Bachelor's degree from some other (Medical) Biology academic training programme in the Netherlands have complied during their bachelor phase with the requirements that apply for admission to the Master's for Biology or the Master's for Medical Biology.

Conditions of admission for students with a Higher Vocational Education

If you have an HVE-degree with a relevant orientation and you would like to proceed with a university programme with respect to (medical) biology at the Radboud University, then you can, essentially, qualify for a shorter programme. You must, in any case, comply with a number of conditions of admission:

- You have obtained a HVE-diploma in one of the following orientations:
  - Secondary teacher training with qualifications for biology
  - A laboratory assistant training that sufficiently links up with the programme of your choice.
  - Certain orientations at the Larenstein Academy
- You can in any case reserve 2.5 to 3 years full-time for the (medical) biology studies.
- You have a pre-university (A-levels) high school diploma with biology and chemistry, or you received training of a comparable level during your HVE-training.

You formally begin as a regular bachelor student. However, based on your preliminary training, you will draw up a transition programme together with the educational advisor, which will cover approx. a half year. The purpose of this transition programme is to have you achieve the level of the bachelor in Biology or Medical biology. The proposed transition programme is then submitted to the examining board for approval.
Following your transition programme, you can proceed with the regular Master programme Biology or the Master programme Medical biology that we offer, so that the academic programme takes a total of around 2.5 to 3 years.

The procedure is as follows:

- You are to contact the educational advisor, Ms. C. Mooren (c.mooren@science.ru.nl) for

information on the possibilities of the transition programme. If you decide to continue your studies at the RU Nijmegen following this conversation, then you are to follow the points below.

- You are to write a letter to the Examining Board (Medical) Biology, attn. the secretary, Toernooiveld 1, 6525 ED Nijmegen, requesting to be allowed to continue your studies in the form of the Master programme Biology or the Master programme Medical biology by means of the transition programme of the academic training concerned. You are to indicate your preliminary education in this letter, along with a brief description of your main traineeship. Include a copy of your diploma and of your final school report. If these are not yet in your possession, then indicate when you expect to receive your diploma. The Examining Board (Medical) Biology considers any requests as referred to above and decides to approve or not to approve the request.
- You will be informed of the decision of the Examining board in writing.

Note The registration as a bachelor student takes place in the usual manner via the IB-group and is therefore separate from the procedure for the transition programme as described above!

Foreign Students/Diploma's

A 'foreign student' is understood to mean: anyone who has successfully completed a bachelor programme and/or master programme abroad, irrespective of his/her nationality. And so this also includes Dutch students with a foreign diploma! All 'foreign students' are in any case to first report to the Central Students Office through(http://www.ru.nl/students/masters_student/admission/application/Student or to contact one of the Students Counselors from the Central Office Counsellors Department (024-3612345). TheStudents Counselors can provide information regarding which foreign diploma's do and which do not grant access to academic programmes and the manner in which one can gain access to a certain programme at the university. They are to secondly contact the educational advisor (Medical) Biology: Ms. drs. C. Mooren (024-3653002).

Requests for exemptions

Based on examinations and/or exam components that have been successfully completed elsewhere and that correspond to the (Medical) Biology programme in terms of content and academic level, it is possible to request exemption from certain components with a similar number of credits. The request for exemption is to be submitted to the Examining Board (Medical) Biology (via Ms. drs. C. Mooren) and must include a sound motivation and copies of the relevant items of evidence on the basis of which the exemption is being requested.

Items of evidence are:

- authenticated description of the component upon which the exemption is to be based, in which the learning goals, content and credits are clearly described;
- a certified document that clearly states the final mark for the component concerned (under the name of the candidate);
- any other documents that the Examining board finds necessary if it is to come to a sound assessment.

2.5 Information and Counselling

prospectus
This prospectus contains all of the relevant information pertaining to the structure of the Master Biology programme and the Master Medical Biology programme. The prospectus can be accessed through http://www.ru.nl/english/education/prospectuses/
email lists
Any and all current notifications concerning the (medical) biology programme (divisions into groups, changes concerning exam dates and exam times, et cetera) are announced by means of the email list of the (sub)divisions concerned. Every year, students miss out on essential information because they do not read their email seriously and on a regular basis, which can have very unpleasant consequences in some cases (missing an exam component, for example).

internet
You can access the homepage of our academic programmes via http://www.ru.nl/biosciences. It provides the Rules and Guidelines of the Examination Board, certain forms, and trainee posts (also for abroad). Also summerschools and vacancies that can be of interest for our students are offered through the homepage.

syllabi and other materials
There is a campusshop in the Thomas van Aquinostraat 2. There you can buy certain materials such as syllabi required by a course. Teachers will inform you about the materials.

collective information on academic programmes
Various information meetings are organised during the academic programme. The purpose is to provide specific information on training phases and optional courses/components. The educational advisor is responsible for these information meetings. Some of the information meetings are included in the training schedule; the meetings that are not included in the schedule are announced via email. The most important information meetings are the so-called **traineeship market** for third-year students (in November). This market allows you to familiarise yourself with all of the traineeship possibilities pertaining to the specialisation phase and the course material that you are to choose during the differentiation phase in preparation of the specialisations. As a master student you can also visit the traineeship market to choose and arrange your second traineeship in case you do the research master.

educational advisor
You may come across problems in the course of your studies. You can probably handle most of these yourself. That is not always the case, however. In addition, you will probably come across questions concerning your studies (choice of orientation, going abroad for traineeship or study, the planning of exams, et cetera). You will find the answers to many of these questions in the prospectus or the other sources of information (as previously mentioned). If desired, you can always set up a personal meeting with the educational advisor. Appointments can be made via the Secretariat, 024-3653002, secrbiol@science.ru.nl.

Depending upon the subject of the meeting, the educational advisor may refer you to some other person or department:

- A student counsellor, when you have questions or problems regarding student grants/loans, special facilities, et cetera.
- University doctor or university psychologist, in the event that the progress of your studies is hindered by physical and/or emotional problems (s*ee below)*.
- University Confidant, in the event of problems in the sphere of sexual harassment or discrimination.

Of course, you can always directly contact the student counsellors, university doctor, university psychologist or the university confidant.

Desk Student Affairs:
The Students Counsellors Office can provide information regarding registering at the Radboud University and the answers to any general questions about studying at the Radboud University, 024-3612345 (Monday through Friday from 10.00h until 17.00h), www.ru.nl/students

The **infotheque of the student affairs desk** (which offers information on other training programmes and the job market, among other things) is open on Monday from 11.00h until 16.00h and from 10.00h until 16.00h on all other working days. Address: Comeniuslaan 4, Nijmegen.

student counsellors department:
Do you have questions concerning issues such as student grants/loans, financial problems or a delay in your studies due to personal problems, then you can call upon a student counsellor in most cases. Anything you discuss with a student counsellor is strictly confidential. You can set up an appointment at the Student Affairs Desk, Comeniuslaan 4, Nijmegen 024 - 3616090. It is always advisable to consult with the educational advisor before requesting an appointment with the student counsellor.

2.6 Biologists' Association Nijmegen and Active Biologist Consultations

Biologists' Association (The 'BeeVee')

The BeeVee is the students' association for all of the students that make up the Biosciences cluster. You can become a member of this association if you are studying (Medical) Biology or Environmental Sciences.

The BeeVee aims to promote the interests of the students who participate in the biosciences cluster. We first of all, take care of your initial books, they are ready and waiting when you begin your studies. You can order the remainder of the books that are required, later on in the academic year, with a nice reduction in price. In addition, we see to it that your academic studies are well organized. A BeeVee membership will only cost you 5 euros a year, or 20 euros for your whole study.

Finally, with the activities that we organize, we provide plenty of things to do besides studying. They are fun, informative and offer you the opportunity to get to know your fellow

students. The first activity that you will experience is the orientation week. During the year, films (and making films), parties and social get-togethers, but also more serious stuff like lectures, excursions and a large symposium once a year are being organized. In terms of reading, we offer the MOTjE, our leaflet for biologists, as well as the Almanak, the yearbook. The ABO committee is made up of students who have a say on various levels and can therefore help solving any problems or complaints that you may have regarding your studies.

All in all, there is enough to do with your spare time. Incidentally, the committees are looking for new members with refreshing ideas.

If this appeals to you, you can visit http://www.beevee.nl/ for additional information on the committees. And if you have suggestions for improvements, then the website committee can always use a helping hand as well.

For information on schedules, subjects and required reading lists, you can visit www.ru.nl/biowetenschappen <http://www.ru.nl/biowetenschappen>.

If you have questions, you can always mail these to beevee@science.ru.nl <mailto:beevee@science.ru.nl>, or call us 024-3652079. Our room is open from 12.45h until 13.15h on working days. You will find us in the Huygens building in room HG00.150.

ABO: Active Biologist Consultations (In Dutch: Actief Biologen Overleg)

The ABO is made up of students from different academic years and with different orientations in (medical) biology. The ABO aims to realize adequate control of and improvements to the academic training program and other related issues within the study of (Medical) Biology. The activities of the ABO consist of the handling of complaints and issues concerning education related matters and increasing the interests of the students in boards and committees. Next to this ABO organizes a special "parents day", an opportunity for parents to visit the study their children have chosen, and an internship fair, where students are able to receive ideas on where to do their internship or working placement. Participants in these consultations, students who wish to help to improve the studying situation, are needed every year.

2.7 Administrative matters during your studies

Secretariat Biology
You can call upon the Secretariat Biology (*see the introduction for the address and telephone number*) for all kinds of information and in order to take care of certain administrative matters such as:

- reporting a change of address
- reporting a lengthy interruption of your studies

- reporting the discontinuance of your studies
- reporting ill (in connection with practicals)
- setting up an appointment with the educational advisor
- correspondence intended for the Examining board

The Secretariat Biology is open on all working days from 9.00h until 17.00h, 024 - 3653002, secrbiol@science.ru.nl

Remember that your exam marks are only officially made known through KISS. The Secretariat is not allowed to deliver grades to students. You can access your marks electronically via your KISS-login.

Faculty Students Administration/Examinations Department

You are to report the following to the FSA/ED as quickly as possible:

- a change of address (holiday address personally; studies address via KISS)
- the termination or discontinuation of your studies
- a change in your academic orientation

The faculty students administration (FSA) is open:

Monday through Thursday from 13.00h until 16.00h and on Friday from 9.00h until 12.00h. *See the introduction for the address and telephone number.*

Registering for training components

You are to register for participating in mastercourses and other courses via KISS. If you do not register (on time), then the teacher may exclude you from participation. It is therefore wise to mind the starting dates of the various courses as indicated in the schedules and the prospectus of your academic programme!
Registering for a course means that you are also registered for the exam. When you have to do do the re-examination without following the course you have to register directly to the re-exam in KISS and inform the teacher about you being a repeater.

If you experience problems accessing KISS, then report this to the Student Affairs Desk, 024-3612345.

Mind the closing dates! If you do not register on time, you will be excluded from participating in courses or (re-)exams.

2.8 University awards

Students who are studying or who have graduated within the Educational Institute Biosciences may be eligible for one of the university awards that are presented every year or two years. The Educational Institute has set up a so-called **award committee** so as to ensure the efficiency of the selection procedure. This award committee selects the candidates for the

awards described below based on a number of criteria. These may vary for the various awards, but what generally applies is that the student concerned must have performed exceptionally well, particularly during the master phase of the programme. In general, a student that graduates with one of the designations 'bene meritum' or 'cum laude', may be among the nominated candidates. There are two university awards:

- The Educational Institute first of all recognises the **'van Nieuwenhoven award**'. This award was found in memory of the first professor of zoology that was appointed at the then Catholic University of Nijmegen and is solely awarded to biology students.
- The **'University Study Award**' is presented each year, in which the nominated candidate of the Educational Institute Biosciences is to compete with the candidates from the other educational institutes within the Faculty of Science.

In addition to these two university awards, biology students are also eligible to be nominated for the '**Organon Young Research Talent award'** , the two-yearly '**Unilever Research award**' and the '**Rijk Zwaan Plant Sciences award**'. The students who are eligible for these awards concern those who have researched subjects during their main traineeships that are in keeping with the fields of interest of these major companies. The nominees must, however, compete with the nominees from the (bio)chemical sector of the Radboud University and the other universities in the Netherlands respectively.

Furthermore there are scholarships from the Huygens Program to be used for studying abroad or doing an internship abroad.
Finally, there are also awards in the form of grants for students in the graduation phase, such as the VSB-grant.

3 The Master phase

3.1 General

The master programme comprises two years, the purpose of which is to have the student complete his/her academic training in (medical) biology in his/her explicitly defined specialism and to prepare the student for a post-master training programme and/or a position in society. By doing specialized research traineeships, attending general and specialistic lectures on special topics and, if desired, taking additional courses, students are to train themselves in gaining independence and a sense of responsibility when carrying out scientific work and upon acquiring up-to-date knowledge pertaining to one's specialism.
In this phase you must now determine for yourself which traineeships you plan to do, when and in which order. In short, it is your responsibility to organize your master phase as efficiently as possible. Although you are essentially free to decide on the details of this phase, there are a few 'rules' that you are to observe:

- You are to choose one of the main orientations before you begin your master phase, namely Research, Communication, Education or 'Management and Technology' (see *Details master programme*).
- You must in any event do one research traineeship (see *Details master programme*) and in addition, you have a certain 'free space' at your disposal that you can complete with courses, an additional traineeship or an extension of one of your traineeships. Moreover, in addition to your traineeships, you are also required to attend various series of master courses and a course in philosophy that is specifically intended for the master programme of our academic programme (see *Overview of mastercourses and Overview free space courses)*.
- You must meet certain requirements before starting with your traineeships *(you are referred to* http://www.ru.nl/biowetenschappen/onderwijs_education/onderwijs-_en/ *Rules on Education and Examination for the Master Biology and Rules on Education and Examination for the Master Medical biology)*. You will have to gather information on your own concerning the possibilities of a traineeship (see *Arranging a traineeship and Overview of traineeships*).
- The combination of your traineeships, how you wish to complete your free space and the master courses must be approved by the Examination Board (see *Request for approval of the master programme*).

3.2 Details of the master phase

The master programme offers four different main orientations: the Research orientation, the Communication orientation, the Educational orientation and the Management and Technology orientation.

The regulations pertaining to establishing the details of your master programme are laid down in the Rules on Education and Examination. The orientations are briefly described below.

The R-orientation
Upon opting for the R-orientation, you indicate to want to further develop yourself in (medical) biological research. The R-orientation includes a lot of practical work either in the field or in a laboratory. This practical work is supplemented with lectures on special topics (so-called master courses) and your free space. The distribution of credits with the R-orientation is more or less as follows:

2x research traineeship of 36 credits of practical work + scientific report
2x thesis of 6 credits
master courses to a total of 18 ec
philosophy course of 3 ec
free space of 15 credits

The thesis (review article) is usually imposed by the supervisor of your research traineeship. A research traineeship is carried out under the **responsibility** of a university teacher. Master students in Medical biology have to carry out one traineeship under responsibility of a teacher belonging to a chair within the Educational Institute of Biosciences, and a second under responsibility of a teacher belonging to departments within the UMCN (University Medical Centre Nijmegen), the Departments of Biomolecular Chemistry, CMBI and Donders Institute that have as such been recognized by the Examination Board. Master students in Biology have to carry out both traineeships under responsibility of a university teacher that has been recognised by the Examination Board, one of which has to belong to the Educational Institute of Biosciences. Under all conditions, the two traineeships have to be carried out under supervision of teachers belonging to different departments (chairs). If you want to follow a traineeship at another university within the Netherlands or abroad, you will have to find a university teacher from the Radboud University who will take the formal responsibility of this traineeship. For a survey of departments/chairs in which you are allowed to do internship see *Overview departments for internships*. You can also ask your student advisor.

'Under the responsibility' means that the person concerned is responsible for the supervision and the evaluation of your traineeship. In actual practice, this generally means that you will conduct research at his/her department under the daily supervision of his/her scientific staff, that you will take his/her specialistic lecture course as part of your master courses and that you will write your thesis under his/her supervision. However this is not allways the case. In some cases, you can conduct your research, either partially or completely, somewhere else (even abroad). Someone else is then responsible for your daily supervision, but not before consultations have taken place between the supervisor concerned and the responsible chairholder.

You are referred to *Overview master courses* for details concerning the lectures on special topics.
The possibilities concerning your free space are described in *Free space courses*.
For the Philosophy courses you are referred to the electronic prospectus for the Philosophy courses you can find through http://www.studiegids.science.ru.nl/2010/en/science/

For students who are interested in **Bioinformatics** we offer the so called **B-track: Mastertrack Bioinformatics**. You can read more about this B-track in *Overview*

departments for traineeships. Look for the Department of "Bioinformatics, Centre of Molecular and Biomolecular Informatics (CMBI)".

The C-orientation
You are referred to the following homepage for more information concerning the C-orientation: http://www.ru.nl/sciencecommunication/

If you opt for the C-orientation, then your 1st master year involves completing the biggest part of the components of the (medical) biology-master. You also begin the courses pertaining to the C-orientation, in addition to your research traineeship. Finally, in your 5th year, you are to complete the remaining components of the C-orientation + Philosophy + a small amount of extra free space:

You are referred to the electronic prospectus for a description of the C-courses: http://www.studiegids.science.ru.nl/2010/en/science/

The MT-orientation
If you opt for the MT-orientation, then your 1st master year involves completing the biggest part of the components of the (medical) biology-master. You also begin the obligatory courses pertaining to the MT-orientation, in addition to your research traineeship. Finally, in your 5th year, you are to complete the remaining components of the MT-orientation + Philosophy + a small amount of extra free space:

You are referred to the electronic prospectus for a description of the MT-courses: http://www.studiegids.science.ru.nl/2010/en/science/

The E-orientation
Following the first master year, students who wish to become fully-qualified teachers can enter the teacher training course in their fifth year of studying. Upon successfully completing this course, the student is entitled to the title 'Master of Science' and he/she will have acquired a teaching qualification for the subject concerned. Contact: Graduate School of Education (Instituut voor Leraar en School), tel. 024-3615573 for more information on the E-orientation. You can also visit http://www.studiegids.science.ru.nl/2010/ (Afstudeervariant Educatie).
The E-orientation will be in Dutch because of the fact that you will become a teacher on a Dutch secondary school.

If you opt for the E-orientation, then you are to complete the components of the (medical) biology master during your 1st Master-year. Your 5th year is made up of the E-components + Philosophy.

If you follow the C, E or MT variant of the Master in Medical biology, you can choose for your research traineeship a university teacher from either the biological departments or the departments from the UMCN.

3.3 Master Biology - description and structure of the programme

Description of the programme of the Master Biology
In study year 2010 - 2011 we start with a new programme for the Master of Biology. Central topic in the **Master programme Biology** is how plants, animals and micro-organisms have adapted to their environment. With research grouped in the *Institute for Water and Wetland Research* (IWWR) much of the adaptation focuses on water issues, and the stress imposed on organisms by exposure to too much water, too little water or bad water quality. The MSc programme not only covers a multitude of organisms and places interactions between them into context, it also integrates all levels of organisation from the molecule and the cell up to ecosystems and the landscape. This combination of experience results in a rich and coherent MSc programme of mastercourses and exciting internships with state-of-the-art research. It prepares you for a career in science, both fundamental and applied, but also provides the necessary knowledge for innovative evidence-based applications in nature and water management.

The Master Biology consists of three different tracks:

Adaptive Organisms
This track has its prime focus on processes at the sub-organismal level. Using the latest molecular and physiological tools the adaptations of organisms to environmental stresses are studied. The regulatory mechanisms are understood, including the genetic constraints, the physiological plasticity and the evolutionary history of the responses of organisms that we see. The programme provides a fascinating overview on the adaptability of plants, animals and micro-organisms to sub-optimal conditions, and conveys crucial information for an understanding of the effects of environmental change. This information is applied in nature management, but also in biotechnology and breeding programmes.

Communities and Ecosystems
Thi track focuses on the ecology of units of interacting individuals, in populations, communities and ecosystems. The biodiversity is analysed and functionally related to the hydrology, nutritional status and landscape configuration of the ecosystem. Ecogenomics tools are applied to obtain information on unknown components such as microbial composition or evolutionary history of populations. This information together gives insight in how different communities (plants, animals, micro-organisms) within an ecosystem are interrelated and interdependent, and how they determine the resilience of the community to environmental stress. This fundamental knowledge is applied in proven applications in nature and water management.

Water and Environment
This track focuses on the insight needed to tackle problems such as climate change, flooding, eutrophication, chemical pollution, habitat fragmentation and bio-invasions. We provide you with the laboratory, field and assessment tools needed to protect ecosystem and human health in the context of multiple environmental pressures. If you wish, you can specialise in Transnational Water Management (TWM), an international program set-up together with the University of Duisburg-Essen, or in Human and Environmental Risk Assessment (HERA) of

chemicals, carried out together with the Radboud University Medical Centre.The track Water and Environment provides you with the qualifications you need for positions at research institutes, industry, consultancies, universities, governments and other scientific and management oriented organisations.
This track is the former master programme Environmental Sciences, including as mentioned above the sub-tracks 'Water and Nature Management (WNM)', 'Transnational ecosystem based Water Management (TWM)' and 'Human and Environmentall Risk Assessment (HERA)'. For detailed descriptions of this main track and the sub-tracks you are referred to the prospectus of the Master Environmental Sciences,
http://www.ru.nl/english/education/prospectuses/
Because of a transition period in which the master Environmental Sciences will become embedded as a track in the Master Biology there will be two ways to enter this master the coming year. You can opt for the master programme Environmental Sciences or you can opt for the Master Biology and choose the track Water and Environment.

Description of the structure of the Master Biology

- 18 ec obligatory courses (15 ec at start)
- 12 ec thesis/theoretical component (i.e. excursion)
- 72 ec research intern internships (36 ec each)
- 15 ec free space for optional courses or internships
- 3 ec philosophy course

Adaptive Organisms	**Community and Ecosystems**
Orientation in biology and environmental sciences	
Genetics and ecogenomics	Ecological and environmental concepts
Adaptation Physiology	Management of ecosystems
Microbiology of wetlands	Biodiversity and ecological assessment
Molecular physiology of plant stress	Environmental and ecological monitoring

For detailed descriptions of the third main track **Water and Environment** and the sub-tracks you are again referred to the prospectus of the Master Environmental Sciences,
http://www.ru.nl/english/education/prospectuses/

3.4 Requesting approval of the master programme Biology/Medical biology

Preferably before you start your traineeships, but in any case *before* you start your second traineeship, you are to submit a **request for approval of the master programme** to the Examination Board (Medical) Biology. This application consists of a list of the components that are to make up your master programme in order to comply with the requirements for graduating. Suitable forms to that end can be downloaded from our homepage: http://www.ru.nl/biosciences. You are to hand in the form as an attachment to secrbiol@science.ru.nl or to c.mooren@science.ru.nl.

The members of the Examination Boards of the Master Biology and the Master Medical biology meet once every month and consider whether the applications for the details of the master programme comply with the requirements that are to be observed for a master examination biology or medical biology.

A request that concerns traineeships within the Educational Institute Biosciences will generally be approved. If you request the approval of a traineeship outside the Educational Institute, then it is customary for the Examination Board to ascertain whether or not the traineeship meets all of the requirements.

It is not always possible to determine *all* of your traineesships and master courses before you start your master programme. This may prevent you from going ahead with submitting your application for your master programme for approval. It is advisable if such is the case that you set up an appointment with the educational advisor so that the two of you can consider your plans together, because it would be very unpleasant if you were to learn later on - after you have completed it - that a certain traineeship does not comply.

3.5 External traineeship at home or abroad

If you independently or with help from the study advisor arrange a traineeship that is to be conducted under the responsibility of someone other than as described above (a so-called **external traineeship**), then you must first obtain the permission of the Examining board to that end. This means that you are to submit your request for approval of the details of your master phase, along with a description of this trainee post, the supervision and the manner in which your work is to be evaluated. Your traineeship will not be officially valid until after the Examining board has granted its permission, and then only pertaining to that special case. Every request for approval of an external traineeship is individually evaluated by the Examining board. But you allways need a supervisor from the Radboud University.

As part of your master phase, it is possible to conduct a research traineeship abroad. More and more students are reaching the conclusion that it is very worthwhile to study abroad for a period of time. This is not only true if you come across subjects during your studies that are not offered in the Netherlands. Studies show that studying abroad for a while can be very significant to one's personal development, studies and perspective. The possibilities concerning a stay abroad are almost unlimited. There are all kinds of national and international programmes that render a stay abroad possible and there are many kinds of grants and funds with which to finance a period of study or training abroad. Interested? Visit the International Office website http://www.ru.nl/io under the section Internationalization. Of course, you can also call or drop by.

Usually your plans for going abroad start with an appointment with the International coordinator of the Master of (Medical) biology mrs. C. Mooren, c.mooren@science.ru.nl

3.6 Arranging a traineeship

You will have to make arrangements for your traineeship yourself. Your own preference is decisive in that respect and you will have to make choices in your own way. However, not everyone knows exactly what he/she wants. And so we recommend that you seriously consider the following tips.

The **traineeship market** in the third year of the Bachelor Biology has proven to be a good starting point for many students. It allows you to quickly access information on the possibilities at all of the 'recognized' institutes that offer trainee post, this free of any obligation. Not only third-year students, but also most second-year students and fourth year students make use of the information offered at the traineeship market. A positive development!

If you are considering a certain traineeship, then contact the staff member of the **chair group** concerned who is specified in the prospectus as the contact. This may be the professor, one of the scientific staff members or a PhD-student. Do not hesitate to do so. These people will not feel that you are bothering them; on the contrary, they will be flattered that you have an interest in their field! Remember that they are most adept to any developments in the field concerned and that they, more than anyone else, are qualified to inform you of the future possibilities within their specialism.

You can meet with the **study advisor** for general information and the details of planning your traineeships. It is important to keep a number of practical matters in mind - particularly if you are on a tight schedule or if you are considering a traineeship outside Nijmegen - such as: when do I take the master courses and the philosophy course? The study advisor is not a specialist on the field of the content of a traineeship and so, if you request information concerning content, she will refer you to the persons who can best answer your questions: the staff members of the department concerned.

Once you have chosen a certain traineeship, make sure that you have made adequate arrangements and agreements with your future supervisor. Discuss all of the aspects that may play a role during the actual practice of the traineeship. To that end, complete a traineeship planning form together. The form is available on the website www.biowetenschappen.science.ru.nl. Below you will find a **list of agreements** that may prove useful upon deciding on a trainee post. Upon completing your traineeship, you are to complete the traineeship-evaluation. that you can also find on the above mentioned website. The completed form is to be handed in at the Secretariat Biology. In this way, the Programme committee will remain well-informed of the quality of the departments that offer traineeships.

3.7 List of agreements for a traineeship

Before a traineeship can begin, it is essential that the student and the direct supervisor in any case discuss the following matters. It is therefore recommended that you take this list with you for your first meeting with your (future) traineeship supervisor!

1. Content of the research

- What is the core question of the research within the traineeship?
- In which way does the traineeship make up part of the research of the department?

2. Research methods

- Which research techniques will be used?
- Which other specific research methods will be used?

3. Duration of the traineeship

- What is the time span of the practical work?
- What is the time span of the theoretical work?

4. Schedule

How much time is reserved for:

- studying literature and preparations?
- practical work?
- reporting?
- theoretical component?

5. Time for supervision

- How intensive and in which manner will the student be supervised?
- If there is more than one supervisor, then who does what?

6. Progress consultations

- How often will there be discussions between the student and the supervisor on the student's progress?
- What is discussed exactly?

7. Evaluation of the practical component

- Which items make up the practical component of the traineeship?
- How is the assessment of the practical work incorporated in the final mark? Which assessment criteria are observed in this respect?

8. Theoretical component

- How will the theoretical component be worked out?

9. Working hours

- How can the working days be arranged?
- Are the working hours fixed or flexible?

10. Working environment and facilities

- Will the student have his/her own workplace?
- Are there any risks or safety issues that should be kept in mind?
- Can the student use computer facilities?

11. Completing the report

- How much time is available for the completion of the report once the student has finished the practical work?

12. Completing the thesis

- How much time is available for the completion of the thesis once the student has finished the practical work?

3.8 Evaluation of a traineeship

It is important that the Educational Institute Biosciences comes to know about good qualities and also sometimes bad qualities of the research departments. Therefore the Educational Board asks from every traineeship an evaluation by the student. To evaluate the research department, the supervision, the materials on the department one can make use of the evaluation form on the website: www.ru.nl/biowetenschappen It is called Format Evaluation Internship and it can be found under the button Forms.

3.9 Writing a thesis

Purpose of the thesis
You will have to learn to generate scientific articles in an abridged form and in your own words. In doing so, you must:

- present a (medical) biological subject in a structured fashion in the form of a report using various articles from scientific journals;
- learn to work with various literature systems.

The subject of the thesis

A specialized subject pertaining to the field of your main traineeship that is readable and comprehensible for a broad public.

Procedure

The subject is to be worked out in more detail on the basis of a number of basic articles or review articles and using various literature systems. It is important that you formulate, deal with and then solve a problem in your thesis. In doing so, you are not only to make use of other articles in addition to the basic article, but also of the knowledge that you have acquired in other courses. For example, guidebooks may prove useful in helping you to use and reproduce technical terms in the correct fashion.

Structure of the thesis

Each thesis must comprise the following:

- title page (title, name of the author, place and date);

- a brief summary (in English, if required);
- an introduction in which a problem is formulated;
- a section in which the burden of proof, the articles used, is/are examined;
- a discussion with critical comments with respect to the articles that are used and conclusions concerning the problem as formulated;
- a reading list.

It is recommended that you timely discuss the set-up of your thesis with your supervisor so that you do not meet with any surprises later on.

If you are experiencing problems in writing your thesis, then discuss this with your supervisor in time. You can also discuss the situation with the educational advisor, a tutor or a teacher that you get along with well.

The Student Affairs Office

The Student Affairs Office regularly offers the opportunity to take a course 'Writing a thesis'. This training course is intended for students who have already began writing a thesis and so it is required that you already have a subject. This course deals with the following aspects: working through and processing literature, preparing to formulate the problem, the set-up of the thesis and the scheduling. You can contact the Desk Student Affairs for more information on the course and if you wish to register (Comeniuslaan 4).

Academic Writing Centre Nijmegen

The Academic Writing Centre Nijmegen (in Dutch: ASN) offers every student or teacher support based on one's individual needs concerning the execution or supervision of academic writing tasks. This support may vary from coaching with respect to various writing assignments to workshops in writing skills to assistance in sophisticating one's writing didactics. The services of the ASN are easily accessible, free of charge and intended for anyone associated with the university so as to contribute to developing a high-quality academic writing culture.

Visit www.ru.nl/asn for more information.

3.10 Overview departments for traineeships

Plant Cell Biology

Head of the department: Prof. dr. C. Mariani

Staff: Dr. I. Rieu
Secretariat: Else Schaberg, HG 2.309, 024-3652777, e.schaberg@science.ru.nl
Website: http://www.ru.nl/pcb/

At the department of Plant Cell Biology (PCB) we aim to understand how plants adapt to stress. Plants continuously have to cope with stress, e.g. as caused by changing or

unfavourable environmental conditions, by resource deficiencies or by biotic agents such as pathogens or herbivores. In our research we try to discover the genetic, molecular and physiological processes that underlie the adaptation to various stresses and thus confer tolerance. We closely collaborate with other members of the Institute of Water and Wetland Research at the RU, research groups from the national graduate school Experimental Plant Sciences, a number of foreign research groups and several plant biotech companies. You can find a detailed description of our research projects under Research. Furthermore we are involved in teaching at the BSc, MSc and PhD level, as you may read under Courses and Student Projects.

Research themes:

Heat stress adaptation
Exposure of plants to high temperatures imposes constrains on growth and can markedly affect development and reproductive success. Major physiological effects are male sterility and abnormalities in fruit development. This is a considerable problem in fruit production in many parts of the world: E.g. tomato plants grown around the Mediterranean frequently suffer from high temperature stress, resulting in reduced fruit set and suboptimal fruit quality. In this research line we aim to discover how plants adapt to high temperatures and what determines the level of heat stress tolerance, looking at genetic determinants and epigenetic and transcriptomic responses.

Hypoxia signalling
Oxygen is a necessity for most forms of life. To be able to avoid the potentially life-threatening situation that arises upon reduced oxygen levels (hypoxia) most organisms have systems in place to measure intra-cellular oxygen availability. Although plants frequently encounter hypoxic conditions, so far there is very limited knowledge on the primary hypoxia signalling pathway in these organisms. In this line of research we aim to unravel how plants sense the oxygen availability and modify gene expression in response by using state-of-the-art methods available for the model plant Arabidopsis thaliana.

Water stress tolerance in Solanum dulcamara
Solanum dulcamara (Bittersweet) has an exceptionally wide habitat range with regard to water availability, thriving both in the dry sand dunes along the coast and in wet areas, such as river flood plains. In the B'sweet initiative, a collaboration between several research groups of the IWWR, we study this phenomenon from the molecular up to the ecological level. In particular, our group is interested in deciphering the signalling pathway by which flooding induces adventitious root outgrowth, focusing on the role of hormones and early responsive genes.

Pathogen resistance genes in Solanum
Species of the genus Solanum comprise wild plants but also many cultivated species such as tomato and potato. Wild Solanum species frequently show resistances to biotic and a-biotic stress factors that can be useful for crop improvement. For example, Solanum dulcamara (Bittersweet) shows clear resistance to Phytophthora infestans, the cause of late blight disease. We have previously made an extensive collection of various bittersweet ecotypes and we are using them to identify and clone new resistance genes (R-genes) against this pathogen.

Similarly, an extensive collection of other Solanum species from Indonesia is used to map the R-gene against the bacterium Ralstonia solanacearum, the cause of brown rot in potato.

Information for students

Student projects (internships) are available for Biology, Molecular Life Science and Natural Science students in all of our research projects. This means students can get acquainted with a range of scientific approaches, including genetics, molecular biology, cell biology, plant physiology and bioinformatics. If you are interested, please feel free to visit our department and talk to the researchers. An appointment can be made with Dr. Ivo Rieu (i.rieu@science.ru.nl or +31 (0)24 3652777/61). We can also accommodate students from the HLO and students from abroad.

Plant Genetics

Head*:* Prof Dr T. Gerats
Scientific Staff*:* Prof Dr Tom Gerats, Dr Janny Peters

Secretary*:* Else Schaberg, HG02.309, Tel 024-652777, e.schaberg@science.ru.nl

Website*:* http://www.pg.science.ru.nl/

Research:

- Functional analysis of genes involved in flower development and evolutionary aspects of flower development
- Effect of chromosome structure on recombination frequency
- Map-based cloning of genes responsible for particular mutant phenotypes
- Water stress tolerance in *Solanum dulcamara*

Description of research:

We study the function of homeotic genes involved in determining how the four main organs of the flower develop in Petunia hybrida. We aim to analyze how flower development is regulated genetically and what the evolutionary background is of these developmental processes (for relevant publications see: http://www.pg.science.ru.nl/en/michielvandenbussche.html).

Analysis of changes in recombination behaviour upon deletion of parts of specific chromosomes. The deletions are caused by irradiation and will be detected by analysis of molecular markers such as SNPs. The recombination events in the next generations will be analysed.

With the help of AFLP and other molecular markers the gene(s) responsible for specific mutants in Arabidopsis can be determined using a map-based cloning approach. In these projects we regularly collaborate with other laboratories that have interesting mutants to be identified.

As a participant of the B'sweet Initiative we collaborate with Plant Cell Biology, Experimental Plant Ecology and Ecogenomics and use *Solanum dulcamara* to study water stress tolerance. As an example of our contribution: recently we studied the genetic variation in natural *Solanum dulcamara* populations from flooded and dry habitats in the Netherlands.

Opportunities for Master students:

The research is particularly suitable for students interested to perform plant molecular work with a genetic basis. Techniques used in our laboratory: high-throughput DNA isolation, (Q) (RT) PCR, molecular marker technology, (cDNA) AFLP, running a LI-COR sequencer, GATEWAY cloning technology, transposon insertion mutagenesis, RNAi, plant transformation, in situ hybridization, 2,3,4 yeast hybrid, genome walking, (S)EM.

In addition plant work in the greenhouse is very important, e.g. phenotyping of mutants, making crosses.

The differentiation course 'plant genome analysis' is recommended.

Molecular Animal Physiology

Head: Prof.dr G.J.M. Martens, mailto:g.martens@ncmls.ru.nl

Scientific staff: Dr F. van Herp

Office: dhr. B. Portier, 3610565/10564, b.portier@ncmls.ru.nl

Website: https://rumba.science.ru.nl/text/edit/15441/www.ru.nl/molanphys/

The Department of Molecular Animal Physiology is part of the Donders Centre for Neuroscience and housed in the Nijmegen Centre for Molecular Life Sciences (NCMLS). Examples of our current research activities and possibilities for student projects are:

A. The molecular basis of psychiatric disorders: effects of (epi)genetic and environmental (early-life stress) factors on brain development

Early pre- or postnatal stress together with genetic background may play an important role in the development of psychiatric disorders such as schizophrenia. To study gene x environment interactions, we examine a rat model, the so-called APO-SUS and APO-UNSUS rat lines; APO-SUS rats display deficits observed in schizophrenia. We explore differences in the (epi)genetic make-up and brain mRNA/protein expression profiles between the APO-SUS and -UNSUS rats. We try to link the (epi)genetic and expression differences to molecular pathways responsible for the behavioural phenotypes. Furthermore, we study genetic variations in genomic DNAs from schizophrenic patients to obtain insight into susceptibility pathways for psychosis. Our research may lead to a better understanding of the highly complex mechanisms underlying schizophrenia and related complex neurodevelopmental disorders.

B. The molecular regulatory mechanisms in the regulated secretory pathway of neuroendocrine cells

We explore the physiological roles of a number of proteins of unknown function, including proteins of the secretory pathway. The studies include the generation and analysis of transgenic *Xenopus* with intermediate pituitary (neuroendocrine) cell-specific transgene expression. In addition, we apply biochemical +/- approaches (differential display proteomics) to identify novel neuroendocrine proteins.

C. Linking behavioral somatosensory learning in rats with gene expression profiles (in collaboration with Dr. Peter De Weerd, University of Maastricht)

We are interested in characterizing gene expression during the acquisition of skills. We use the whisker system in the rat as a model system because it permits the controlled delivery of stimuli in somatosensory cortex (barrel cortex). This research fits in a larger program where links are sought between gene expression, molecular pathways and cognitive processes, for both rats and primates, with the ultimate goal of influencing learning through anti-sense or other techniques.

Techniques used include gene transfer approaches (such as microinjection of DNA to generate transgenic *Xenopus* frogs), (2-D) protein separation, proteomics, mass spectrometry, (real-time quantitative/arbitrarily primed)-PCR, microarray analysis (mRNA expression profiling), mutagenesis, SNP/CNV genomic analysis, cell culture, electron/fluorescence microscopy, (live) imaging, and behavioral tests (operant conditioning, psychophysics, staircase threshold measurements).

There are no strict requirements; inclusion of the Differentiation courses Cell Biology, Molecular Biology, Neurobiology and Developmental Physiology in your training schedule is however advised for this internship.

Cellular Animal Physiology

Head: Prof. dr. E.W. Roubos

Staff: Dr B.G. Jenks, 3653335 and dr W.J.J.M. Scheenen, 3652036

Secretariat: G. Hulzebos, 3652702, g.hulzebos@science.ru.nl

We perform fundamental and applied research on adaptation and cognitive processes, with particular emphasis on intercellular and intracellular communication in the brain and pituitary gland. In this endeavor we take a multidisciplinary approach involving morphological, molecular, biochemical and electrophysiological methods.

The traditional core of our research has been the analysis of neuroendocrine integration using an amphibian model, background adaptation in the South African clawed toad, *Xenopus laevis*. Amphibians have the remarkable ability to change their skin color in response to the color of background. In animals on a white background the pigment in dermal melanophores

is concentrated in a perinucular position and consequently the animal appears white. In animals on black background there is a release of the peptide a-melanophore stimulating hormone (a-MSH) from the pars intermedia of the pituitary gland. a-MSH stimulates the dispersion of the pigment in the dermal melanophores and consequently the animals skin darkens. We use this eye-brain-melanotrope system to study mechanisms of signal transfer.

Current studies are focused on the role of Brain-Derived Neurotrophic factor (BDNF) in synaptic plasticity, the role of CRF, urocortin and their receptors in stress adaptation, neuropeptides in volume transmission via the cerebral liquor and characterization of integrative function of the melanotrope cell at the level of neurotransmitters, receptors, ion channels, second messengers and calcium sensing. In recent years our reseach has expanded to mammalians, namely the rat and mouse. In mammals a large body of evidence has emerged linking chronic stress with increased vulnerability for depression and anxiety disorders. As corticotropin-releasing factor (CRF) is hypersecreted under these psychological conditions, we study underlying brain mechanisms possibly causing these disorders. Urocortin (Ucn), a recently discovered member of the CRF peptide family may play a role in the pathophysiology of stress-induced disorders.

Our results support the hypothesis that CRF and Ucn neuronal systems work in concert in response to acute challenges, but are inversely regulated in their activities during chronic hyperactivity of the hypothalamo-pituitary-adrenal axis.

Organismal Animal Physiology

Head: prof.dr. G. Flik

Staff: dr. P.H.M. Klaren

Contact: mw. D. Maurits, 3653242, D.Maurits@science.ru.nl

The department's research program focuses on the regulation of stress-adaptation, in particular on the role of communication between neuro-endocrine systems (hypothalamus-pituitary gland-adrenals axis, hypothalamus-pituitary gland-thyroid gland axis) and the immune system. Stress requires careful regulation of energy expenditure and therefore stress regulatory systems receive priority over systems regulating reproduction, immunity, growth and feeding: stressed animals tend to show poor growth, not to eat or reproduce, and get sick. Stressors, such as high population or stock densities (crowding) and temperature changes, affect growth negatively and result in an increased susceptibility for diseases, the latter due to suppression of the immune system. Several hormones from the pituitary, thyroid gland and adrenal (e.g. prolactin, growth hormone, ACTH, MSH, endorphines, thyroid hormones and cortisol) are involved in the adaptation to these stressors, resulting in a (partial or complete) recovery from the stressful conditions. A remarkable role is played by leptin, a hormone related to energy regulation via control over fat stores; fish can experience starvation under many natural conditions and leptin's role in energy regulation may be fundamentally different in ectotherms like fishes, compared to endothermic mammals.

The physiology of stress-adaptation is studied in fish (adults, as well as stages in early development), in particular the structure and function of systems involved in adaptation

(brain, pituitary, gills, gastro-intestinal tract, adrenals, immune system, etc.) at the molecular, cellular, organ and organism level. Techniques from physiology, biochemistry and molecular-biology are employed, as are a wide range of imaging techniques: light- and electron-microscopy, confocal laser scanning microscopy and functional MRI. Immunocytochemistry and in-situ hybdridisation are important applications in our imaging program.

Within the Institute for Water and Wetland Research we collaborate with the departments of Animal Ecophysiology (stress in reef fish), Microbiology (probiotics and feeding) and Botany (vegetarian feed in fish aquaculture). Other research groups we collaborate with are the departments of Cell Biology and Immunology, and Aquaculture and Fisheries at Wageningen University, groups in Belgium (Antwerp (fMRI), Leuven) and Canada, and (in the context of EU collaborations) Norway, Portugal, Spain, France and Greece. In collaboration with IMARES (IJmuiden/Yerseke) we run a program on pain and welfare in fish.

Furthermore, a line of research on bone physiology in fish is supported by a SMARTMIX grant of the ministeries of Economics and Education; in this research zebrafish and carp are used as model fish to study osteogenesis in dermal scales as a tool to develop medication against osteoporosis. A close collaboration with the consortium partners in Leiden, Amsterdam and Utrecht as well as with the department of Dentistry at the RU is ongoing.

Beyond studies at the RU, master's students are welcome to spend some time abroad; in those cases part of the internship is fulfilled in Nijmegen in preparation for the stay abroad.

Experimental Plant Ecology

Head: prof.dr. J.C.J.M. de Kroon

Staff: dr. E.J.W. Visser, mw.dr. H. Huber, G.M. Bögemann, mw. J.W.E. de Caluwe, mw. A.E. Tiekstra

Office: mw. J.J.M. Broekmans, HG01.025 , 024-3652410, J.Broekmans@science.ru.nl

Contact: dr. E.J.W. Visser, HG01.129, 024-3653382, Eric.Visser@science.ru.nl

Website: http://www.ru.nl/plantecology/index.html (ook voor stageonderwerpen)

Natural habitats are not homogeneous but heterogeneous. Essential resources for plant growth (such as water, mineral nutrients, light) and biotic factors (such as pathogens and herbivores) are not evenly distributed in natural environments. On the contrary, field research has shown that all natural habitats show a patchy distribution of resources and other abiotic and biotic environmental factors, and that this variation is expressed at different scales in space and in time. As a research group, we focus on the study of **functional responses of plants to environmental heterogeneity**. In other words, we are interested in the general ecological question of how plants can cope with a variable environment, and what traits they have developed to maximize their performance in a spatially and temporally heterogeneous environment.

Plants have developed a broad array of adaptive mechanisms to increase resource extraction from patchy habitats. These traits are often referred to as **foraging behavior**, because they are analogous to the search behavior of browsing animals. Plant foraging by roots and shoots relies mainly on morphological and physiological adjustments which are triggered by environmental factors, and which are internally coordinated by hormonal signaling. Such inducible responses are also called **phenotypic plasticity** and they play a central role in our current research program. We are mainly focusing on the mechanisms behind the expression of plasticity (e.g., petiole elongation in response to shading, root proliferation in response to patchy nutrient supply), on genetic diversity in these mechanisms, and on ultimate costs and benefits of plastic adjustments to environmental conditions.

A significant portion of our research is devoted to the study of **clonal plant species**. They can produce genetically identical copies of themselves by the formation of little offspring plants on horizontally growing stems. This mode of growth results in the formation of potentially extensive networks of plants which are physically linked to each other. We are mainly interested in ecological implications of these connections, as they allow for the transport of resources to young plants (post-natal care), and they allow for a division of labor in resource capture within the network.

Riverine grasslands form an ideal model system a fascinating ecological arena for our main research activities. These systems can be found along large water streams (e.g. river Waal) and its vegetation is characterized by a strong gradient in species composition ranging from flooding-tolerant species near the water level to more drought resistant plants further uphill. Our group has a long tradition in studying the physiological causes and ecological consequences of variation in **flooding tolerance** within and between species, and this tradition (combined with questions of phenotypic plasticity and foraging) is continued in a number of ongoing projects. We are currently most puzzled by the unresolved question of what environmental factors and plant-specific characteristics determine the upper and the lower boundaries of species distribution on a flooding gradient.

In close connection to the above-mentioned questions, we are investigating the **micro-evolutionary dynamics** of a few model species (e.g. Trifolium repens) in riverine grasslands. In spite of very strong environmental selection pressures these species show extraordinarily high levels of genetic diversity. We aim at finding out how natural selection operates in the field (e.g., what favors and dis-favors certain genotypes) and what factors contribute to the generation, maintenance, and erosion of genetic diversity. We are using a combination of ecological, physiological and molecular techniques to study different aspects of selection and micro-evolution in the field.

Ecogenomics
Animal Ecology and Ecofysiology

Head: prof. dr. G. van der Velde
Staff: prof. dr. G. van der Velde, dr. I. Nagelkerken

Office: drs. P. Charpentier, HG 01.014, 3652476, p.charpentier@science.ru.nl

The research of the department is focused on ecology and ecophysiology, population biology and the study of faunal communities, in relation to abiotic and biotic factors. It concerns particularly aquatic animals, invertebrates and fishes. The techniques used vary from SCUBA diving and other types of field observations and sample collection, to advanced analytical, microscopical and physiological techniques. Research on terrestrial ecology is possible through the cooperation of the department with the Foundation Bargerveen (http://www.barger.science.ru.nl). Their research is focused on biodiversity in relation to habitat destruction and restoration.

Possibilities for student internships (stages) are:

1. Bioinvasions and their consequences:

- Bioinvasions of exotic animals in the Dutch rivers
- Biofouling research: ecophysiology and ecology of sessile aquatic animals which cause economical damage to shipwalls and ducts, such as mussels, barnacles and tube-worms.

2. Tropical ecosystems:

- Coral reef fish communities, and nursery functions for coral reef fish of mangrove forests, seagrass beds and other biotopes (mainly on the Dutch Caribbean islands and along the coast of Tanzania).
- Foodweb studies in tropical wetlands (fishes, invertebrates, birds)
- Genetic exchange between populations (fishes, molluscs)

3. European ecosystems:

- Faunal biodiversity of complex landscapes. Differences between faunal composition of affected habitats, habitats under restoration, and intact habitats (mainly abroad) in relation to environmental factors.
- Excursions to areas in Europe (e.g. Ireland, Serfaus) where the faunal diversity is still comparable to that of The Netherlands, fourty to fifty years ago.
  Length: 2 weeks; open for M.Sc.-students and HBO-students in their final year.

Aquatic Ecology & Environmental Biology

Head: prof.dr. J.G.M. Roelofs
Staff: dr. L.P.M. Lamers, dr. A.J. Smolders

Office: mw. J.Broekmans, 3652902, j.broekmans@science.ru.nl

The department investigates processes that determine the distribution and abundance of organisms in aquatic and semi-aquatic habitats with a focus on macrophytes and macrofauna. The department is part of the Institute for Water and Wetland Research (IWWR). Research takes place in riverine ecosystems, fens, bogs and poorly buffered surface waters.

Aquatic Ecology and Environmental Biology: plant species in poorly buffered surface waters, fens, bogs and riverine habitats.

- The impact of sulphate and nitrate load on the nutrient cycles in surface waters and

nutrient poor ecosystems is studied in meso-cosm experiments. The role of micro-organisms in these cycles is explicitly taken into account
- Research into the possibilities for the restoration of floodplains, fens, bogs, seepage mires and pine forests degraded by eutrophication, dessication, and acidification. Re-establishment of severely threatened species from poorly buffered ecosystems is investigated in large field experiments and in chemostats in the lab.

Microbiology

Head: Prof.dr.ir. M.S.M. Jetten

Staff: dr. J.T.M. Keltjens, dr. H.J.M. Op den Camp, dr. L.A. van Niftrik, dr. B.K. Kartal

Office: mw. M. Uijt de Haag, 3652940, mailto:mariauyt@science.ru.nl

Contact for interships: dr. H.J.M. Op den Camp (h.opdencamp@science.ru.nl, tel. 52657)

Website: http://www.ru.nl/microbiology

Research aim: Ecophysiological microbiology is aimed at the diversity and activity of microorganisms in their natural environment, on their mutual interactions and on their survival strategies. The research is focused on the microbial ecology of freshwater systems and in particular on the microbial processes at the very dynamic oxic/anoxic interface between the sediment and the water column. Besides ecological aspects, also the biochemistry, molecular biology and ecophysiology of relevant trophic groups of bacteria involved in the carbon, nitrogen and sulfur cycles are studied.

Description of research: A major research topic is the microbial nitrogen cycle and more specific, the chemolithoautotrophic bacteria active in this cycle: in the first place anaerobic ammonium oxidizers (anammox), but also aerobic ammonium oxidizers and aerobic nitrite oxidizers. The microbiological research of anammox, in which ammonium and nitrite are converted to nitrogen gas with hydrazine as an intermediate, is leading in the world. More generally, we investigate the interactions of the above-mentioned three groups of autotrophs at the oxic/anoxic interface, and their application in wastewater treatment.

Volatile sulfur compounds are very malodorous and toxic, and are also produced in a number of industrial processes. Further, they have a major impact on global warming and acid precipitation processes. Research is focused on the bacterial production and degradation of volatile organic sulfur compounds. Studies of the degradation are coupled to the application of promising bacterial isolates in treatment of polluted air.

Methane oxidizing bacteria (methanotrophs) utilize methane as their sole source of carbon and energy. Methanotrophs play an important role in the oxidation of methane in natural environments (wetlands, freshwater systems). This research is conducted in close cooperation with the Department of Aquatic Ecology and Environmental Biology and focuses on the function, identity and ecophysiology of both aerobic and anaerobic methanotrophic bacteria in wetland ecosystems.
The experimental approach is polyphasic, including ecophysiology, molecular ecology, biochemistry, cell biology and environmental genomics. We are interested in how

biochemistry/cell biology determine the ecological niche differentiation of the bacteria and which environmental factors determine the qualitative and quantitative output of the respective elemental cycle to the atmosphere.
Techniques used include enrichment and continuous culture of relevant bacteria in laboratory bioreactors, fluorescence in situ hybridization (FISH), PCR amplification, DNA sequence analysis, denaturing gradient gel electrophoresis (DGGE), 2D-gel electrophoresis, MALDI-TOF mass spectrometry, bioinformatics, stable isotope probing, gas chromatography, HPLC analysis and a variety of protein purification methods.

Opportunities for students: In all of the aforementioned research topics several projects are available for Biology students. As a result of the on-going research, projects are constantly be reformulated. The student is supervised by a Ph.D. student, post-doc or staff member. Especially in the first part of the training guidance will be intense: regularly with the supervisor, weekly sessions with other members of the research group. In this period the student will be introduced to literature, and techniques relevant for his/her topic. In the second part of the training the student will show him(her)self more initiative in planning, designing and performance of experiments. At the end of the experimental period a report has to be written and the work is presented in a seminar. In addition, a literature thesis has to be written on a subject not related to the own research. The theoretical examination consists of capita selecta of modern microbiology; the student will be consulted with respect to the choice of the material.

Requirements:
To start with the internship "microbiology", one of the specialized microbiology courses (Physiological Microbiology and Ecological Microbiology) is recommended. As an introduction to the training the research practical 'Microbiology' (BSc level, contact person: dr. H.J.M. Op den Camp) is very useful.

Cell & Applied Biology

Head: prof.dr. E.J.J. van Zoelen (contact person)
Staff: Dr. A.P.R Theuvenet, Dr. J.E.M. van Leeuwen, Prof.dr. W. Olijve, Dr. K.J. Dechering

Secretary: mw. J. Rullmann-Freriks, HG02.204, 3652701, j.rullmann-freriks@science.ru.nl

Website: http://www.celbi.science.ru.nl/ (also for more information on traineeships)

Research in the department focusses on the role of polypeptide growth factors in the control of proliferation and differentiation of normal cells, stem cells and tumor cells. Use is made particularly of cells grown in tissue culture, using a combination of cell biological, molecular biological, biochemical, biophysical and bioinformatical approaches. There are three lines of research in the department:

1. **Lineage-specific differentiation of human mesenchymal stem cells (MSCs):** MSCs from bone marrow are able to differentiate in vitro into bone, cartilage or adipose (fat) cells. Using genome-wide expression analysis by microarray techniques we are studying the gene expression profiles of MSCs during growth factor-induced lineage-specific

differentiation. The role of regulatory genes (generally nuclear transcription factors) is being studied by lentiviral overexpression and shRNA-mediated repression. These studies are important for regenerative medicine in patients with osteoporosis or arthritis.

2. **Intracellular targeting of ErbB receptors**: After ligand binding ErbB receptors are internalized and degraded in lysosomes. Impairment of this process can result in enhanced mitogenic activity and cancer. In our studies, emphasis is placed on the role of E3 ligases and deubiquitinating enzymes, which control the ubiquitination and intracellular sorting of the internalized ErbB receptors.
3. **Allele-specific PDGFRA expression in human glioma cells**: PDGFRA plays an important role in neural development. We have detected multiple polymorphisms in the PDGFRA promoter region, based on which strong (H2a) and weak (H1) haplotypes can be identified. We have shown that the H1 allele predisposes to neural tube defects but protects against glioma brain tumors. Current studies focus on the haplotype-specific expression regulation of PDGFRA in cultured glioma stem cells.

Recommended for traineeships: 2nd year course Animal Cell Biology and 3rd year course Medical Biotechnology

Molecular biology

Head: prof. dr. H.G. Stunnenberg

Staff: dr. C. Logie, dr. G.J.C.Veenstra

Contact: mw. M. van den Goor, 3610523, m.vandengoor@ncmls.ru.nl

Gene expression and epigenetics (Prof. Dr. H.G. Stunnenberg)
We explore the binding of factors to chromosomal loci and the histone code; a combinatorial epigenetic code of histone modifications that determines the expression status of individual genes. We use embryonic stem cells,
normal and cancer cells in chromatin immunoprecipitation approaches with focus on members of the nuclear receptor superfamily and their co-factors.

Malaria Epigenetics and Proteomics (Prof. Dr. H.G. Stunnenberg)
On the one hand we are using large-scale high accuracy mass spectrometric proteome analysis of the human malaria parasite Plasmodium falciparum to identify proteins and their post-translational modifications and on the other hand we are profiling epigenetic histone post translational modifications so as to understand how the malaria parasite orchestrates its gene expression program in the course of its life cycle.

Chromatin motors (Dr. C. Logie)
We are interested in the relation between chromatin structure and the biochemical processes that direct chromosome metabolic events such as transcription, replication, recombination, repair, segregation, condensation and cohesion. Our current research focuses on two multi-protein ATPases: SMC and SNF2. We use human cells, wild type and cancer cells as well as the yeast S.cerevisiae to modify and purify chromatin motors. The scientific problems we are

currently tackling are the elucidation of the proteomic context of these ATPases, identification of their temporal window of action within the cell cycle and discovering the mode of regulation of these complexes by kinases and acetylases.

Embryonic gene regulation (Dr. G.J.C. Veenstra)
Focus of this line of research are the regulatory transitions in gene expression during early vertebrate embryogenesis, using Xenopus as a model system. We study newly discovered proteins that are related to known general transcription factors but are unique to metazoans or vertebrates, in addition to studies of epigenetic regulation in early development and differentiation. We explore the contribution of these proteins to developmental pathways and novel molecular mechanisms of gene regulation. In addition we are involved in experimental annotation of the embryonic Xenopus tropicalis genome using ChIP-sequencing and RNA-sequencing using modern NextGeneration sequencing technology. This research contributes to our understanding of both normal and abnormal development, growth and differentiation.

Web site: http://www.ncmls.nl/molbio

Requirements
Students are expected to have successfully completed the courses Biochemistry and Molecular Biology II and Functional Genomics prior to applying for an internship at the department.

Bioinformatics, Centre of Molecular and Biomolecular Informatics (CMBI)

Department of Bioinformatics
(CMBI -Centre for Molecular and Biomolecular Informatics)

Head of the department:
Prof. Dr. G. Vriend.
Scientific Staff:
Dr. C. van Gelder, prof. dr. M. Huynen, dr. G. Schaftenaar, prof. dr. R. Siezen, prof. dr. J. de Vlieg.
Secretariat:
B. van Kampen, CMBI 260 Room 0.02 (NCMLS building), tel: 3619390, email: B.vanKampen@cmbi.ru.nl.
Contactperson about education: Dr. C. van Gelder, email: C.vanGelder@cmbi.ru.nl.
Website: http://www.cmbi.ru.nl/.
Research groups

- Bioinformatics of protein structures
- Bacterial Genomics
- Comparative Genomics
- Computational Drug Discovery

Bioinformatics of protein structures (prof. Dr. G. Vriend, e-mail: G.Vriend@cmbi.ru.nl). Proteins are very complex molecules. Despite many years of research every day something new is discovered about their structure or function. We work on sequence - structure - function relation analyses of proteins, and on methods for gathering, disseminating, validating and mining data related to proteins (structures, sequences, mutations, ligand binding, expression profiles, etc). The prediction of protein structures and the effects of mutations as well as molecular visualisation are important aspects of our work. We often collaborate with biologists and medics to solve real problems with a real biomolecular origin, like a disease.

Bacterial Genomics (prof. Dr. R.J. Siezen, e-mail: R.Siezen@cmbi.ru.nl). Gram-positive bacteria play an important role in different aspects of food fermentation, ingredient production, food safety and health. In collaboration with NIZO food research (Ede) and the Top Institute Food and Nutrition (Wageningen), bioinformatics tools are being used to analyse and compare complete genomes of food-relevant gram-positive bacteria. Emphasis is put on the positive attributes of lactic acid bacteria (Lactococcus, Lactobacillus, Streptococcus) and the negative attributes of pathogenic and spoilage bacteria (Listeria, Bacillus cereus, Clostridium).

Comparative Genomics (prof. Dr. M. Huynen, e-mail: M.Huynen@cmbi.ru.nl). The -omics era is characterized by tremendous amounts of data (genome sequences, single nucleotide polymorphisms, gene expression data, proteomics data, metabolite concentrations data), and by (relatively) little understanding of these data or of their value for biology. Within the computational genomics group we try to bridge the gap between experimental data and biological knowledge. We focus specifically on prediction of protein function, and protein-protein interactions such as observed in protein complexes or biochemical pathways. In doing that we are not only interested in the functions of the proteins and their interactions in man, but also how these interactions have evolved.

Computational Drug Discovery (prof. Dr. J. de Vlieg, e-mail:jacob.devlieg@merck.com and Dr. S.B. Nabuurs, e-mail: S.Nabuurs@cmbi.ru.nl). Key goal of the Computational Drug Discovery (CDD) group is to develop computer-based techniques for structure-based drug design and translational sciences. The CDD group is working closely together with the Department of Molecular Design & Informatics (MDI) of MSD, resulting in a unique collaboration between academic research and industry. Computational techniques have created many opportunities to accelerate and rationalize the multidisciplinary drug discovery process, and provide novel approaches to the design of drugs. In silico technologies play a critical role in catalyzing the intensive "wet-dry" cycle and linking the chemistry and biology that characterizes modern drug design. In the CDD group a variety of scientific methods are developed and applied including molecular profiling analysis, text mining, computer-based simulation methodologies and integrative chem-bioinformatics techniques.

Opportunities for students:

- Suitable for Biology, Molecular Life Sciences, Chemistry and Natural Sciences students.
- For internships in the groups of Prof. Siezen or Prof. Huynen the course Vergelijkende Genoomanalyse (SB116B) is mandatory.
- For internships in the group of prof. Vriend the course Structuur, functie en bioinformatica (SB113B) is recommended.
- For internships in the group of prof. de Vlieg the courses Structuur, functie en bioinformatica (SB113B) and Computational Drug Discovery (CMBI101) are recommended.

Bioinformatics-track in MSc Biology

Students who are interested in bioinformatics can follow the bioinformatics track (B-track) in the MSc programme of Biology. In addition to their MSc diploma Biology they will receive a diploma supplement stating that they followed the B-track program. Within the B-track both research projects (stages) have to have a bioinformatics research topic. One of the stages has to be followed at the CMBI, the other can be followed at other departments of FNWI and UMC. B-track students have to follow in total 25 EC of bioinformatics classes in their BSc and MSc phase. At least 16 EC of these courses needs to be at MSc level. There is a list of courses available which contains bioinformatics and bioinformatics-related (mainly statistics, data management and informatics) courses, both from the RU as well as from other universities. The student can also suggest courses for the B-track. More information about the B-track can be found at www.cmbi.ru.nl/btrack or contact dr. C. van Gelder (C.vanGelder@cmbi.ru.nl).

Biophysics

Head: prof.dr. A.J. van Opstal
Staff: prof. dr. A.J. van Opstal, dr. T.F. Oostendorp, dr. J. Goossens, dr. D. Schubert and prof. dr. H.J. Kappen

Contact: prof.dr. A.J. van Opstal, 3614251

The research activities in the department of Biophysics use a physical approach in the study of the most complex living system: the brain. Research student candidates need a good mathematical background and should have completed the third-year course Neurobiophysics.

Research on Brain and Behaviour

Our central research theme is neuronal information processing and perception of sensory signals and the generation of adequate motor responses. The various teams concentrate on several key issues within this central topic, using a variety of different approaches -such as

electrophysiology, psychophysics, behavioural analysis and computer simulations- which are used in both human subjects and in trained animals:

1) Sensorimotor transformations

- Neural representation of visual and auditory targets in extra-personal space.

- Study of the neural processing underlying the generation of fast goal-directed eye- and head movements.
- Fusion of visual, auditory and vestibular information for navigation and spatial oriëntation.

2) Movement coordination

- Coordinated activation of muscles for the generation of force and movement.
- Coordination of eye and head movements.

3) Neuroinformatics

Modern neuroscience has shed light on the mechanisms providing the huge capacity for information processing of the primate brain. Each neuron is quite slow compared with the processor in a modern computer, but the superior performance of the human brain

stems from the fact that large numbers of cells are active in parallel. An important topic of research is how neural communication and self organization of neural networks can provide the capacity for the execution of complex sensorimotor tasks.

4) Bio-electricity

The team concentrates on the characterization of electrical sources accompanying the manifestation of neural (mainly cortical) and muscular activity. One goal is to improve the diagnostic applicability of the electrocardiogram and the EEG. A further important

objective is the development of biophysical models that can facilitate the interpretation of bioelectric data in various clinical settings (electroneurography, electromyography and cardiography).

5) Cortical microcircuitry

This research studies the intricate neural circuitry of rat barrel cortex (a benchmark system to study local neural organisation and neural plasticity), both in vivo and in vitro (slice preparation) by using a variety of electrophysiological, neuropharmacological and neuroanatomical techniques.

Biomolecular Chemistry (IMM - NCMLS)

Head: Prof. dr. G.J.M. Pruijn
Staff: dr. W. Boelens, prof. dr. N.H. Lubsen

Secretariat: Els van Genne, room 2.95 NCMLS; tel. 3614254; e-mail: e.vangenne@ncmls.ru.nl

The Department of Biomolecular Chemistry (Radboud University, Faculty of Science, IMM) is located at the Nijmegen Center for Molecular Life Sciences (NCMLS - 'Research Tower', floor 2), Geert Grooteplein 26-28 (route 271).

The research at our department is focused on the following (for a detailed description of the various research topics you can visit our web-site *http://www.biomolecularchemistry.nl/*:

Characterisation and function of autoantigens (Pruijn)

Patients who suffer from autoimmune diseases, such as rheumatoid arthritis, often show the phenomenon of autoimmunity. These patients produce antibodies to self-proteins, which are referred to as autoantigens. In general, such autoantigens are macromolecules which have important cellular functions. We primarily study the structure and function of autoantigens involved in the synthesis and degradation of RNA and proteins. Next to that we are interested in posttranslational modifications of proteins (phosphorylation, citrullination), because we believe that these play an important role in the initiation of autoimmunity. In this respect, we are also studying the mechanisms that lead to the breaking of immunological tolerance to self-proteins in autoimmune patients. Finally, we apply the knowledge obtained on the structure of autoantigenic molecules for the development of autoimmune diagnostics.

Small stress proteins: structure, function and pathology (Boelens/Lubsen)

The cell protects itself against stress, like heat, radicals or radiation, by synthesizing a set of special proteins, amongst which the 'small heat-shock proteins' (sHsps). The sHsps have *in vitro* chaperone activity: i.e., they prevent the aggregation of other proteins. *In vivo,* they enhance the stress-tolerance of cells. Man has ten different sHsps, which are most abundant in the eye lens, in heart and muscles. In the brain they become induced in Alzheimer's disease and multiple sclerosis. The three-dimensional structures and working mechanisms of the various sHsps are poorly understood. Our group explores by means of mutagenesis, protein-interaction studies, and cell biological approaches the structure, chaperoning mechanism en cytoprotection of the sHsps, and their roles in diseases, ageing and apoptosis.

Opportunities for students:

In the aforementioned research topics several projects are available for (Medical) Biology, Chemistry, Molecular Life Science and Natural Science students. As a result of the ongoing research projects are constantly reformulated. We assign an experienced supervisor (PhD student; post-doc) to each individual student.

In our work we use modern (biochemical, molecular and cell biological) techniques such as recombinant DNA, selection of recombinant (human) antibodies by phage display, various proteomics techniques, DNA and protein microarrys, cell culture, RNA interference, the mammalian two-hybrid system, RNA-protein interactions, confocal microscopy etc.

Mandatory course: Biochemie-Moleculaire Biologie II (BMB-II; BB017C)

Recommended courses:

- Celbiologie van dieren (BB023B)
- Structuur biomoleculen (SB101B)
- Immunologie (BB019B)

Compulsory courses for major, choose 2 of the following mastercourses:

- Apoptosis
- Chemical Biology
- Molecular aspects of host defense, tissue destruction and repair
- Signal transduction and transport

Biochemistry (UMCN St. Radboud)

Head: Prof. dr. R. Brock

Scientific Staff: Dr. G. J. C. G. M. Bosman, Dr. W. F. Daamen, Prof. dr. W. J. de Grip, Dr. W. J. H. Koopman, Dr. T. H. van Kuppevelt, Dr. P. H. G. M. Willems

Secretariat: Ms C. Teunissen, 36 14259, c.teunissen@ncmls.ru.nl

Website: http://www.ncmls.nl/ and the websites of the invidual research groups

Research:

- - Signal transduction in T lymphocytes
- - molecular aging in erythocytes
- - Cellular molecule import
- - signal transduction and ion transport
- - molecules of the extracellular matrix
- - tissue engineering
- - G protein-coupled receptors

Description of research

Biochemistry of Integrated Systems **-** Bosman, Brock, tel. 36 -15390, -66213 www.ncmls.nl/biochemistry/Integrated/index.html

This group joins two lines of research: (i) The molecular analysis of cellular signaling and (ii) the cellular import of molecules to specifically inhibit molecular interactions inside cells. In signaling, we address molecular signaling networks in T-lymphocytes as well as plasma membrane-located signaling mechanisms that regulate and mediate aging of the human erythrocyte. These activities relate to the development of new therapeutic approaches for autoimmunity and cancer, erythrocyte-related pathologies and the relationship of these processes with molecular and cellular aging and cancer. The activities are tightly connected to the other lines of research in the department: In the analysis of T-cell activity, there is increasing awareness of the role of energy metabolism. The interaction of drug molecules with glycoproteins and the extracellular matrix is a critical step controling their cellular uptake and bioactivity.

***Matrix Biochemistry* -** Daamen, Kuppevelt, tel. 36 -14303, -16759

www.ncmls.eu/biochemistry/matrix/frames_1.html

This group focuses on two lines of research (i) The biochemical analysis of extracellular matrix molecules and their role in pathological cascades, and (ii) the construction of biomatrices to induce tissue formation (tissue engineering). With respect to the biochemistry of the extracellular matrix, focus is on the sequence and function of glycosaminoglycan domains and their involvement in pathologies such as cancer and nephropathies. With respect to tissue engineering, focus is on the construction of "smart" scaffolds, which induce tissue/organ formation *in vivo* (skin, urogenital tissue, blood vessels).

***Membrane Biochemistry* -** Koopman, Willems, tel. 36 -14589

http://www.ncmls.nl/biochemistry/membrane/index.html

Classically, mitochondria are famous for their role as powerhouses of the cell. What may be less known is, that mitochondria are also crucially involved in the cell's ability to cope with a variety of stress situations. This group uses a combination of biochemistry, molecular biology and high-content live cell imaging to get mechanistic insight into the relationship between mitochondrial structure, localization and function. Emphasis lies on the coupling between cellular calcium homeostasis and mitochondrial energy production. As a second line of research, we study the cell biological consequences of life-threatening mutations in the oxidative phosphorylation system with the final aim to uncover targets for therapeutics that can improve the clinical condition.

***Visual mechanisms* -** De Grip, tel. 36 -14263

This research group addresses molecular mechanisms of selected G protein-coupled receptors, in particular photoreceptor proteins from the retina. For this purpose biotechnological production methodology, i.e. large-scale expression using recombinant baculovirus and his-tag based purification are employed.

Opportunities for students

Suitable for students with Biology, BMW, MLW and Chemistry background.

Cell Biology (UMCN St. Radboud)

Head of Dept*:* Prof. dr. B. Wieringa
Staff*:* Dr. J.A.M. Fransen, Prof.dr. P. Friedl, Dr. K. Wolf, Dr. W. Hendriks, Dr. C.E.E.M. van der Zee, Dr. D.G. Wansink

Secretary and contact address*:* Mrs. M. Reawaruw, phone 024-3614329, e-mail: M.Reawaruw@ncmls.ru.nl. For details or for direct contact addresses of staff members visit us at the WEB at http://www.umcn.nl/cellbiology

Research Description:
Joint research of the Dept. of Cell Biology (NCMLS) is aimed at understanding the pathobiological significance of

1. cellular energy and redox metabolism: Metabolic and allosteric effects of ATP and NAD(P)(H) on cell viability and growth.
2. coupling between energy and redox metabolism and actin-based cell shape dynamics and cell motility,
3. reversible protein phosphorylation reactions involved in the coupling between cell fate and growth regulation, actin cytoskeleton dynamics, and metabolic state,
4. the role of proteases and adhesion receptors in different types of cancer cell invasion, and
5. the mechanisms of cancer cell killing by cytotoxic T lymphocytes.

Study of these processes is important for a better understanding of health problems that are related to cancer cell growth and motility, neurodevelopment and neurodegeneration, immune defense, or diseases like myotonic dystrophy and mitochondrial myopathies.

BACKGROUND: Among the thousands of small compounds in mammalian cells, metabolites like ATP, PCr and NAD/NADH or NADP/NADPH have a special position in that they are utilized in the core pathways of energy and redox metabolism (glycolysis, PPP-pathway, TCA-cycle, OXPHOS) or directly as co-factors in the allosteric control of protein activity. Distinctly different processes like cell viability control and cell growth, formation of cell protrusions, development of podosomes and invadopodia by malignant cells, phagocytosis by macrophages, or the generation of lamellipodial/filopodial extensions in motile cells, and even cell cycle transition events, share the hallmark that they are under temporal and spatial control of ATP or NAD(P)(H)-based reactions. Without exception these processes are also determined by the coordination of actin polymerization behavior, force generation by myosin ATPases, and the local control of phosphorylation of proteins in upstream signaling pathways. Currently central in our interest is how the local distribution of ATP and NAD(P)(H), and activity of members of the protein tyrosine phosphatase (PTP) family or the ACG-kinase family member Myotonic Dystrophy Kinase (DMPK) determines morphodynamic behaviour and fate of neurons, muscle, macrophages and tumor cells.

Other key topics are the diversity of tumor invasion and interaction with the tumor stroma; novel escape responses of tumor progression during targeted experimental therapy; the serial dynamics of T cell scanning across antigen-presenting cells during immune cell activation and effector function; and the regeneration of epithelial and interstitial tissue using tissue engineering. To visualize cell motility, cell-matrix interactions and dynamic cell patterning during cell differentiation, immune cell interactions and tumor invasion we use 2D and 3D extracellular matrix (ECM) based cell culture models and highly advanced imaging procedures with light, CSL or multiphoton microscopes to monitor cellular and molecular events in real time and simultaneously. As models, genetically modified cells and transgenic mice are used. To validate in vitro findings, in vivo imaging of tumor and immune cell migration is performed by multiphoton microscopy.

Suitable profile:
All MSc students with a chemical/biological, biological/physical or biomedical profile, with molecular biological and/or cell biological elements in their training program are invited to

apply for traineeship opportunities. We assign an experienced supervisor to each individual student. Therefore, we have only a limited number of internship positions available at any given moment. For all further information we refer to http://www.ncmls.nl/celbio/

Physiology (UMCN St Radboud)

Head: prof.dr. R. Bindels
Staff: dr. P. Deen. dr. J. Hoenderop

Contact: dr. J. Hoenderop, 3610580, email: J.Hoenderop@ncmls.ru.nl

Website: http://www.physiology-nijmegen.nl

Regulation of electrolyte and water transport in kidney and intestine
The research groups Ion Transport and Osmoregulation from the department of Physiology in Nijmegen have a long long-standing reputation in the field of membrane transport, and, in particular, epithelial transport. Research at this department is focused on aquaporin water channels, epithelial calcium and magnesium channels and sodium-chloride cotransporters. One line of research is focused on the identification of novel ion transporters in kidney and small intestine. Using advanced molecular biological techniques we identified and characterized new ion and water transporters including aquaporin water channels and epithelial calcium and magnesium channels. Our research aims to clarify the cell biological consequences of mutations in the genes encoding for these renal transporters, which are the cause of diseases such as Nephrogenic Diabetes Insipidus, Bartter and Gitelman syndromes and disturbances in the calcium and magnesium homeostasis of the body. Another line of research aims to understand the factors that determine the activity of epithelial transporters, which include phosphorylation, glycosylation, regulated trafficking and hormonal regulation. The obtained knowledge will not only substantiate the role of epithelial transporters under (patho)physiological conditions, but could ultimately also give way to the development of pharmacological strategies to treat ion en water-related mal(re)absorption disorders. For more information please also consult our website: www.physiology-nijmegen.nl

Methods and Techniques
Depending on the subject the student can obtain experience with a wide variety of techniques including:

- Molecular-biology: recombinant DNA technology, Northern en Southern blots, real-time PCR, fusion proteins, siRNA
- Maintenance of cell lines: transfection and culture of various cell lines
- Biochemistry: enzyme/ion transport activity measurements, cell signaling techniques, pull-downs, proteomics, yeast-two-hydrid, 2D-gel electrophoresis
- Immunology: immunohistology, immunoblots, preparation of antibodies, immunoprecipitations
- Imaging: real-time cytosolic ion concentration measurements with video and confocal microscopy
- Miscellaneous: radio isotopes, animal research, electrophysiology, bioinformatics

Topics
The department of Physiology is a dynamic, enthusiastic and internationally orientated research group with an excellent scientific track record. Students will be guided by senior PhD students or Post-doc researchers. Interested students with a background in (Bio)Chemistry, (Medical) Biology and Molecular Life Sciences are welcome to perform an internship at the department of Physiology. The projects are carefully planned and the amount of positions is limited so make sure you organize your internship in time. Interested students can participate in the topics:

- Water channels: physiology and pathophysiology
- Epithelial calcium and magnesium channels: from molecule to pathophysiology

For more information please also consult our website: www.physiology-nijmegen.nl

Biological Psychology (Social Sciences)

Head: Prof.dr. Marcus Ullsperger

Staff: dr. Gilles van Luijtelaar, dr. Roland Maes, dr. Eric Maris, dr. Clementine van Rijn, dr. Marijtje Jongsma

Secretary: Saskia van Uum, B.02.14, tel: 024-3612544

Website: http://www.ru.nl/socialewetenschappen/nici/divisions/all_divisions/cognitive

On the Department of Biological Psychology (located in the Donders Istitute for Brain, Cognition and Behaviour), students in biology can participate in different research projects, among others:

Electrophysiological correlates of learning and memory processes (dr. R. Maes, tel 3615992, email: r.maes@donders.ru.nl)

Numerous human and animal conditioning research has generated a number of experimental procedures, each of which is linked to well-developed theories on learning and memory. These procedures include single-stimulus paradigms prompting elementary forms of (associative) learning, such as habituation and perceptual learning, and more complex, multi-stimulus paradigms. The latter include simple classical conditioning, latent inhibition,

extinction, and discrimination learning. Even more complex paradigms concern occasion-setting procedures in which behavioral responding to target stimuli is modulated by the presence or absence of other stimuli.

The research is directed at the neuro-electrophysiological correlates of these diverse forms of learning in rats and humans and constitutes a valuable tool for establishing the neurobiological substrates and nature of cognitive processes involved in learning and memory, both within healthy organisms as well as in models of distinct pathologies (e.g. epilepsy, chronic pain, and aging).

Rats and humans are subjected to procedures known to prompt simple and/or complex forms of learning, while measuring local field evoked potentials on the skull (humans), or on the dura mater or in sub-cortical regions (rats).

Epilepsy and its modulation (dr. Gilles van Luijtelaar, tel 3615621, email: g.vanluijtelaar@donders.ru.nl)

The cortico-thalamic network: its role in modulation. The availability of a genetic rat model for absence epilepsy and recent discoveries of how specific parts of the cortex control spontaneous seizures allow the study of mechanisms involved in the control of these absence seizures. Moreover, it gives possibilities to study network interactions and plasticity in the cortico-thalamo-cortical network.

A closed loop system for prevention of limbic seizures. Seizure control by drugs is poor in many epilepsy patients. Brain surgery is only an option for a limited number of patients. Research is aimed to develop various deep brain stimulation techniques and protocols in rats with temporal lobe epilepsy in order to treat them. Some deep brain stimulation techniques will induce plasticity; other techniques are aimed to block an ongoing seizure. Next, we will develop an early seizure detection technique, and, finally, a closed loop system that allows stimulating the rat brain after the onset of a seizure has been detected.

Opportunities for students

It is recommended that an interested student contacts dr. van Luijtelaar minimally four months before the actual start of the experiments. Students (biological-physical profile) can participate in ongoing human or animal research; however, in the latter case permission from the Animal Welfare officer must be obtained. The work placement offers the opportunity to acquire and combine knowledge from the field of electrophysiology and behavior (e.g. learning psychology, epilepsy and behavior, drugs and behavior) including a number of laboratory techniques that are indispensable for those who are seeking a career in neuroscience. The student will acquire theoretical knowledge on recent developments within the field of animal and human learning psychology, sensory perception (e.g. pain in volunteers and in patients), brain networks, specifically in the sub-domain of interest, and will experience in a) working with laboratory animals (rats), if the work placement concerns animal research, b) will be trained in using electrophysiological equipment, stimulators and other equipment used to present learning tasks (including programming), c) will learn to

interpret EEG, learn to use programs for behaviour recording and analyses, d) will learn to perform data analysis, including statistics, e) and to report experimental data.

Human Genetics (UMCN St Radboud)

Head: prof.dr. H.G. Brunner

Contact: dr. B.Franke, 3610181, B.Franke@antrg.umcn.nl

Website: http://www.humangenetics.nl/ (shows examples of student research projects at our department)

At the department of Human Genetics we perform research within the divisions of Molecular Genetics, Cytogenetics, DNA-diagnostics and Clinical Genetics. **Basic biological** research questions focus on a number of central themes. Within these themes the research involves the chromosomal (sub)localization (mapping) of disease-causing genes, the identification of these genes (molecular cloning), the detection of disease-causing or disease-associated mutations and polymorphisms in the genes, gene regulation analysis by microRNAs and epigenetics, as well as the modelling of the (protein) structure of genes of interest and unravelling of their biological function. Apart from that we use animal models (mouse, Drosophila) to gain insight into developmental processes involving the genes and encoded proteins of interest. The central research themes within the department are:

(A) Monogenic disorders: inherited blindness and deafness, mental retardation, inherited renal disease and molecular dysmorphology. In monogenic disorders a clear relationship exists between a genetic defect and a disease; most -if not all- individuals carrying the genetic defect are affected with the disease. In the research projects within this theme we aim at identifying the gene(s) for a given disorder, often by genetic linkage analysis, next generation sequencing and/or gene expression studies and characterize the pathways leading from the mutated gene to disease.

(B) Multifactorial disorders: psychiatric disorders like ADHD, autism and unipolar depression, developmental dyslexia, and auto-immune diseases including rheumatoid arthritis and Crohn's disease (and the pharmacogenomics of their treatment). In multifactorial disorders both genes and environment contribute to increased disease risk. In the research projects within this theme we identify genes for disease using genome-wide and candidate gene-based genetic association studies as well as gene expression profiling, and characterize the effects of genetic variants on gene function. Furthermore, we try to predict the effect of treatment of individual patients by their genetic make-up.

(C) Chromosomal abnormalities and cancer: chromosomal abnormalities and structural genomic variation contributes to many different types of disease, including cancer. Within the research projects in this theme we identify chromosomal defects, mostly by microarray-based techniques, and characterize their relation to disease.

With regard to **medical biotechnology** we develop methods for detection of genetic and genomic aberrations (mutations, polymorphisms, chromosomal abnormalities), and for profiling of gene expression at the RNA level relevant to the diseases of interest.

At the level of **pathology** the methods mentioned above are used for the diagnosis of inherited or acquired cancers and other disorders. Furthermore, the methods are used for prediction of treatment effects and disease prognosis of patients based on their genetic make-up.

Regarding **epidemiologic studies** we perform genetic association studies, expression profiling and proteomics to identify genes and genetic polymorphisms causing increased risk for multifactorial disorders or risk of non-response and increased toxicity during treatment of disease.

Techniques commonly used in the different research themes include gene cloning, hybridisation-detection methods, somatic cell genetics, sequencing, linkage analysis with highly polymorphic markers, different mutation and polymorphism detection (genotyping) methods, (next generation) sequencing, fluorescent in situ hybridisation, gene expression profiling on microarrays, proteomics and other protein analysis methods, manipulation of embryonic stem cells and generation of transgenic mice, transgenesis in Drosophila melanogaster. Furthermore, bioinformatics is part of many research projects.

More detailed information on (a selection of) current subjects for student training periods can be found at http://www.humangenetics.nl/.

Medical microbiology/virology (UMCN St. Radboud)

Head: Dr. Frank van Kuppeveld

Contact: Phone: 024-3617574. E-mail: f.vankuppeveld@ncmls.ru.nl. Location: NCMLS, route 268, room 1.71.

Scientific staff: Dr. Ronald van Rij, Dr. Jan Zoll

Research:
The Molecular Virology research-group, which is housed in the Nijmegen Centre for Molecular Life Sciences (NCMLS), investigates replication mechanisms, innate host defense mechanisms and viral evasion strategies, and pathogenesis of plus-strand RNA viruses. The 2 main lines of research are: (1) *"Picornavirus replication, innate host defense, pathogenesis, and antiviral drugs"* and (2) *"The role of RNAi as an innate antiviral defense mechanism in insects"*.

Description:
(1) *"Picornavirus replication, innate host defense, pathogenesis, and antiviral drugs".* The family of Picornaviruses (small RNA viruses) contains many important human and animal pathogens that are associated with various acute and chronic diseases.This family includes, among others, the enteroviruses (e.g., poliovirus, coxsackievirus, rhinovirus), parechoviruses, hepatoviruses (e.g. hepatitis A virus), cardioviruses (e.g., EMCV, TMEV, Saffold virus) and aphthoviruses (e.g. foot-and-mouth-disease virus). These plus-stranded RNA viruses replicate their genome in the cytoplasm of infected cells. This research line focuses on: (1a) *"Molecular aspects of picornavirus replication"*, focusing on the role of viral proteins and complex RNA structures in the viral RNA genome in the process of viral RNA replication.

(1b) *"Picornaviral strategies to suppress antiviral host responses"*, focusing on the molecular mechanisms by which Picornaviruses manipulate the host cell in order to suppress anti-viral host cell responses like (innate) immune responses and apoptosis. (1c) *"Picornavirus pathogenesis and antiviral drugs",* focusing on the potential role of enteroviruses in the onset of insulin-dependent (type 1) diabetes mellitus (infection and impairment of pancreatic beta-cells and/or cells of the immune system?), and the development and characterization of (new) inhibitors of enterovirus replication. For more info, see http://www.ncmls.nl/ncmls/menustructures/pi/theme1/frankvankuppeveld.asp.

(2) *"The role of RNAi as an innate antiviral defense mechanism in insects"*. Insects and other non-vertebrates lack the adaptive and innate immune responses that mediate antiviral defense in mammals. Yet, insects are able to effectively clear viral infections. We recently showed that RNAi provides antiviral immunity in the fruitfly, Drosophila melanogaster. Viruses produce dsRNA during their life cycle, which feeds into the RNAi pathway and guides degradation of viral RNAs. As a counter-defense, many viruses evolved mechanisms to suppress the RNAi pathway. For example, Drosophila C virus - a fly specific pathogen - inhibits RNAi by binding to dsRNA and thereby preventing Dicer cleavage. We are interested in the defense of invertebrates against viruses. Specifically we study: (2a) *"The mechanism of RNAi and viral evasion mechanisms"*. Many mechanistic aspects of the RNAi antiviral defense mechanism are unclear. For example, how are viruses recognized by the RNAi machinery? What is the composition of the antiviral effector complex? Which small RNAs are generated? etc. We address these issues through a combination of molecular biology, classical virology and fly genetics. Furthermore, we aim to identify viral suppressors of RNAi, and study their mechanism of RNAi suppression. Finally, we are studying whether RNAi has a natural antiviral activity in mammals. (2b) *"Alternative antiviral immune mechanisms in Drosophila"*. While RNAi is an important antiviral mechanism, it is highly unlikely that insects rely on a single mechanism for their antiviral defense. We aim to identify novel antiviral mechanisms in Drosophila, study their mechanism and interactions with the RNAi machinery. More info;
http://www.ncmls.nl/ncmls/menustructures/pi/theme1/ronaldvanrij.asp

Opportunities for students:
For the research goals described above, we make use of a variety of molecular biological, biochemical and cellular biological techniques. These include *in vitro* mutagenesis, construction of infectious cDNA clones, *in vitro* transcription and *in vitro* translation, RNA/DNA hybridization, CAT and LUC reporter assays, expression and purification of recombinant proteins, analysis of RNA-protein interactions, cell culture, transfection of eukaryotic cells with RNA or DNA. Furthermore, we make use of a variety of microscopical techniques (confocal laser scanning microscopy, digital video imaging, fluorescence resonance energy transfer microscopy, fluorescence recovery after photobleaching) to determine the fate, localization and/or dynamics of GFP-tagged reporter proteins in infected cells. For the RNAi studies, we use Drosophila as a model organism (both cell culture and the entire fly), allowing us to use fly genetics in our studies. Students are encouraged to indicate and motivate their preference for a specific topic of the internship.

Medical Microbiology/parasitology (UMCN St. Radboud)
Head: prof. dr. R.W. Sauerwein

Secretary: 3614615

Contact: dr. Will Roeffen, 3614664, w.roeffen@ncmls.ru.nl

Malaria infections, sexual stage development and parasite transmission from man to mosquito

At the department of medical microbiology/parasitology, research focusses on transmission of malaria parasites and the development of its sexual stages. These stages do not cause clinical symptoms but are transmitted by mosquitoes to the next host and are thus responsible for transmission of the disease. Knowledge about transmission of malaria parasites could lead to interruption of the transmission cycle and may prevent further spread of parasites.

Research: The mission of Medical Parasitology is to develop a malaria vaccin.

1. Clinical development of a transmission blocking malaria vaccine
2. Clinical trials with malaria vaccines candidates
3. Development of a genetically attenuated whole parasite vaccine
4. Optimization of human experimental malaria infections
5. Immuno-epidemiology of malaria transmission
6. Immunological malaria responses in pregnancy and neonates
7. Anti-malaria drug resistance

Description of research:

Activities include basic biological and immunological research on malaria parasites in search for candidate vaccines. The group is conducting translational research in trying to move interesting vaccine candidates into clinical testing. Clinical trials for safety, immunogenicity and protective efficacy are part of the clinical activities.

The group is one of the very few centres in the world where experimental human infections are carried out which is a powerful instrument to test vaccine efficacy and study human immunological responses. In addition, field studies in the tropics are conducted to understand the natural immuno-epidemiology and the spread of the parasite in the population. Of special interest are 1) the transmission stages of malaria parasites, the infection from men to mosquito and the development of parasites in the mosquito 2) the development of the parasite in the liver. Knowledge about transmission of malaria parasites could lead to interruption of the transmission cycle and possibly elimination of malaria. Parasite cultures are also used to study the potential of new anti-malarial drugs.

Techniques used: parasite transfection, parasite culture, mosquito breeding, imaging techniques, recombinant protein production, characterization and purification, real-time PCR, FACS, humoral and cellular immunology.

Rheumatology (UMCN)

Head: prof.Dr. W. van den Berg
Contact: dr. T.R.D.J. Radstake, email: T.Radstake@reuma.umcn.nl

Website: http://www.rheumaresearch.nl/ & www.ncmls.nl

Regulation of dendritic cells to battle autoimmune diseases
Autoimmune diseases such as RA are frequent (1% of the population) and often still lead to severe disability and a shortened life expectancy. The department of Rheumatology sees many different autoimmune diseases among which RA, inflammatory myopathies, seronegative spondylarthritis (SpA) and Systemic sclerosis (SSc) form the major focus. Dendritic cells (DCs) are the generals of the immune system designed to control the balance between tolerance and immunity. Nowadays, accumulating evidence exist that suggest that autoimmune disease arise from an aberrant function of DCs. Our group has previously focused on the role of Toll-like receptor (TLR) and Fc gamma receptor (FcgR) family as the key receptor systems that regulate DC function. Here we demonstrated that the cell mediated activation of DCs via FcgR and TLR in rheumatoid arthritis (RA) is severely disturbed. Recently, we investigated the potential role of DCs in SpA and SSc as well and observed a different but markedly altered function compared with controls. Currently we focus to delineate the disease specific DC aberrances with the ultimate goal to harness ex vivo modulated DCs to battle autoimmune diseases.

Methods and Techniques
Depending on the subject the student can obtain experience with a wide variety of techniques including:

- Cell cultures: DC/Macrophage cell cultures, flow cytometry, magnetic bead cell separation, mixed lymphocyte reactions.
- SiRNA and viral overexpression techniques
- QPCR, RNA and DNA isolation
- Immunology: immunohistology, immunoblots, preparation of antibodies, immunoprecipitations

Topics
The department of Rheumatology is a dynamic, enthusiastic and internationally orientated research group with an excellent scientific track record. Students will be guided by senior PhD students or Post-doc researchers. Interested students with a background in (Bio)Chemistry, (Medical) Biology and Molecular Life Sciences are welcome to perform an internship at the department of Physiology. The projects are carefully planned and the amount of positions is limited so make sure you organize your internship in time. Interested students can participate in the topics:

- FcgR regulation in Rheumatoid Arthritis
- The role of TLR signaling in multiple autoimmune diseases
- Plasmacytoid DCs in the fibrotic process in Systemic Sclerosis

For more information please also consult our website: www.NCMLS.nl

Glomerular diseases and transplantation Immunology (UMCN, St Radboud)

Head Department of Nephrology: Prof. Dr. J.H.M. Berden

Head Nephrology Research Lab: Dr. J. van der Vlag, 3616539, j.vandervlag@nier.umcn.nl

Location of the lab: Route 279; 5th floor M850 (Nijmegen Centre for Molecular Life Sciences)

Introduction
The two main research lines within the Nephrology Research Laboratory are (renal)transplantation immunology and glomerular diseases. Short and long-term internships are possible for Biology and other Life Science students. After an interview with the student one of the research projects listed below will be selected for the internship. The internship will be finished by a written report and an oral presentation.

Techniques
In our research we apply a wide variety of immunological, cell biological, biochemical and molecular techniques, at the in vitro level (cell culture), at the in vivo level (animal models) and for the analysis of patient material (serum, urine, kidney biopsies).

Projects

Functional properties of heparan sulfate (HS) domains in (glomerular) inflammation: Heparan sulfate is a linear sulfated polysaccharide chain attached to core proteins. The HS chain has an enormous structural diversity, which corresponds to its numerous functions. HS plays an important role in leukocyte trafficking in inflamed tissue. Recently, we derived a glomerular endothelial cell line from the immortomouse. We established an adhesion assay, in which we identified specific HS domains on glomerular endothelial cells that are important for the rolling and firm adhesion of leukocytes. The aim of this project is to elucidate the structure-function relationship of HS in (glomerular) inflammation. HS structure on endothelial cells will be manipulated by siRNA and related to function in leukocyte trafficking both and. This should lead to the development of new HS-based therapeutics for treatment of (glomerular) inflammation.

Identification and characterization of apoptosis-induced chromatin modifications as targets for the immune system in the autoimmune disease Systemic Lupus Erythematosus (SLE): SLE is associated with a disturbed apoptosis and/or clearance of apoptotic cells, which results in circulating apoptotic chromatin. During apoptosis autoantigens, including chromatin, can be modified. We have evidence that apoptosis-induced histone modifications break the tolerance to self-chromatin and subsequently drive the autoimmune response to chromatin in SLE. This project aims to identify and characterize (new) apoptosis-induced histone modifications ("histone code" for apoptosis) that are targets for SLE-derived autoantibodies, and play a role in the development of autoimmunity.

Role of the TRPC6 channel in glomerular diseases: The TRP protein superfamily is a diverse group of cation-permeable channels, mainly expressed in the tubular system in the kidney. Recently, mutations in the transient receptor potential channel TRPC6 were reported

to be associated with autosomal dominant focal glomerular sclerosis (FGS). TRPC6 expression was shown in podocyte foot processes. This project aims to identify the precise role of TRPC6 in the pathophysiology of proteinuria and glomerulosclerosis, using different in vivo and in vitro approaches.

Induction of graft tolerance by tolerogenic dendritic cells (DC): In experimental transplantation models the graft survival can be prolonged by administration of donor-derived tolerizing DC to the recipient prior to transplantation. The aim of this project is to develop a protocol to obtain highly effective tolerizing DC by interfering with Toll like receptor (TLR)-induced signalling. In particular the role of cytokines and cytokine receptors in tipping the balance of tolerance and immunitry will be addressed.

The role of heparan sulfate and heparanase in proteinuria: In recent years we have demonstrated that the loss of glomerular HS in patients with proteinuria and in animal models for proteinuria is associated with an increased expression of the HS-degrading enzyme heparanase. We aim to identify the role of glomerular cells, cellular processes and molecular factors in the development of proteinuria that involve HS and/or heparanase. Ultimately, this will lead to the identification of molecular targets for therapeutic intervention.

Pathology (UMCN St. Radboud)

Head: prof.dr. J.H.J.M. van Krieken
Contact: dr. G.N.P. van Muijen, 3614399 of 3614389, g.vanmuijen@pathol.umcn.nl

At the Pathology Department there are two main lines of research: oncology and immunopathology. Students who are interested to do a practical period at the Pathology Department can participate in projects that study:

- Celbiological and molecular processes which are important in tumorigenesis and tumor progression
- Tumorangiogenesis
- Experimental glomerulonefritis
- Molecular diagnosis

During their practical period several techniques may be used:

- Molecular biological techniques (RNA/DNA-isolation, Southern and Northern blotting, PCR, recombinant DNA technology, microarray technology, proteomics)
- Cytochemical techniques (DNA-cytochemistry, DNA and RNA in situ hybridisation, immunocytochemistry, immuno electron microscopy)
- Techniques for tumor cell biological research (tissue culture, metastasis assays, laser microdissection, celproliferation and apoptosis assays)
- Quantitative microscopy
- Immunological techniques (preparation and characterization of antibodies, Western blotting, ELISA)

Several research projects are in collaboration with other research groups within UMC St Radboud, or with groups at the FNWI or at other Dutch or foreign universities.

Laboratory of Pediatric Oncology (UMCN St. Radboud))

Laboratory of Pediatric Oncology
Head: Dr. Frank van Leeuwen

Staff: Dr. Frank van Leeuwen, Dr. Blanca Scheijen, Prof. Dr. Peter Hoogerbrugge

General contact person: Dr. Frank van Leeuwen, tel: 024-3666202,
fn.vanleeuwen@cukz.umcn.nl

Websites: http://www.ncmls.nl/

The research within the Laboratory of Pediatric Oncology, part of the Radboud University Nijmegen Medical Centre and NCMLS, focuses on identification and characterization of (novel) signaling pathways that contribute to development of pediatric Acute Lymphoblastic Leukemia (ALL). At this moment approximately ten people, including PhD students, postdocs and technicians participate in studies of this relatively new group that is headed by dr. Frank van Leeuwen. Our research focuses on understanding the process of cancer development, in particular leukemia and the regulation of cell adhesion and migration (implicated in metastasis). Students that join our lab for an internship will be introduced in both the theoretical and practical part of the project. For a well defined balance of input and output, we require a minimum of 5 months hands-on practical work.

(I) Identification and characterization of genes that are implicated in leukemia development

Leukemia is the most common form of pediatric cancer. Despite improved therapies due to extensive research, still a large number of patients eventually do not survive this disease. Our research focuses on the identification of novel mutations that contribute to leukemia development. By a genome-wide screen using array CGH, we have found a large number recurrent genetic alterations in bone marrow samples obtained from children with Acute Lymphoblastic Leukemia. This has led to the identification of genes implicated in B cell development, cell cycle progression and cell survival. We will investigate the role of these genes during leukemia formation, hematopoietic development and therapy resistance. The current studies are focused on the role of mutated transcription factors for B-cell development and the impact of a mutated epigenetic regulator on differentiation en cell metabolism.

During a traineeship students may get hands-on experience with the following techniques:

- RNA interference
- SDS-PAGE electrophoresis
- RT-PCR
- Western blotting and immunodetection
- GATEWAY cloning
- Sequencing and restriction analysis
- Transient/stable transfection methods
- Cell culture

- Retro- and lentiviral transductions
- Flowcytometry
- Protein production and purification
- Chromatin ImmunoPrecipitation (ChIP)
- Animal models

(II) Characterization of cellular structures that facilitate cell adhesion and migration

Podosomes and invadopodia are cellular structures which establish close contact with the extracellular matrix. They are thought to be key structures of cell invasion. Accordingly, much effort is currently focused on their potential roles in both physiological and pathological processes involving cell invasion, such as inflammation, or atherosclerosis and metastasis. We have recently found that expression of some of the proteins that regulate podosome formation strongly correlates with the development of metastasis in breast cancer. We now focus our studies on elucidating the role of these proteins the biology of breast cancer metastasis and the biochemistry of podosome formation.

During a traineeship students may get hands-on experience with the following techniques:

- (Confocal) Immune-fluorescence microscopy
- Live cell imaging
- RNA interference
- SDS-PAGE electrophoresis
- Western blotting and immunodetection
- Sequencing and restriction analysis
- Transient/stable transfection methods
- Cell culture
- Retro- and lentiviral transductions
- Flowcytometry
- Protein production and purification

We advice students to follow at least one of the Courses on Molecular Biology, Cell biology and/or Biochemistry.

Laboratory of Pediatric Infectious Diseases (UMCN St. Radboud)

Head: Prof.dr. Peter W.M. Hermans

General contact person: Prof.dr. Peter Hermans, tel. 024-3666406, P.Hermans@cukz.umcn.nl

Website: http://www.ncmls.nl/; http://www.umcn.nl/

The research activities of Hermans and his team have a predominantly translational profile. The pathogenesis, immunology and epidemiology of paediatric infectious diseases are the central research themes. In close collaboration with various laboratories and medical departments, nationally and internationally, the team aims to improve the molecular and clinical understanding of the biology of infectious diseases. In the field of microbial

pathogenesis, the molecular interaction between host and microorganism is studied in detail. The research team has great experience in the molecular microbiology and microbial genetics of Streptococcus pneumoniae. Bacterial genomic fingerprinting, genomic array footprinting, transcriptional- and proteome profiling of both the microbial pathogen and the infected host, high-throughput protein identification, Streptococcus pneumoniae virulence - and vaccination studies in various animal models, and functional analyses of bacterial proteins are carried out within a variety of research projects. The team has recently expanded its activities towards respiratory tract infections caused by Moraxella catarrhalis, Haemophilus influenzae and Staphylococcus aureus. The work aims to develop and improve tools to diagnose, treat and prevent these bacterial infections. In addition, the research team investigates the mechanisms underlying the severity of the clinical manifestations during viral respiratory tract infections in otherwise healthy children using microarray analysis, protein profiling and functional studies of peripheral blood and nasopharyngeal and bronchoalveolar fluids combined with immunological analyses. These research activities are expected to contribute to the development of innovative tools for the early diagnosis and monitoring of viral respiratory tract infections.

Recent key publications

de Vries SP, Bootsma HJ, Hays JP, Hermans PW. Molecular Aspects of Moraxella catarrhalis Pathogenesis. Microbiol Mol Biol Rev. 2009 Sep;73(3):389-406.

Tjalsma, H., L. Lambooy, P.W.M. Hermans, and D.W. Swinkels. 2008. Shedding & shaving: Disclosure of proteomic expressions on a bacterial face. Proteomics 8:1415-1428.

Burghout, P.J., H.J. Bootsma, T.G. Kloosterman, J.J.E. Bijlsma, C.E. de Jongh, O.P. Kuipers, and P.W.M. Hermans. 2007. In search for genes essential for pneumococcal transformation: the RadA DNA repair protein plays a role in genomic recombination of donor DNA. J. Bacteriol. 189:6540-6550.

Kloosterman, T.G., W.T. Hendriksen, J.J.E. Bijlsma, H.J. Bootsma, S.A. van Hijum, J. Kok, P.W.M. Hermans, and O.P. Kuipers. 2006. Regulation of glutamine and glutamate metabolism by GlnR and GlnA in Streptococcus pneumoniae. J. Biol. Chem. 281:25097-25109.

Hermans, P.W.M., P.V. Adrian, C. Albert, S.C. Estevão, T. Hoogenboezem, I.H.T. Luijendijk, T. Kamphausen, and S. Hammerschmidt. 2006. The streptococcal lipoprotein rotamase A (SlrA) is a functional peptidyl-prolyl isomerase involved in pneumococcal colonisation. J. Biol. Chem. 281:968-976.

Bogaert, D., A. van Belkum, M. Sluijter, A. Luijendijk, R. de Groot, H.C. Rümke, H.A. Verbrugh, and P.W.M. Hermans. 2004. Colonisation by Streptococcus pneumoniae and Staphylococcus aureus in healthy children. Lancet 363:1871-1872.

Tumorimmunology (UMCN, St. Radboud)

Head: prof.dr. C.G. Figdor

Staff: prof. dr. G.J. Adema, dr. R. Torensma, dr. J. de Vries, dr. A.Cambi, prof. dr. T. de Witte

Contact: L. de Jager van Berkel, 3617600, l.dejager@ncmls.ru.nl

At the department of Tumorimmunology fundamental immunological research is performed. The aim of our research is to unravel the role of the immune system and in particular the dendritic cell. Although we perform fundamental research our goal is to implement the results of this basic research into the clinic. To do so we cover a broad range from fundamental in vitro research to experimental therapy for cancer patients. This should lead to better treatment of these patients. We focus on melanoma (skin cancer), kidney cancer and hematological tumors (leukemia). More information can be found on our homepage: www.umcn.nl/til

Just a few running projects:

The Dendritic cell as professional antigen presenting cell
Central question: why is a DC a superior antigen presenting cell

- identification of DC specific molecules (DC-SIGN, DC-STAMP, DC-CK1 were discovered so far)
- functional characterization of DC specific molecules
- cell biological characterization of DC subsets

Immuunresponse towards melanoma
Cloning of a melanocyte differentiation antigen enabled a detailed immunological study of the immune response towards melanoma.

Hallmarks are:

- better antigen presentation by dendritic cells
- specific helper and cytotoxic T-cell response
- clinical grade production of a melanoma vaccine
- a mouse model enabling the study of tolerance induction and immune response induction for melanoma
- experimental therapy using tumorantigen loaded dendritic cells for melanoma patients

Stem cell research
Our body is renewed constantly to replace worn-out and lost cells. To do so the organism is equipped with Stem Cells. The stem cell pool is maintained during life due to self-renewal. Offspring of this stem cell pool differentiates into an appropriate mature cell. We focus on the differentiation of stem cells into immunological cells and organs. Such 'tissue engineered' immunological tissue can be employed to help the organism to fight cancer and infectious diseases.

Biophysical aspects of cell adhesion
Cell adhesion is a very dynamic process that is tightly regulated even down to the molecular level. In this research line several biophysical approaches are combined in order to address mechanistic questions ranging from the single molecular to the cellular level. Most of these

are based on fluorescence measurements either by quantitative flow-cytometry, or (confocal) fluorescence microscopy. However, given the limited resolution of optical microscopy, high-resolution techniques such as electron microscopy and scanning probe microscopy are exploited as well (co-localization). Dynamic processes are monitored using specific imaging techniques like fluorescence recovery after photobleaching (FRAP), fluorescence resonance energy transfer (FRET), and particle tracking analyses (co-migration). Atomic force microscopy is used to assess the forces that are at play in cell adhesion directly, at the single molecular level. Currently, we are trying to relate the outcome of these molecular scale measurements to the dynamic properties of the entire cell by examining video imaging analyses of cell (trans-) migration and rolling on various substrates. For this, close collaborations with the Biophysical Techniques and Applied Optics groups of the Utwente, as well as the NCMLS imaging facility (MIC) and the UMC hematology departments have been established.

A broad spectrum of cellbiological, immunological, biochemical and molecular biological methods are used to study cell adhesion, migration, proliferation, cytotoxic assays, immunofluorescence, hybridoma technology, ELISA, immuneprecipitation, western, southern, northern blotting, RT-PCR, sequencing, site directed mutagenesis, cDNA transfection, recombinant protein production, protein purification and in situ hybridisation.

Coaching
Students are considered as future researchers. They work together with their coach on specified parts of actual projects. Studentprojects are carefully planned. Only postdocs or senior JO's coach one student at the time to guarantee the quality. However, this means that the number of slots is limited.

The atmosphere at the TIL: enthusiastic fundamental research laboratory with many international contacts.

Gynaecology (UMCN St. Radboud)
Contact: dr. Peter de Boer, 3610869/3613557, p.deboer@obgyn.umcn.nl

The department of Obstetrics and Gynaecology of the Medical Faculty mainly conducts clinical research. However, on three themes, a cellular molecular approach is taken, for female reproductive oncology on ovarian tumors in collaboration with the department of Biochemistry. For male reproduction pathology, we concentrate on azoospermic men, studying meiosis and sperm formation in testicular biopsies, and crypreservation of sperm extracted from these biopsies. For obstetrics, the focus is on high blood pressure during pregnancy, research extending into in-vitro and animal models with an emphasis on vascular structure.

Nijmegen Centre for Mitochondrial Disorders (UMCN St Radboud)
Head: Prof. Dr. Jan Smeitink
Staff: Dr. Bert van den Heuvel, Dr. Werner Koopman, Dr. Leo Nijtmans, Dr. Richard Rodenburg, Dr. Peter Willems

General contact person: Dr. Leo Nijtmans, tel: 024-3610938, L.Nijtmans@cukz.umcn.nl

Websites: http://go.to/ncmd, http://www.eumitocombat.org, http://www.ncmls.nl

The Nijmegen Centre for Mitochondrial Disorders is a full-facility international reference centre for clinical care, biochemical, pathological and molecular diagnostics and research of patients suspected for or with established disturbances of the mitochondrial energy metabolism. The mitochondrial research is acknowledged in the Nijmegen Center for Molecular Life Sciences theme Metabolic Genomics and the main research program V Metabolic and Genetic Disorders of the UMCN.

The main topic of our research concerns the oxidative phosphorylation (OXPHOS) system in health and disease with the final aim to develop new treatment strategies for genetic disorders of the system in man. Special attention is given to human complex I (CI) or NADH:ubiquinone oxidoreductase.

Prof. Smeitink is coordinator of the established European consortium 'EUMITOCOMBAT' in which 12 universities and 21 research groups out of nine different European countries work together. With this extensive international network we are able to offer students the possibility to do a traineeship abroad.

Student projects may involve a traineeship in the following research topics:

(I) Elucidation of the assembly pathway of human Complex I (CI)
(Dr. Leo Nijtmans, Dept. Paediatrics UMCN; Tel: 024-3610938; L.Nijtmans@cukz.umcn.nl)

Research interests include the biogenesis of mitochondria and in particular the complexes involved in the process of OXPHOS, with a specific focus on one of the largest multi-protein complexes that are known in nature: Complex I (CI). The assembly of this giant enzyme is very intricate in view of the fact that it consists of at least 46 subunits which are encoded either by the nuclear or mitochondrial DNA.

Research questions investigated comprise: what is the sequence of assembly of subunits of CI? What are the crucial steps in the assembly? What are the functions of the individual accessory subunits of CI? How is assembly affected in CI deficient patients? Answers to these research questions provide insight in the molecular mechanisms leading to mitochondrial disorders.

More specifically, in our research we mainly focus on:

- The role of (candidate) assembly chaperones and their possible binding partners.
- Effects of specific knockdown of CI subunits by RNA interference on the assembly of CI.
- Assembly of CI in living cells by using fluorescent tags.
- CI assembly defects in patient cells.

During a traineeship students are able to get experienced with a divers spectrum of techniques:

- RNA interference

- 1D Blue-Native PAGE electrophoresis
- 2D Blue-Native/SDS PAGE electrophoresis
- SDS-PAGE electrophoresis
- In-gel activity assays
- RT-PCR
- Confocal life cell imaging
- Creation of transmitochondrial cybrids
- Western blotting and immunodetection
- Sucrose-gradient ultra-centrifugation and Mass spectrometry
- GATEWAY cloning
- Sequencing and restriction analysis
- Transient/stable transfection methods
- Cell culture

We advice students to follow at least one of the Courses on Molecular Biology, Cell biology and/or Biochemistry.

(II) Cell biological consequences and mitigation of mitochondrial dysfunction
(Dr. Peter Willems and Dr. Werner Koopman, Dept. Membrane Biochemistry NCMLS; Tel: 024-3614589; W.Koopman@ncmls.ru.nl)

Research focuses on the (patho)physiology of metabolic disease and mitochondrial dysfunction with special reference to genetic disorders of the OXPHOS system. Emphasis lies on the combination of biochemistry, molecular biology and advanced life cell imaging to assess the molecular mechanisms underlying the cellular consequences of mitochondrial dysfunction. Of particular interest for the latter is the search for therapeutics that can improve dysfunction. Measurements are performed on cell lines and primary cultures of patient skin fibroblasts and skeletal muscle myotubes. Research topics focus on:

- Mitochondrial and cellular Ca^{2+} and ATP homeostasis
- Mitochondrial network complexity and mitochondrial dynamics
- The role of mitochondria in oxidant generation
- Regulation and consequences of the above during normo- and pathophysiology

During a traineeship students are able to get experienced with the following techniques:

- Cell culture
- Cell transfection using baculoviral vectors
- Fluorescent proteins
- In-cell bioluminescence monitoring using aequorin and luciferase
- Video-rate UV calcium imaging using confocal microscopy
- Multispectral videomicroscopy of living cells
- Fluorescence recovery after photobleaching analysis
- Image processing, quantitative analysis and data modelling
- 1D Blue-Native PAGE electrophoresis
- SDS-PAGE electrophoresis
- In-gel activity assays

- Western blotting and immunodetection

Hematology (UMCN St. Radboud)

- **Contact Immunotherapy**: dr. Harry Dolstra, 3619753, h.dolstra@chl.umcn.nl
- **Contact Molecular Hemato-oncology**: dr. Bert van der Reijden, 3610401, b.vanderreijden@chl.umcn.nl of dr. Joop Jansen, 3610372, j.jansen@chl.umcn.nl
- **Contact Trombose hemostase onderzoek:** dr. Waander van Heerde, 3610800, w.vanheerde@chl.umcn.nl

Stem cell transplantation and Immunotherapy

Allogeneic stem cell transplantation (SCT) is potentially a curative treatment option for various hematological cancers. The therapeutic efficacy is based largely on the immune-mediated graft-versus-tumor (GVT) response, in which donor-derived T lymphocytes eradicate residual tumor cells. However, relapse remains a problem indicating that in some patients the GVT response is insufficient. Our goal is to develop specific forms of immunotherapy to induce a more potent anti-tumor immune response without damaging normal cells and tissues. Severe damage can lead to graft-versus-host disease (GVHD). Therefore, our research focuses on the identification of immunogeneic proteins that are selectively expressed on tumor cells. These antigens are characterized at the molecular level, and studied whether they are capable of inducing an immuneresponse ex vivo in the human setting and in vivo in animal models. Furthermore, applied research is performed to investigate whether the identified and characterized antigens can be used for dendritic cell vaccination in patients.

Besides regular and specialized cell culture we apply cellular immunological techniques such as T cell stimulation assays, chromium-release assays, ELISA and immuno-flowcytometry. In addition molecular (cell)biological techniques such as PCR, gene cloning, transfection, retroviral transduction and real-time RT-PCR are used.

Molecular biological research: Molecular Hemato-Oncology unit

Acute myeloid leukemia is characterized by the uncontrolled proliferation of immature non-functional blood cells that have lost their ability to differentiate towards functional mature cells. Mutations that cause acute myeloid leukemia are predominantly found in signal transduction molecules and transcription factors. While the mutations in signalling molecules affect proliferation and cell survival, the mutations in the transcription factors affect the differentiation of the immature blood cells. To gain insight into myeloid blood cell differentiation we are studying the effect of mutated transcription factors in acute myeloid leukemia.

One type of leukemia we are studying in particular is acute promyelocytic leukemia. This disease is characterized by uncontrolled proliferation of immature non-functional promyelocytes. Strikingly, treatment of these malignant cells with high doses of vitamine A forces the cells to differentiate towards mature granulocytes with a limited life span. The addition of vitamine A to standard chemotherapy has resulted in a doubling of cure rates from 40% with chemotherapy alone to 80% when combined with vitamin A. All patients with acute promyelocytic leukemia have a mutation in the retinoic acid receptor transcription

factor. We are studying how the mutated transcription factor affects gene expression, which targets are aberrantly expressed in leukemia and what genes are responsible for the differentiation of the malignant cells upon treatment with vitamin A.

Used techniques include standard DNA cloning techniques, Western and Northern blotting, yeast-two-hybrid assays, micro array CHIPS, micro array fluidic CARD and standard real-time PCR, flowcytometry, immunefluorescence, chromatin IPs, ubiquitination assays, RNA-i, retroviral gene transduction and murine bone marrow transplantation assays.

Trombosis hemostasis research

Hemostasis is a physiological response to vascular injury and starts when blood is exposed to subendothelial structures or connective tissue. The process defends against massive blood loss and massive thrombus formation. A proper hemostatic balance is orchestrated by the vessel wall, blood cells, coagulation and fibrinolysis. Disturbances of this equilibrium may lead to bleeding complications or thrombotic events. In the western population, thrombosis is responsible for approximately 40% of all deaths. On the contrary, hereditary deficiencies of hemostatic factors are uncommon but the associated bleeding episodes already cause morbidity and mortality during childhood.

Fundamental and clinical hemostasis research is performed at the Central Laboratory for Hematology in conjunction with the department of Haematology. Highlights in our fundamental and clinical research programme are: (1) genetic regulation of the hemostatic balance; (2) risk factors in the formation of inhibitory antibodies in patients with hemophilia A and (3) the pathophysiological function of annexins in hemostasis. Our research tools vary from molecular biology techniques up to protein chemistry as we do have access to real time PCR techniques, flow cytometry analysis tools and SELDI-TOF proteomics.

Neuro-oncology (UMCN, St. Radboud)

Head: dr. Pieter Wesseling
Contact: dr. Judith Jeuken, 024-3618896, j.jeuken@pathol.umcn.nl

Neuro-oncology research has been carried out within the UMCN for many years now as a close collaboration between several departments including Pathology, Neurosurgery, Neurology, Radiotherapy, Radiology, and Medical Oncology. Fundamental biological research is being performed on different types of primary brain tumors, with our main focus on gliomas. Investigations encompass different cellular levels such as the genetic background (aberrations detected at the DNA and RNA level), histopathological features and clinical characteristics (for example survival and response to chemotherapy). Correlations between these different aspects are evaluated in order to get a better understanding of the biological behavior of these tumors through which a more accurate prediction of tumor behavior can be provided resulting in individual therapeutic decision(s) for each individual patient. Next to analysis of tumor biopsies, xenograft-lines and cell-lines are used to study different aspects of gliomas in more detail.

Currently the focus of our glioma research is on :

(a) *Response to chemotherapy*. By a genome wide analysis on gene- (DNA and RNA), protein-, metabolite- and pathway-level factors responsible and/or indicative for specific clinical features (for example chemoresistance / chemosensitivity or long / short survival) are investigated. Markers with therapeutic or prognostic value will be further validated and implemented in a routine diagnostic setting using appropriate techniques. Knowledge on the pathways involved may result not only in tailor made therapy for each individual patient but may also provide options to modulate the expected tumor behavior to the benefit of the patient.

(b) *Invasive growth of the glioma cells.* Because of their invasive growth patterns (infiltrating the surrounding (normal) brain tissue) gliomas can usually only be partially resected by the neurosurgeon and regrowth of the remaining tumor cells is common. Knowledge of the genes, proteins and mechanisms involved needs to be expanded using the appropriate glioma-models as well as tumor biopsies from the tumor core (non-invasive) and the invasive tumor front. In the future options to inhibit this growth pattern at an early stage are expected to improve surgical resection possibilities and clinical outcome of the patients.

(c) *MR Spectroscopy*. With the use of magnetic resonance spectroscopy metabolic profiles of tumors can be established. In the UMCN we have the equipment to perform both *in vivo* (patient) and *ex vivo* (tumor biopsy) Spectroscopy on humans and on animals. The clinical value of these metabolic profiles are bing estabilshed.

To further elucidate the aspects described above, different approaches are used in our group :

Genetic analysis :

- characterization the numerical and structural chromosomal aberrations by ((array)CGH)
- detection of (gene) mutations/deletions relevant for specific tumor types
- establish expression patterns in groups with (clinically) different characteristics (affimetrix expression array analysis)
- validation of the genetic analysis as an additional tool in tumor classification
- establish assays that can be implemented in a routine diagnostic setting

Clinical research :

- establish the clinical characteristics (survival, response to chemo/radiotherapy)
- establish the correlation between clinical and genetic data and identification of molecular markers with prognostic and therapeutic implications

Histopathological analysis :

- culturing of primary brain tumors
- evaluate 'pitfalls' within the brain tumor diagnostics
- correlation between histopathological features and genetic data
- evaluate immunohistochemical markers in relation to their clinical and genetic characteristics

Xenograft experiments :

- evaluate response to different chemotherapeutic agents of different human glioma lines
- investigate (invasive) growth patterns of different human glioma lines
- modulation of chemoresponse and invasive growth

Radiology analysis :

- interpretation of *in vivo* MR Spectroscopy data from brain tumor patients in correlation with the genetic and clinical data
- assist with *ex vivo* Spectroscopy (HRMAS) on human tumor tissue, xenografted tissue and cell-lines. Data processing and interpretation of the results
- assist with *in vivo* MR Spectroscopy on glioma xenografted mice. Interpretation of the results and correlate/translate to the patient setting.

During their traineeship students will have their own project and depending on this project they will work with and optimize different techniques for example CGH (Comparative Genomic Hybridization), array-CGH, expression profiling, (F)ISH (Fluorescent In Situ Hybridization), karyotyping, DNA en RNA isolation, Sequence-analysis, LOH (Loss of Heterozygosity), MLPA (Multiplex Ligation-dependent Probe Amplification), cell culture, histological techniques. Additionally, students attend several meeting(s), for example on ongoing research, held at the department of pathology at a weekly basis.

Close collaborations exist between different departments within the UMCN as well as with other national and international research groups.

Dermatology (UMCN, St. Radboud)

Staff: prof.dr. J. Schalkwijk, 3614094 j.schalkwijk@derma.umcn.nl and dr. P.E.J. van Erp, 3613548, p.vanerp@derma.umcn.nl
Website: http://www.skin-lab-nijmegen.nl/

The Laboratory of Skin Biology and Experimental Dermatology is a well-equipped facility for basic and biomedical scientists working on skin biology and skin diseases. We are interested in inflammatory diseases (e.g. psoriasis and eczema), disorders of differentiation and tissue engineering of skin.

We have a number of ongoing projects where students can participate. These include:

- cell biology of epidermal growth and differentiation
- regulation of inflammation and host defense mechanisms in human skin
- development of (flow)cytometric techniques to analyze cellular behaviour in human skin
- tissue engineering of human skin
- Skin barrier research

Techniques

- *Cell culture*
- *Gene cloning*
- *Production of recombinant protein*
- *Quantitative PCR*

- *Immunohistology*
- *Flow cytometry*
- *Enzymology*
- *Protein purification*

Orthodontics and Oral Biology (UMCN, St. Radboud)

Head: prof.dr. A.M. Kuijpers-Jagtman
Contact: dr. J.W. Von den Hoff, 3614084; h.vondenhoff@dent.umcn.nl

Within the laboratory of Oral Biology of the department of Orthodontics and Oral Biology, animal experimental and cell biological research is conducted in the field of wound healing after cleft palate repair.

The aim of this research is to develop new strategies to improve tissue regeneration after cleft palate surgery. Since several years we are studying palatal wound healing and methods to reduce scar formation. This research makes use of our rat model for palatal wound healing, and several *in vitro* models. At present we incorporate growth factors and cytokines into collagen scaffolds to improve palatal tissue regeneration. In a more fundamental project we are studying the contribution of bone marrow stem cells to palatal wound healing. This also involves studying the differentiation of stem cells to fibroblasts and myofibroblasts in 2D culture models, and 3D modified collagen scaffolds. The final aim is to reduce the differentiation of myofibroblast from fibroblasts in order to prevent scar formation. Recently, we started a project on the regeneration of muscle tissue using modified collagen scaffolds and muscle stem cells. The general aim of our research is to improve tissue regeneration in CLP patients after surgery. Students can apply for an internship of al least 6 months in the field of wound healing or muscle regneration.

The following techniques are being used:

- (Immuno)histochemistry for mineralized tissues
- In situ hybridization
- Biochemical assays on tissue samples
- Cell culture
- Confocal laser scanning microscopy (CLSM)
- Flow cytometry (FACS)
- SDS-PAGE and substrate zymography
- Western blotting
- Quantitative PCR

Clinical Chemistry (UMCN St. Radboud)

Laboratory of Genetic, Endocrine and Metabolic Disorders

Head: Prof. dr. R.A. Wevers

Scientific staff: Dr. J. Gloerich, Prof. dr. H.P.M. Hermans, Prof. dr. L.P.W.J. van den Heuvel, Dr. L.A.J. Kluijtmans, Dr. F.N. van Leeuwen, Dr. D.J. Lefeber, Dr. L. Nijtmans, Dr. R.J.T. Rodenburg, Prof. dr. C.G.J. Sweep, Prof. dr. D.W. Swinkels, Dr. ir. M.M. Verbeek

Secretariat: Ms S. Hoenderop, tel. +31-24-3614567, e-mail: mailto: s.hoenderop@labgk.umcn.nl

Website: www.umcn.nl/lgem

Research:
- Mitochondrial disorders
- Neurochemistry of Neurodegenerative and Neurometabolic disorders
- Proteomics and neuromuscular disorders
- Disorders of Glycosylation
- Renal development in health and disease or Pediatric Nephrology
- Pediatric oncology
- Infectious diseases
- Iron metabolism
- Endocrine disorders

Description of research:
The Laboratory of Genetic, Endocrine and Metabolic Disorders, department of Laboratory Medicine, has several areas of research. Via our secretariat more detailed information is available on the research lines of the laboratory. A wide array of techniques is available at the level of metabolites, proteins (proteomics) and at the molecular genetic level. The main research lines are:

Mitochondrial disorders
The Nijmegen Center for Mitochondrial Disorders (NCMD) is an international reference center for patient care, diagnostics and research of mitochondrial patients. The NCMD investigates about 500 patients and/or patient biopsy samples on a yearly base. The research group characterized most of the 39 structural nuclear encoded complex I genes and found first mutations in such genes in various complex I deficient patients. The group currently is involved in the elucidation of the cell biological consequences of human complex I deficiency.

Neurochemistry of Neurodegenerative and Neurometabolic disorders
Research focuses on the following topics: 1) Pathogenesis of Alzheimer's disease (AD). In order to get more insight into the pathogenesis of this neurological disorder, cell culture and animal models are used. 2) Biomarkers for neurodegeneration. It is difficult to clinically distinguish between various neurodegenerative disorders (dementia syndromes such as AD; movement disorders such as Parkinson's disease) early in the disease process. We aim to develop biomarkers for these disorders in order to improve and accelerate the clinical diagnosis. 3) Disorders of neurotransmitter metabolism. Diagnosis of these disorders relies on specialized biochemical diagnostic assays. Novel genetic disorders have been identified by our laboratory in the past years and it is expected that the number of inherited disorders will continue to expand.

Proteomics and neuromuscular disorders
The Nijmegen proteomics facility centre in our laboratory uses state of the art techniques (2-dimensional electrophoresis, MALDI, LC in combination with fourier-transformed mass

spectrometry). For research purposes the laboratory concentrates on neuromuscular diseases and on the human proteome of various subcellular organelles in muscle.

Disorders of Glycosylation
Genetic defects in protein glycosylation lead to severe multi system disease in the first year of life. Our studies focus on the molecular background of such defects. Our studies focus on:
a. elucidation of primary defects in as yet unsolved cases
b. development of new methylation (expression arrays, proteomics)
c. O-glycosylation mechanisms

Renal development in health and disease or Pediatric Nephrology
In the pediatric nephrology the research is focussed on: a) The pathogenicity of the hemolytic uremic syndrome; b) Inherited tubular transport defects; c) The role of the extracellular matrix in renal pathology; d)Efficiency of renal replacement therapy. The studies are performed on the level of metabolites (metabolomics), protein (proteomics) and DNA/RNA (genomics).

Pediatric oncology
The mission our laboratory is to investigate the cell biology and genetics of childhood malignancies by combining genetic profiling using array CGH with cell biological studies in mouse models and model cell lines. Currently, our efforts are aimed at the identification and characterization of (novel) signaling pathways that contribute to therapy resistance in pediatric Acute Lymphoblastic Leukemia (ALL). Other research interests include regulation of (tumor) cell invasion and metastasis by the actomyosin cytoskeleton and the role of nonconventional myosins in immune regulation.

Infectious diseases
The pathogenesis, immunology and epidemiology of pediatric infectious diseases are the central research themes. The Laboratory aims to improve the molecular and clinical understanding of the biology of infectious diseases. The laboratory research team has great experience in the growth and genetic manipulation of *Streptococcus pneumoniae*. Bacterial genomic fingerprinting, genomic array footprinting, transcriptional profiling (micro arrays, Q-PCR) and proteome profiling (two-dimensional gel electrophoresis and quantitative mass spectrometry; profiling of both pathogen and host), high-throughput protein identification, *Streptococcus pneumoniae* virulence - and vaccination studies in animal models for both invasive and non-invasive disease as well as asymptomatic carriage, and functional analysis of bacterial proteins are carried out within various research projects. The laboratory has recently expanded its activities towards infections caused by *Moraxella catarrhalis, Haemophilus influenzae* and *Staphylococcus aureus.* In collaboration with various renowned researchers in the field of microbial pathogenesis, we seek to study the molecular interaction between host and microorganism. Our work searches for the development of tools to diagnose, treat and prevent infectious diseases. Hence, our work contributes to the medical care of children suffering from life-threatening infections.

Iron metabolism
This research theme aims at the full understanding of iron metabolism, in particular the identification and characterization of novel factors that mediate dysregulation of iron

homeostasis in various human disorders among which some of the world's most prevalent diseases such as anemia of chronic kidney disease, rheumatic diseases, hereditary hemochromatosis, iron deficiency anemia due to disorders of iron metabolism, iron loading inherited and acquired anemia's, bacterial and malaria infections, cardiovascular disease and the metabolic syndrome. New findings are translated into novel diagnostic assays and therapeutic strategies that can be implemented in the clinic. Among our most recent achievements is the development of a mass spectrometry and immunochemical assays for the recently discovered iron regulatory hormone peptide hepcidin that is currently subject of several translational studies (www.hepcidinanalysis.com).

Endocrine disorders
The research focuses on prognostic and predictive markers in cancer (breast, ovarian, colon) and on endocrine and metabolic diseases. Within the first theme new assays for biomarkers are developed and validated. A well-documented biorepository is available for testing and validating of these new markers. The second theme is primarily focused to diseases of the adrenal gland.
Ongoing PhD studies:
- Signifance of hCG in gestational trophoblastic disease
- Role of Tribbles in breast cancer
- Molecular markers in Pheochromocytoma
- Oestrogen receptor target genes
- Understanding the role of the BRCRP efflux pump, in regulating peripheral steroid metabolism and insulin resistance

Cognitive Psychology (NICI, Social Sciences)

Head: prof.dr. H. Bekkering, 3612632, h.bekkering@donders.ru.nl

Contact: dr. P. Medendorp, 3616041, p.medendorp@donders.ru.nl

In daily life, we seem to be perfectly aware of objects and events in our surroundings. We can even keep track of objects that are no longer in sight when we move around. To interact with the world, however, we need information about where the body is. Apparently, that is no problem either. For example, we can catch a ball without looking at our hands; we are able to reach for things in the dark.

A major goal in cognitive neuroscience is to understand these deceptively simple processes. We try to discover the algorithms and brain areas that represent and store spatial information and transform it into accurate goal-directed movements. So far, much research has focused on the early spatial coding mechanisms or on the late peripheral motor control systems. Yet, spatial coding and movement control are tightly interconnected. That is, spatial information is used to guide our movements and multi-sensory information about our movements is used to update spatial information. These interactions and transformations are complex and poorly understood, since many parameters in different frames of reference must be integrated and controlled simultaneously. Moreover, these transformations are not machine-like processes but involve various higher-level cognitive functions like attention, working memory, planning and decision-making.

We study two important aspects of this problem 1) How do we update spatial information for goal-directed actions during self-motion? 2) How do we integrate spatial and effector (eyes, hands etc) information to plan action? These topic are addressed by studying human subjects in an approach combining computational modeling, neuro-imaging by means of functional magnetic resonance imaging (fMRI) and magneto-encephalography (MEG) at the FC Donders Centre for Cognitive NeuroImaging, and psychophysical techniques using a state-of-art research lab facilitated to measure eye, arm and body movements.

Prerequisite Courses: Neurobiofysica

Donders Centre for Cognitive Neuroimaging

Managing director: Prof. Dr. David Norris

Secretary: mw. T. Stijns, tel. 024-3610651, tildie.stijns@donders.ru.nl

Website: http://www.ru.nl/neuroimaging

The mission of the Donders Institute's Centre for Cognitive Neuroimaging (DCCN) is to conduct basic and applied research in cognitive neuroscience (i.e. human and animal cognition, as viewed from the perspective of the brain). Much of the rapid progress in this field is being driven by the development of complex neuroimaging techniques for the in-vivo scanning of activity in the human brain - an area in which the DCCN plays a leading role. The research themes of the DCCN cover central cognitive functions, such as perception, action, attention, memory, language, learning and plasticity. The aim is to unravel these complex cognitive functions and discover how they are represented in the brain. This is done by identifying the networks of brain areas that are vital to each of these functions.

The DCCN also aims to establish how the different brain areas coordinate their activity with very high temporal precision (in the order of tenth of milliseconds) to enable human and animal cognition. A further aim is to understand how neurons make networks, and how networks carry out cognitive functions - in other words, how we get from neurons to cognition. Another important aspect of the research is to improve the imaging methods themselves, by optimising the combination of imaging techniques with high spatial (fMRI) and high temporal (MEG and EEG) resolution (i.e. multimodal imaging), and by developing advanced data analysis tools to extract the relevant information from the highly complex signals which these imaging systems provide.

The DCCN research is organized in several research groups, each headed by a Principal Investigator. Information on the research groups can be found at our website.

If you are interested in a trainee ship at the Donders Institute's Centre for Cognitive Neuroimaging you can apply by sending your CV and a motivation letter to: tildie.stijns@donders.ru.nl. Candidates should spend at least 6 months at the DCCN.

Environmental Science

Head: prof. dr. ir. J. Hendriks

Staff: dr. R. Leuven, dr. R. Lenders, dr. A. Ragas, dr. M. Huijbregts en mw. dr. M. van Katwijk

Contact: mw. G. Delmee en mw. N. Mohr, 3653281, secres@science.ru.nl

Research themes at the Department of Environmental Science

We aim to understand and predict biological responses to physical and chemical pressures. Our research focus is on the impact of reconstruction and pollution on plant, animal and human populations in the rivers and estuaries of the Rhine and Meuse basin. Our students are trained to become professionals in research, management and consultancy on environmental, nature and water issues. As we are both interested in and dedicated to environmental problems, we develop scientific knowledge and implement it in society.

Our research is centered on the following fields:

- ecological rehabilitation of rivers and estuaries
- environmental risk assessment of substances

Usually, the first traineeship is internal, i.e. carried at our department, while the second is external, i.e. hosted by one of our partners. We have close relationships with several ecological and environmental research institutes (in particular NIOO, RIVM), governmental agencies, NGO's, consultants and industry.

For more detailed and actual information of the research topics we refer to our homepage (http://www.ru.nl/environmentalscience) and subsequent links to the topics and staff. In addition, some of our partners participating in hosting trainees can be found at (http://www.ru.nl/environmentalscience/partners/). You are invited to contact our staff directly or via our internship coordinator Mark Huijbregts.

Examples of topics for a MSc thesis that are currently available:

- Reconstructing the historical fish fauna of Rhine and Meuse
- The (pre-)historic influence of humans on riverine flora and fauna
- Determining ecological key-factors by means of threatened flora and fauna species in the Dutch river district
- The role of scientists and stakeholders in water management
- Ecological characteristics of macroinvertebrates in urban water systems (Arnhem-Nijmegen).
- Analysis of ecological characteristics of BIO-SAFE species as a tool in ecological evaluations
- Seagrass beds and turtle grazing: interactions and feedbacks related to nutrient and water dynamics (Indonesia)
- Seagrasses against lugworms: two ecosystem engineers that stabilise and destabilise their sediments respectively: who wins? (Eastern Scheldt)
- Sustainable aquaculture and fisheries: application of People-Planet-Profit criteria and life cycle analysis in aquaculture practice

- Spatial variability in the exposure of birds and mammals to substances in floodplains
- Coupling of hydromorfological and chemical stress to ecological response and human risk with the use of meta-analysis and simple models
- Hot in macro-ecology: how organism body size can explain species attributes (minimum area to be conserved, predator-prey interactions, etc.)
- Are new substances threatening human and ecosystem health: nano-materials, fluorinated compounds, new generations of pesticides, etc.
- Reduction of ecological risks as a result of the dredging of contaminated sediment
- How to combat climate change? Primary causes and effects
- Are biofuels carbon-neutral?
- Differences between actual and perceived risks of chemicals

For an actual and detailed overview of topics for traineeships at Environmental Science we refer to http://www.ru.nl/environmentalscience/education_0/student_research/master/

3.11 Overview master courses

During the master phase, parallel to the traineeships, you have the opportunity to take mastercourses the so called '**caput courses'** (courses on selected topics). Caput courses are series of lectures that correspond to 3 credits. The lectures are provided by both the departments of the Educational Institute Biosciences as well as by departments of the UMCN and the NCMLS. There are 3 periods during the academic year in which various caput courses are organized, in the form of two fixed hours on Friday, for the duration of around 12 weeks, followed by a written examination. The first period is from September through November; the second period is from December through February and the third period is from March through June.
See our homepage for the schedules: http://www.ru.nl/biowetenschappen

A caput course can be the theoretical component of a traineeship.

Registration for participating in caput courses is to occur via KISS; the same applies to registering to participate in the examinations pertaining to the caput courses.

For a schedule of caput courses and their examination date throughout the academic year you can visit www.ru.nl/biowetenschappen

Human fertility and infertility

Course ID: **BM012C** *3 ec* August 30 - November 5, 2010 dr.ir. P. de Boer

Teaching methods
- 13 hrs lecture
- 13 hrs student presentation
- 12 hrs student project

Prerequisites
This caput has been developed as an extension to the element 'human fertility and germcells' of course BB047B, Human embryology and reproduction (Humane embryologie en voortplanting) of the BSc phase. Some background in genetics, molecular biology, cell biology, anatomy, histology/cytology and endocrinology all help in applying these principles to mammalian/human reproduction.

Objectives
The goal of this course is to enable participants to practise the integration of knowledge of genetics, epigenetics and germ cells in the process of reproduction. From this integration, a more independent judgement of spontaneous human reproduction relative to artificial human reproduction maybe developed. Also the critical evaluation of research outcomes as published in the international literature, is one aspect of this course, as is the delineation of lacuna(s) in our understanding of human reproduction.

Contents
Central to the caput is the origin of germcells, colonisation by these cells of the gonad, oogenesis and spermatogenesis as these processes will determine the quantity and quality of gametes: secondary oocytes and sperm. Quality control mechanisms in both oogenesis and spermatogenesis will receive attention as will epigenetic and genetic aspects of gametogenesis and early preimplantation development. Over the last years, special emphasis has been placed on the epigenetic aspects of information transmission to enable the next generation to arise. Due to the relative unavailability of human research material, mouse model systems will often be used and discussed. Contact hours are divided between introductory lectures, often with chromatin of germcells as the starting point, and the presentation of recent literature by the student participants.

Examination
Participants do write an essay. Ideally, the essay which can be based on the presentation of participants, gives a treatise of an aspect of human reproduction, evaluating the known and unknown elements. The essay preferable is in English.

Apoptosis

Course ID: **BM004C** *3 ec* August 30 - November 5, 2010 dr. W.C. Boelens
prof. dr. N.H. Lubsen

Teaching methods
- 20 hrs lecture

Prerequisites
Biochemistry and Molecular Biology II (BMB-II)

Objectives
After completing the course the student should be able to understand what apoptosis is, how it is regulated and in which way it is involved in the many different cellular processes. Apoptosis is a highly regulated process that is needed to kill a cell clean and neatly. For a very long time the process was neglected, but now the importance of the process is generally accepted. Apoptosis is involved in many different aspects of life, such as embryonic development, tissue homeostasis and regulation of the immune response. Deregulation of the apoptotic process plays an important role in the development of autoimmune diseases, cancer and viral infection.

Contents
- Introduction Molecular Aspects of Apoptosis
- Apoptosis and Cancer
- Apoptosis and Stress
- Apoptosis and Autophagy
- Regulation of Translation during Apoptosis

Literature
Hand-outs, distributed via blackboard

Examination
Written exam.

Extra information
contact: dr. W. Boelens, phone 36 16753, e-mail: w.boelens@ncmls.ru.nl

Capita selecta: Metabolism, transport and motility

Course ID: **LM011** *3 ec*

dr. L.P.W.J. vanden Heuvel
prof.dr. P.M.T. Deen
mw dr. R. Masereeuw
prof. dr. B. Wieringa

Teaching methods

- 20 hrs lecture
- 60 hrs individual study period

Prerequisites

recommended: 'Biochemie en moleculaire biologie II' and 'Celbiologie der dieren'

Objectives

Make students familiar with the biomedical significance of energy and metabolites in the "small molecular world"and how the role of these compounds is integrated in the larger cellular network for metabolism, transport and motility. Specifically, students should be able to

- appreciate the significance of 'metabolic, transport and motion research' for molecular life sciences
- recognize current possibilities and developments in the field
- implement the newly obtained knowledge in future research activities

Contents

Students will be offered a comprehensive series of introductory lectures on the topics of interest that go beyond basic (bachelor) knowledge of biochemistry and cell-biology textbooks. They will be asked to read background literature and use information at websites to make themselves familiar with knowledge on the significance of metabolite profile analysis, the role of energy and redox metabolism in cell viability and mobility control, (reverse) genomics and proteomics for the study of transport proteins, channelopathies, mitochondrial diseases, and multifactorial disorders. Emphasis will be on the value of multi-disciplinary approaches.
Subjects:

- The essence of metabolic investigations
- Multifactorial disorders
- OXPHOS system diseases
- Proteomics and human pathology
- Water channels
- Body water homeostasis
- ABC transporters and solute carriers
- Regulation of drug transporters in health and disease
- Coupling of energy/redox metabolism to cell viability and motility control
- Biochemical adaptation to energy and redox stress

The course will be focused on aspects of metabolism, transport and motility in muscle, brain, kidney disease and cancer and other related health problems.

Literature
Literature assignments and hand-outs are distributed during the lectures

Examination
written examination.

Extra information
Contact: Dr. L. van den Heuvel (024-3617983 ot 024-3614428),
B.vandenHeuvel@cukz.umcn.nl

Adaptation physiology

Course ID: **BM010C** *3 ec* September 27 - October 8, 2010 prof. dr. G. Flik
dr. P.H.M. Klaren

Teaching methods
- 26 hrs lecture
- 54 hrs individual study period

Prerequisites
Acquaintance with the content of the Bachelor courses 'Adaptation Phyiology' and 'Endocrinology' is highly recommended, but not a strict requirement.

Objectives
Increased insight in dedicated aspects of the broad field of adaptation physiology through interactive lectures on recent developments in this research field.

Contents
This series of lectures focuses on organismal physiology: regulatory mechanisms in the intact animal are addressed (Integrative Physiology). The central theme is how animals (including humans) have adapted to realise a dynamic interaction and to cope with continuously changing environmental conditions. Homeostatic and allostatic principles are discussed. Two internal systems are predominantly involved in this adaptation: the nervous system and the endocrine system. Together these systems control the activity of peripheral endocrine and non-endocrine targets, resulting in a functional adaptive response. In this regulation the hypothalamus and pituitary gland are pivotal as relays between the central nervous system and peripheral organs; in the hypothalamus signals from central and peripheral sensors are integrated with peripheral (endocrine) signals from e.g. the immune system and gastrointestinal tract. The intensive interaction of the immune system and the neuroendocrine system is illustrated with the stress response, based on ongoing recent research towards the neuroendocrine mechanisms at the basis of active and passive coping strategies in animal models.
The course's content is centered around the themes: Adaptation and Evolution, Temperature Adaptation, Allostasis and Allometry, Plasticity of Organ Systems, and Shore Lines and Estuaries. When appropriate, topics that received attention in recent papers and science sections of news papers can be addressed.

Literature
The lectures will be published as Powerpoint-handouts (without subtexts!) on BlackBoard.
Recommended: dedicated chapters in Eckert's Animal Physiology.

Examination
The written exam consists of a selection of open questions on different topics.

Extra information

contact: Mrs. D. Maurits (d.maurits@science.ru.nl)

Gene expression, chromatin and disease

Course ID: **BM009C** *3 ec* Not in 2010 - 2011 dr. C. Logie
dr. G.J.C. Veenstra

Teaching methods
- 24 hrs lecture

Prerequisites
Biochemistry and Molecular Biology II and Functional Genomics courses. This prior knowledge can be found in Lodish 6th edition, Chapters 4, 6, 7, 8, 20, 21.

Objectives
This course aims to showcase current insights in the role of gene expression with respect to cancer, congenital disease, embryonic development and establishing cellular identity. Special emphasis will be on epigenetics (heritable modifications of chromosomes), transcription factors and the molecular biology of tumor suppressors.

Contents
1. Introduction chromatin structure and function
2. Epigenetics as molecular memory
3. Chromatin and cancer
4. Imprinting and imprinting syndromes
5. Animal models for the pathology of chromatin dysfunction

Literature
Literature: Lectures, PowerPoint print-outs

Examination
Written Essay

Extra information
Contact person: dr. Logie tel: 3610525, c.logie@ncmls.ru.nl

Oncology

Course ID: **BM015C** *3 ec* November 8, 2010 - January 28, 2011 dr. G.N.P. van Muijen

Teaching methods
20 hrs lectures, 60 hrs self study

Objectives
To gave insight into fundamental and medical aspects of tumor growth oncogenesis, tumor progression, distribution of the various types of tumors, diagnostic procedures and various therapeutic options will be discussed. Finally, psychologic implications of cancer will be discussed.

Contents
During this course several subjects in oncology will be presented and discussed. These subjects are:
1. Chemical carcinogenesis
2. Epidemiological aspects of tumors
3. Tumor stroma
4. Tumor stem cells
5. Tumor angiogenesis
6. Hereditary tumors
7. Chemotherapy and receptor-mediated therapy
8. Immunotherapy
9. Radiotherapy
10. Psychological aspects of cancer

Literature
Readers

Examination
Written exam.

Ecology and management of large rivers

Course ID: **BM002C** *3 ec* Not in 2010 - 2011

dr. H.J.R. Lenders
dr. R.S.E.W. Leuven
prof. dr. ir. A.J. Hendriks
prof. dr. G. van der Velde
prof. dr. A.J.M. Smits
dr. L.P.M. Lamers
drs. C.A.M. van Turnhout
dr. A.J.P. Smolders

Teaching methods

- 26 hrs lecture
- 54 hrs individual study period

Objectives

Goals of the caput lectures are:
to provide insight in the genesis, structure and functioning of large river ecosystems
to provide insight in possibilities and opportunities for ecological rehabilitation of large rivers

Contents

1. Ecological concepts for river management
2. Morfo-dynamics and floodplain sedimentation
3. Palaeogeography of the Dutch Delta
4. History of human occupation of riverine environments
5. Trends in water and sediment quality in relation to biota
6. Vegetation: biogeochemical constraints and floodplain dynamics
7. Fauna in river systems: macroinvertebrates, fish, reptiles and amphibians, birds, mammals

8. Biological invasions in river systems
9. Ecosystem based water managments: innovative techniques in management
10. Ecological rehabilitation

Literature

Learning materials as well as ppt-presentations will be made available through Blackboard

Examination

By a written examination

Extra information

Lectures will be given by specialists in the field of river functioning and management. Besides internal teachers a variety of lecturers from other universities, research institutes, private nature conservancy and research organisations and consultancy firms will be invited.

Population ecology

Course ID: **BM021C** *3 ec* January 30 - April 15, 2011 prof. dr. J.C.J.M. de Kroon
dr. ir. E. Jongejans

Teaching methods

- 24 hrs lecture
- 56 hrs individual study period

Objectives

The purpose of the caput is to have you become familiar with population matrix models, which is a type of model that is frequently used in tackling the problems sketched above. In addition to explaining the basis of the models, in which the mathematical background is avoided as much as possible, case studies are handled that clarify how you can gain insight into the underlying causes of certain developments in a population and how you can adequately respond to this in terms of management.
Training method
The caput course starts off with a few lectures in which the basic principles of the matrix models are explained. Using specified articles and chapters that you are to study in your own time, you are to quickly master these basic principles. The next step of the course involves examining case studies, which are presented at the beginning of the course in the form of a reader with articles. During the course, each student is to give at least one presentation on a certain article. Upon concluding your presentation, you are to put forward a number of problems that will then be discussed with the entire group. The strengths and weaknesses of the article, as well as the adopted approach, can be adequately communicated in this way.
The course will be graded on the basis of the presentation and a written exam at the end of the course. In the exam a new article is to be evaluated by each student individually in which they can use all course materials ("open boek tentamen").

Contents

The populations of plants and animals are constantly changing. Some species are very successful and grow and multiply themselves rapidly. Examples include weeds and invasion species that penetrate into an ecosystem from some other continent. This while the circumstances are difficult for other species. Due to the reduction and fragmentation of their natural habitat, their populations are constantly decreasing in size, which increases the risk of becoming extinct.
Much use is made of population models in order to gain insight into the questions why the populations of some species can considerably expand and why other species are threatened in various ways. These models make it possible to determine the most important stages in the life cycle of a plant or animal species. The management can respond to this by promoting certain stages (in the case of rare species) or by precisely combatting certain stages (in the case of a plague species).

Examination

The final assessment is based on the verbal presentation and one's contribution to the discussion.

Extra information

contact: Ms. J. Broekmans, 3652410, j.broekmans@science.ru.nl

Vegetation monographs

Course ID: **BM034C** *6 ec* January 30 - July 1, 2011 prof. dr. J.H.J. Schaminee

Teaching methods

In a series of ten meetings of three hours (one meeting every two weeks), students and supervisors will discuss different aspects of an actual subject in present-days vegetation research, resulting in a book (in Dutch language) that will be published later in the year. The rest of the time is needed for reading literature and preparing presentations, as well as for writing the aimed contribution to the book and commenting on drafts of other chapters. The course (6 EC's) has limited access and candidates will be selected on the basin of an interview. As the course is a joint course with Wageningen University, the meetings will be alternating in Nijmegen and Wageningen; the venue of 2010-2011 will be Wageningen.

Objectives

This course serves different goals. The students will learn to research (select and study) literature, to present the results of this research and to lead a joint debate - with the other students and supervisors - on the topic for which he/she is in charge; finally, the student will prepare, in close collaboration with his/her supervisor, a manuscript for a chapter in the aimed book.

Contents

Three years ago we started - in a close collaboration between Master students and supervisors to write a first book in a series called 'vegetation monograph'. The first project started in November 2007 and was dealing with the topic of vegetation geography. The book - with the title 'Grenzen in beweging' - has been published by Uitgeverij KNNV in October 2008. The second series, that started in November 2008 has focused on the discrepancy between the conservation of semi-natural communities and landscapes and the development of what is called 'new nature'. The title of the series and book is 'Natuur als nooit tevoren' (Nature as never before). At the moment we are in the process of finishing a third volume on 'plant-dierrelaties' (plant animal relationships). This will be published oktober 2010. Short after that we will start to work on boek number 4, of which the topic will be "historical ecology". The provisional title of the book is 'Geboeid door het verleden'.
The students will be supervised by authorities in the field of nowadays vegetation research and nature conservation in the Netherlands. In the first meeting of the course, the topic and individual items will be defined and teams (one student - one supervisor) will be formed. Each student will be co-author of the book and first author of the chapter for which he is in charge.

Examination

Manuscript for the chapter of the aimed book

Molecular and cellular neurobiology

Course ID: **BM001C** *3 ec* April 18 - July 1, 2011 dr. B.G. Jenks
prof. dr. E.W. Roubos
prof. dr. G.J.M. Martens

Teaching methods
- 20 hrs lecture

Prerequisites
Bachelor level Cell Biology, Molecular Biology and Neurobiology

Objectives
The aim of this course is to give students an appreciation of current issues in Neurobiology, particularly molecular and cellular aspects and how these can impact on neurodgenerative diseases and behavior.

Contents
This course considers advanced topics of molecular and cellular aspects of neurobiology. Particular attention is given to where such mechanisms impact on behaviour. Among the topics covered in recent years are: Hypothalamic Control of Feeding; Oxytocin: a Multifunctional Behavioral Neuropeptide; The Neurobiology of Fear; Adult Neurogenesis; The Molecular and Cellular Mechanisms involved in Neurodegeneration; Genetic and Epigenetic Mechanisms underlying Neurodevelopmental Disorders. A selection of these, or similar topics will be presented in the course. Instructors for the course are: Bruce Jenks (10h of lectures), Gerard Martens (8h) and Eric Roubos (2h). The lectures are in English (Exam can be in English or Dutch).

Examination
Written exam

Principles of Systems Biology

Course ID: **BM041B** *3 ec* January 30 - April 15, 2011 prof. dr. L.M.C. Buydens

Teaching methods
14 x 2 hrs = 28 hrs lecture
14 x 4 hrs = 56 hrs individual study

Objectives
To obtain insight into the fundamental concepts and applications of systems biology at the theoretical and practical level, with emphasis on human metabolism. Lectures will be given by members of the Nijmegen Centre for Systems Biology and Bioenergetics (CSBB; www.csb-bioenergetics.nl) and invited external lecturers.

Contents
Biological systems like cells, tissues and organisms display a highly organized structure and function. The essence of systems biology has been described as: "The study of biological systems by systematically perturbing them (biologically, genetically, or chemically); monitoring the gene, protein, and informational pathway responses; integrating these data; and ultimately, formulating mathematical models that describe the structure of the system and its response to individual perturbations". In this sense, systems biology is a groundbreaking scientific approach that integrates recent developments in the fields of biochemistry, pharmacology, cell biology, cell physiology, computer science and systems engineering. Systems biology will be a vital tool in elucidating the many interacting factors that contribute to the cause of diseases. One of the most immediate impacts will be on the drug development process, bringing innovative drugs to the patient more quickly.
This course is intended to give advanced students a firm background understanding of the concepts used in systems biology. The biological focus will be on how systems biology approaches can help to understand human metabolism in health and disease. This directly relates to the recently established Nijmegen Centre for Systems Biology and Bioenergetics (CSBB), which aims to create large-scale metabolic flux models as well as dynamic models of single cells. These will be used to predict the consequences of disease-related disturbances of energy homeostasis with the aim to develop effective and safe pharmacological and nutritional interventions.

Subjects
1. Biological systems
- Metabolism
- Signal transduction

2. Model types
- Many particle models
- Kinetic models
- Dynamical systems
- Optimization and control theory
- Structural stoichometric models

- Deterministic kinetic and spatial models
- Stochastic dynamics

3. Modeling skills

- Model building
- Model reduction and combination
- Data collection and statistical analysis
- Parameter selection and optimization, model testing and selection
- Local sensitivity/control theory and global sensitivity/uncertainty analysis
- Optimal control

4. Special topics

- Spectral unmixing, machine learning and pattern recognition
- Drug discovery, nutraceuticals and adverse drug effects
- Mitochondrial medicine

Literature

"Systems Biology", Klipp et al., Wiley-VCH, 2009; price: ~ 60 Euro.

Examination

The final written exam includes essay questions, divided across the topics.

Cellular Imaging in Four Dimensions

Course ID: **BM016C** *3 ec* January 30 - April 15, 2011 dr. P.H.G.M. Willems
dr. W.J.H. Koopman
dr. J.A.M. Fransen

Teaching methods

- 20 hrs lecture
- 60 hrs individual study period

Objectives

Students gain knowledge into the fundamentals and applications of advanced cellular imaging techniques in biomedical research. The lectures will provide the students with practical examples of ongoing research in the Molecular Life Sciences.

Contents

'Cellular Imaging in Four Dimensions; principles and applications' (Coordinator P. Willems, p.willems@ncmls.ru.nl, 3614589)
I. Principles of fluorescence and electron microscopy
1. Introduction to microscopy (Jack Fransen)
2. Advanced microscopical techniques (Jack Fransen/Peter Friedl)
3. Proteinacious reporter molecules (Werner Koopman)
4. Chemical reporter molecules (Peter Willems)

II. Image processing and quantification in microscopy
5. Image processing and quantification (Werner Koopman)
6. Analysis of molecular complexes in cellular signal transduction (Roland Brock)
III. State-of-the-art applications in biology and medicine

7. Imaging of intracellular protein routing in health and disease (Jack Fransen)
8. 'Dyeing' mitochondrial shape and function in metabolic disease (Peter Willems/Werner Koopman)
9. Dynamic imaging of cancer (Peter Friedl)
10. Analysis of cellular import, residence time and breakdown of potential therapeutic molecules (Roland Brock)
Examination (Tentaminering)
The final written exam includes 10 assay questions, one question per subject.
Extra information (Bijzonderheden)
contact: mrs L. Brocatus, 024-3614259, L.Brocatus@ncmls.ru.nl

Examination

The final written exam includes both parts of the course.

Extra information

contact: mrs. J. Rullmann, 3652701, j.rullmann-freriks@science.ru.nl

Endocrinology

Course ID: **BM032C** *3 ec* April 18 - July 1, 2011 prof. dr. G. Flik
dr. P.H.M. Klaren

Teaching methods
- 20 hrs lecture
- 40 hrs individual study period

Prerequisites
Acquaintance with the content of the Bachelor courses "Endocrinologie" and "Adaptatiefysiologie" is recommended, but not a strict requirement.

Objectives
The lectures are intended to increased the students' insight in current concepts and novel developments in the field of endocrinology.

Contents
This course focuses on selected topics in endocrinology. The scientific content of the caput course builds upon that of the Bachelor course "Endocrinology", but is far more advanced. Dedicated lectures address topics such as:
- The emergence of Endocrinology
- Evolution of ligand-receptor combinations
  - Ligand exploitation theory
  - Novel thyroid hormone metabolites and funtions
- Interactions between regulatory systems
  - Endocrines and the nervous system in the digestive tract
  - Endocrines and the immune system: chemokines and cytokines
- Complexity in endocrine signaling
  - The CRH/ACTH system
  - The melanocortin receptor family
- The power of comparative endocrinology
  - Stanniocalcins: from fish to human
  - PTHrP/PTH

Lecturers will present their comparative endocrinological views on the selected topics. Also, some lectures can be devoted to topics that receive public attention.

Literature
The PowerPoint-presentations of the lectures will be made available on Blackboard and/or a dedicated website.

Examination
The written exam will consist of a number of open questions on selected topics.

Extra information
Contact: Mrs. Daisy Maurits d.maurits@science.ru.nl

Estuarine Ecology

Course ID: **BM008C** *3 ec* April 18 - July 1, 2011 prof. dr. P.M.J. Herman

Teaching methods
- 26 hrs lecture
- 54 hrs individual study period

Objectives
This caput course is held every two years, as of September 2002. The definitive information concerning this caput course will be made known in due time before the course begins. Take note of the announcements on the notification boards at General Biology and Environmental Sciences (AS 038).

Contents
This master course will introduce you to the structure and the functioning of estuarine ecosystems, the transitional environments from freshwater to brackish waters and from brackish to salt waters. It specifically aims at providing insight in the complex interacting processes that determine the functioning of these ecosystems. A multidisciplinary, systems-oriented approach and the use of models to enhance understanding of system functioning is an objective of the course, but it is in no way a technical modeling course. Multidisciplinarity is also extended to the problem of management and maintenance of estuarine systems.

Subjects
Focus will be on food webs and the cycles of substances, on physical-biological interactions, and on the relevance of scientific understanding for management. Various guest speakers will participate in the course. After an introduction into the geology and physics of estuaries, the food web is discussed, touching on such topics as import/export of organic matter, primary production, pelagic and benthic consumption processes, microbial processes, higher trophic levels. Subsequently the focus is laid on the estuary as a habitat, with a discussion of major gradients and how they determine the fauna and flora, and of physical-biological interactions and the self-organisation of the estuarine landscape. Finally, the relevance of these topics for estuarine management is discussed.

Examination
Written exam.

Vegetation ecology and eco-informatics

Course ID: **BM033D** *3 ec* April 18 - July 1, 2011 prof. dr. J.H.J. Schaminee

Teaching methods
The lecture series (3 EC's) consists of nine or ten lectures of two hours, of which the first one will cover general aspects of the 'subject of the day', the second one - presented by an invited guest lecturer - a more specific item connected to this subject. As this master course is a joint course with Wageningen University, the meetings will be alternating in Nijmegen and Wageningen; the venue of 2011 will be Nijmegen. The period of lecturing will be in spring (March-June).

Objectives
This master class will present a wide ranges of subjects dealing with vegetation ecology. Not only principles and methods of modern vegetation research will be treated but also its application in nature policy and nature conservation. Depending on actual themes and the availability of guest speakers, the definitive program of this master course will be known not earlier than two or three months before the course begins.

Contents
The master class gives a synopsis of a wide range of subjects in nowadays vegetation research. Special attention will be paid to the use of large data bases and information systems in recent vegetation research, a new field of interest, called eco-informatics. The course will open with some insight in the historical backgrounds and be concluded with a discussion on future prospects. In the lectures in between, the analytic and synthetic phase in vegetation research will be discussed, as well as the ever-growing importance of computer techniques and items like plant-animal relationships, vegetation mapping and the role of grazing in nature management. The position of plant communities in the landscape will be another item. Insight in the composition, ecology and management of plant communities is more important than ever before, in the light of climate change and changing land use patterns.

Examination
Essay

Capita Selecta: Molecular aspects of host defense, tissue destruction and repair

Course ID: **LM012** *3 ec* 11 March - 8 July 2011 prof. dr. G.J.M. Pruijn
Prof.dr. J. Schalkwijk
dr. P. van der Kraan
dr. R. Torensma

Teaching methods
- 22 hrs lecture

Prerequisites
- 'Biochemie' and 'Moleculaire Biologie II' (BB017C) required;
- 'Immunologie' (BB019B) recommended.

Objectives
After completing the course the student is aware of the molecular mechanisms underlying tissue destruction and repair and has knowledge of the various ways in which the immune system is challenged by both exogenous and endogenous triggers. The student has learned how the immune system responds to these triggers and understands the relationship with infectious and chronic diseases. The student has gained insight into the experimental approaches that are applied to study the molecular and cell biological aspects of infection, immunity and tissue repair.

Subjects
The course will be focused on two types of tissues: skin and cartilage
- Immune system
- Autoimmunity
- Inflammation
- Animal models
- Stem cells
- Tissue repair

Literature
Course material (hand-outs; review articles; scientific papers) will be distributed via blackboard.

Examination
written examination.

Extra information
Contact: Prof.dr. G. Pruijn, 024-3616847, G.Pruijn@ncmls.ru.nl

Microbiology of wetland ecosystems

Course ID: **BM014D** *3 ec* October 11 - 22, 2010 prof. dr. ir. M.S.M. Jetten
dr. H.J.M. op den Camp

Teaching methods

- 16 hrs lecture
- 1 hrs personal study counseling
- 2 hrs question session
- 6 hrs problem session
- 40 hrs individual study period

Prerequisites

It is expected that you have knowledge on the basic aspects of microbiology and microbial ecology obtained via previous courses geomicrobiology, biology of micro organism or microbial ecology or by self study of the relevant chapters of Brock Biology of micro organism

Objectives

The lectures and literature study aim to give students insight in the latest developments within the microbiology of wetlands with respect to methane, nitrogen and sulfur cycling.

Contents

This caput builds on the previous blocks of the master track IWWR and highlights the role of microbes in the important biogeochemical cycles of nitrgen, sulfur and methane
After an introduction in the modern methodes of microbial ecology and microbial metagenomics we will explore the microbes responsible for the biogeochemcial nitrogen cycle with an emphasis on nitrification, denitrification, and anaerobic ammonium oxidation. Furthermore the role of aerobic and anaerobic methane oxidizing microbes in fresh water wetlands will be addressed. The key players in the sulfur cycle and their application in air treatment will summarized. Finally we will read and discuss four recent scientific articles.

Literature

Relevant chapters in Brock Biology of micro organism
hand-outs and 4 scientific papers will be available via black board

Molecular physiology of plant stress adaptation

Course ID: **BM035B** *3 ec* October 25 - November 5, 2010 dr. I. Rieu
prof. dr. C. Mariani

Teaching methods
- 16 hrs lectures
- 16 hrs literature study
- 6 hrs group presentations+discussion
- 6 hrs excursion
- 8 hrs self study

Prerequisites
Basic knowledge of molecular biology is required.

Objectives
- The student can describe the current state of knowledge on how plants adapt to the discussed abiotic stresses at the molecular, cellular and whole organism level
- The student can describe the goals, strategies and challenges of current fundamental and applied research into plant stress adaptation
- The student can interpret and discuss findings presented in scientific papers and oral presentations

Contents
Plants have to deal with a constantly changing environment, which often results in sub-optimal growth conditions, also known as abiotic stress. This includes extremes in temperature, water-, nutrient- and oxygen availability and excesses of detrimental compounds. Being sessile organisms plants have less opportunity of stress avoidance than animals, and thus a relatively large part of the genome is thought to be implicated in adaptation and tolerance. In this caput series we discover how plants adapt to various forms of abiotic stress and how adaptation is regulated at the molecular level. The emphasis will lie on current developments in fundamental research and biotechnological application and as such the course includes discussions of recent papers, guest lectures by specialists in the field and an excursion to one of the leading European plant biotech companies, Bayer BioScience in Ghent, Belgium.

Literature
The subjects will be discussed based on papers made available to the students during the course.

Examination
Assessment of literature presentation & a written exam.

Extra information
Alternative contact at the secretariat of the dept. of Plant Cell Biology: E. Schaberg

(e.schaberg@science.ru.nl; 024-3652777)

Genetics and ecogenomics

Course ID: **BM037A** *3 ec* September 13 - 24, 2010 prof. dr. N.M. van Dam
prof. dr. A.G.M. Gerats
dr. J.L. Peters

Teaching methods
The course consists of lectures, guest lectures, problem-solving hours, and contributions by the students, who are expected to give an oral presentation on a topic related to this course. The subject can be choosen from an available port-folio or as proposed by the student. On the last day of the course, the students will be asked to write an essay on a topic related to the course. A list of topics - and the issues that need to be addressed in the essay - will be presented at the time.

Prerequisites
Basic bachelor courses equivalent to Genetics and Population Genetics (BP011B) and Molecular Biology and Recombinant DNA (BP010B).

Objectives
In this course we will focus on the basic and applied aspects of genes, genomes, and state-of-the art technologies that are used to study the functional evolution of genes in various organisms. At the end of the course, the students will have acquired a deeper understanding of the genetic and genomic principles of evolution, speciation and adaptation of organisms in the context of their biotic and abiotic environment. Moreover, they will have practiced how to critically analyze scientific papers and present the essentials of research in a public presentation.

Contents
1. Introduction to the course, schedule, aims and mutual expectations
2. Lecture: Basic principles of genetics, refresher course
3. Lecture: Genomes: structure, organization and evolution
4. Lecture: Gene technologies: history and future
5. Lecture: Transformation and its use in biotechnology, agriculture and ecology
6. Lecture: The age of -omics: transcriptomics, proteomics, metabolomics and phenomics
7. Lecture: Epigenomics another level of evolutionary complexity?
8. Lecture: DNA barcoding and biodiversity

Literature
PDFs of presentations on Blackboard
Portfolio (PDFs of papers) on Blackboard

Examination
Presentation
Essay (topic to be selected from a list)
Participation in the course activities

Orientation in biology and environmental sciences

Course ID: **BM036A** *3 ec* August 30 - September 10, 2010 prof. dr. J.C.J.M. de Kroon
prof. dr. ir. A.J. Hendriks

Teaching methods

- 15 hrs excursion
- 18 hrs lecture
- 4 hrs question session
- 18 hrs problem session
- 20 hrs individual study period

Contents

As a first Master course in the curriculum you will become acquainted with the research as carried in the Institute for Water and Wetland Research (IWWR), where most general biologists from Nijmegen reside. After a general introduction to the mission and research program of the IWWR, you will receive information from all IWWR research groups on the topics they study and the methods and instruments they use. This program is supplemented with excursions to institutes and organisations for you to get clear impressions of the working environments of Nijmegen biologists, the kind of problems they tackle, and how the knowledge you acquire is applied. Finally, this Orientation course contains a self-assessment on your personal goals for your Master program and the working environments that you prefer, so that you can make well-founded choice for the tracks and interships to chooce.

Examination

- attend a minimal number of research group introductions and excursions
- fill in the self-assessment

Ecological and environmental concepts

Course ID: **BM038A** *3 ec* September 13 - 24, 2010 dr. H.J.R. Lenders
prof. dr. ir. A.J. Hendriks
dr. R.S.E.W. Leuven

Teaching methods
Lectures, self study and discussion sessions

Objectives
The student is acquinted with the concept of sustainable development and can handle derived concepts and methods for environmental and ecological research and management.

Contents
In this 3EC course ecological and environmental concepts will be presented and discussed. Starting point will be the concept of Sustainable Development in its broadest sense (ecology/environment, economy and social aspects, otherwise known as the triple P concept: People, Planet and Profit). Emphasis will be on the historical context and on (handling) the unknown future of sustainable development. Subjects that will be passed in review are: Reference and Target Images, Ecology & Economy, Ecosystem Health, Novel Ecosystems, Cradle to Cradle, Scenario Analysis, and Multiple Criteria Analysis.
Presently, further details cannot be given since the course is still under construction yet.

Subjects
See course description. Details will be announced later.

Literature
To be announced later

Examination
Written examination

Extra information
The course is still under construction

Management of ecosystems

Course ID: **BM039A** *3 ec* September 27 - October 8, 2010 prof. dr. J.G.M. Roelofs
dr. L.P.M. Lamers

Contents

Nature management and restoration has, to a large extent, been based on a trial and error approach. In the present course we will show, for a large variety of ecosystem types, why an approach based on biogeochemical research is vital for ecosystem management and restoration.This method, focusing on key factors and key processes, provides insight into the actual causal relationships between environmental changes and ecosystem responses. In addition, it indicates the target processes for restoration and conservation of biodiversity, and thereby enables scientists and nature managers to predict restoration prospects for locations that differ with respect to their initial conditions.

Biodiversity and ecological assessment

Course ID: **BM040A** *3 ec* October 11 - 22, 2010 dr. R.S.E.W. Leuven

Teaching methods
Lectures (11 h), Tutorials (2 h), working group assignments (5 h), practical training (5 h), Project: writing review (28 h), presentations(2 h), self tuition (24 h), written exam (3 h)

Prerequisites
BSc Environmental sciences, Biology, Natural Sciences.

Objectives
The course is focused on competences, skills and knowledge that will be required for research on biological diversity and assessments of biodiversity in (aquatic) ecosystems.

Contents
The course gives an overview of contemporary scientific concepts and theoretical backgrounds concerning biological diversity. Subsequently, the focus will be on the relevance of biodiversity for functioning of (semi) aquatic ecosystems and the assessment of biodiversity values in riverine systems. The course will be concluded with current themes in biodiversity research.

Subjects
The first part of the course deals with concepts and theory on biological diversity. The focus will be on key questions, such as: What is biodiversity? How to measure and to value biodiversity at various spatial and temporal scales? and What are key factors determining biological diversity?. In addition attention will be paid to extinction of species (the concept of critical population size; irreplacebility of species, global biodiversity and indicators of recent decline) and conservation of biodiversity (legal protection of biodiversity and restoration measures for biodiversity). The second part deals with the relevance of biodiversity for functioning of (semi) aquatic ecosystems. This issue will be elaborated for various types of (semi) aquatic ecosystems such as mangroves, coral reefs, seagrass dominated ecosystems, wet grasslands and riverine ecosystems.
Biodiversity assessment and valuation will be elaborated for a case study on biodiversity in riverine ecosystems (e.g. application of BIO-SAFE model and ecological status assessments). The course will be concluded with reviews of current research themes such as biodiversity in relation to ecosystem services, ecosystem engineers, novel ecosystems, economical values, agricultural practice, aquaculture; appropriate assessments and bioinvasions.

Literature
Student manual and literature will be available on Blackboard

Environmental & Ecological Modelling

Course ID: **MM002A** *3 ec* 25-10-2010 t/m 5-11-2010 prof. dr. ir. A.J. Hendriks
prof. dr. J.C.J.M. de Kroon
dr. A.M.J. Ragas

Teaching methods

- 52 hrs computer course
- 16 hrs lecture
- 16 hrs individual study period

Prerequisites

BSc Environmental Science(s), Biology, Chemistry, Moleculair Sciences or Natural Sciences. The course is part of the MSc Biology and MSc Environmental Sciences.

Objectives

After completing the course the student should be able to

- Indicate why and where models are needed in research and management on environmental, nature and water issues.
- Classify and evaluate environmental and ecological models (analytical, numerical, stochastic, deterministic etc.)
- Identify and follow the stages in model development in a structured approach (from derivation to validation)
- Understand and apply a few elementary models that are often used in ecological and environmental issues (e.g. exponential, logistic, hyperbolic equations)
- Build and apply simple models critically in the context of his/her own research or management activities in internships and jobs

Contents

If we prepare an outdoor trip, we check the weather forecast, as projected by meteorological models. Political parties submit their programs for calculation of the expected economic benefits. Mathematical models have become indispensible in various parts of society, including ecological and environmental issues. Conclusions by scientists, recommendations by consultants and decisions by managers are often based on models.

Models allows one to
· connect causes to effects in long term, large scale and inherently complex issues, such as climate change or population development
· understand related phenomena in different fields, e.g. Michaelis-Mention kinetics of enzymes and Holling type II responses of predators
· combine confusing, contradicting or incomplete information, as obtained in the lab and field.
· circumvent practical, financial, ethical restrictions imposed by experiments and surveys
· provide quantitative predictions, including uncertainties, in addition to qualitative descriptions and explanations

· allow extrapolation knowledge outside the domain
· select models based on theoretical concepts for empirical curve fitting
The course starts with an introduction in modelling, discussing objectives, types and stages of models. Next, you will be made familiar with a few equations often used in ecological and environmental issues, by lectures and exercise demonstrating their behaviour. Next you will be trained in developing your own models, going through different stages, such translation of systems to models, calibrating parameters and a sensitivity analysis. You will become acquainted with different models used in different setting (research, management, consultancy) and different disciplines (ecology, chemistry, hydrology). The course ends with an exam testing all knowledge and skills acquired.

Literature
Study material will be made available via Blackboard

Examination
Combination of written exam and project.

Research Skills

Course ID: **MM013** *3 ec* second quarter dr. R.S.E.W. Leuven
dr. H.J.R. Lenders
prof. dr. ir. A.J. Hendriks
dr. A.M.J. Ragas

Teaching methods
- 2 hrs lecture
- 1 hrs student presentation
- 45 hrs student project
- 2 hrs question session
- 30 hrs individual study period

Prerequisites
BSc Environmental sciences, Biology, Chemistry or Natural Sciences.
This course is obligatory for all students environmental sciences of the Research orientation.

Objectives
- Able to search, to manage and to refer consistently scientific literature references.
- Able to describe the "standard" contents of a research article and to apply this knowledge to increase the quality of papers.
- Able to discuss relevance of various interview techniques for different types of information and to prepare a formal interview.
- Capable of drawing up a research design (including a realistic time schedule) for a master thesis and expressing clearly and understandably how the research project is set up.

Contents
The course is focused on competences, skills and knowledge that will be required for drawing up a feasible design of a master research project in environmental science and for preparation of master thesis or scientific publication about the results of that project.

Literature
Student manual and reader will be available on Blackboard

Examination
Beoordeling van projectverslagen

3.12 Overview courses Philosophy

In the master phase you are due to take at least one course of Philosophy related to your programme of the Master Biology or Medical biology.

For an overview of the possibilities we refer to
http://www.studiegids.science.ru.nl/2010/en/science/

3.13 Free space courses

This section concerns a number of 'separate' courses that are not scheduled in the curriculum. You can take one or more of these courses in the form of your free space during the master phase.

Do remember that you can fill your free space with courses that are given both within as well as outside of the Educational Institute Biosciences and that the possibilities by far surpass the descriptions provided below! A condition that applies is that your free space courses must be of the master level or at least of year two or three from the bachelor; in some cases you can take a foundation year course that make up part of a different academic programme.

Beroepsorientatie (in Dutch)

Course ID: **BM026B** *3 ec* 2x per jaar. In het najaar op dinsdagmiddag en in het voorjaar op vrijdagmiddag drs. J.G.J. van den Broek

Teaching methods
- 26 hrs lecture
- 54 hrs student project

Prerequisites
Studenten van de Faculteit NWI in de laatste fase (vijfde studiejaar) van hun studie

Objectives
Studenten
- krijgen meer inzicht in hun eigen competenties en ambities
- kunnen hun competenties en ambities relateren aan de eisen van het werkveld
- verzamelen op een interactieve manier informatie over relevante ontwikkelingen binnen hun zoekrichting
- verkennen de mogelijkheden om een passende baan te verwerven
- leren om zich in woord en geschrift te presenteren als "academisch professional"

Contents
Course in Dutch language
In this "training" we aim on the Dutch job market for (medical) biologists. For the sake of profundity and minor differences in personal reflections, analyses and feedback this training requires the use of language on the level of "native speakers". That's why this training will be given in Dutch.

Subjects
De cursus bestaat uit de volgende onderdelen:
1. Zelfverkenning en zelfanalyse
2. Arbeidsmarktoriëntatie en actieve verkenning van de zoekrichting
3. Vaardigheidstrainingen (met o.a. afstudeerplan) en sollicitatietrainingen (brief, cv en sollicitatiegesprek)

Examination
Schriftelijke opdrachten en mondelinge presentaties
Participatie
Eindpresentatie
Eindopdracht (schriftelijk verslag)
Geen tentamen

Extra information

Contact: drs. J. van den Broek, 53346, via n.poelen@science.ru.nl
In verband met de vaardigheidstrainingen is aanwezigheid verplicht!
Er is plaats voor 16 deelnemers per cursus.

Course Working with Radionuclides Level 5B

Course ID: **BM007C** *2 ec* November 29 - December 3, 2010 A.L.M. de Leeuw W.P. Moerman

Website
http://www.ru.nl/amd

Teaching methods
- 5 hrs lecture
- 6 hrs laboratory course
- 9 hrs question session
- 1 hrs problem session

Objectives
The intended purpose of the course "Radiation expertise level 5B" is to impart to the student such competence and skills in the field of radiation protection that he/she, after having successfully completed the instruction course, has gained an adequate level of expertise to enable him/her to independently apply radioactive substances. This course is requested by legislation for all students and workers who will work with radioactive substances without direct supervision. This applies mainly to students in their masters study, but in some cases also to students in their bachelor study.

This one week course contains lectures and laboratory exercises dealing with most aspects of radiation safety, radiation protection or health physics, whichever term you prefer to use. Participants spend approximately 20% of their time performing laboratory exercises using radiation detection equipment. These laboratory exercises complement the health physics principles covered in lectures. Topics include: Radiation Physics, Radiation Detection and Measurement Techniques, Radiation Dosimetry, Radiation Biology, Assay Techniques, Shielding, Legislation and Health Physics Principles. The diploma examination is in multiple choice format. The diploma is valid in the Netherlands.

The course is not only open to students, part of the members are from hospitals and companies.

Contents
This five day course is necessary for working in a radionuclide laboratory.
The course will be given on Monday to Friday, 09:00 - 17:00.
The course will be given several times a year in Dutch. Once a year it will be given in English.

Subjects:
- radiation physics
- radiation risk and effects

- practical radiation safety
- legislation

More information: www.ru.nl/amd > cursussen > cursussen stralingsdeskundige

Literature

The reader in dutch will be sent to each student who applies for the course.
Cursistenhandleiding cursus Stralingshygiëne niveau 5B (dictaat)
The book should be bought by the participants:
Practische Stralingshygiëne, G. Brouwer en J. van den Eijnde (ISBN 9789077423097)
The English version: Practical Radiation Protection, by the same authors, (ISBN 9077423036)

Examination

There will be a written exam. By sufficient result the student will receive a certificate which is valid in Holland and gives you the right to work autonomous with radioactive materials.

Extra information

contact: Ria Hogenkamp (phone: 3613178, h.hogenkamp@amd.ru.nl)

Course on Laboratory Animal Science

Course ID: **BM024D** *3 ec* several times in 2010-2011 dr. ir. P.P.A.M. Leenaars

Website
http://www.umcn.nl/scientist/afdelingen/cdl/laboratory_animal_science_course

Teaching methods
Lectures, practical work, demonstrations, individual and group assignments. Several (external) guest lecturers will appear.

Prerequisites
The course is only open for students who have at least 500 study hours in basic biology. At least 200 study hours anatomy/zoology and 200 study hours animal physiology should be part of this 500 study hours in basic biology.
For MLW students this means:

- part of the first year biology course "Ontwikkeling en evolutie in de bouwplannen van dieren" (BP004B). For detailed information contact the coordinator of this course: dr. F. van Herp (f.vanherp@ncmls.ru.nl)
- one or both of the following courses from the bachelor biology:
"Endocrinologie" (BB048B) or "Adaptatiefysiologie" (BB020B)
- one or both of the following capita selecta from the master of biology
"Endocrinology" (BM048B) or "Adaptation Physiology" (BM010B)

Objectives
The course has the aim to gain knowledge and insight into the design of an animal experiment in a scientific and ethically justified manner, taken into account that alternatives (refinement, reduction, replacement) are not possible.

The program of the course on laboratory animal science comprises the requirements cited in article 9 of the Wet op de dierproeven (Experiments on Animals Act) and the (European) FELASA category C demands. The certificate of completion of the course together with an academic degree in biomedical science will lead to a legal recognition to design animal experiments in the Netherlands.

Contents
The objective of the course an laboratory animal science is to present basic facts and principles that are essential for the humane use and care of laboratory animals and for the quality of research.

The course will focus on:
the responsible and appropriate use of animals in scientific experiments in which alternatives

(refinement, reduction, replacement) play an essential role.

The student:
* will be able to make an ethical argumentation whether the use of laboratory animals in a specific experiment is acceptable (the benefits outweigh the expected adverse effects)

* has insight into the consequences of the animal experiment on the welfare/distress of the laboratory animal and how to effectively tackle this

* will form a critical attitude towards the use of animals in scientific research

* will be able to design an appropriate animal experiment which meets the legal requirements and scientific demands (statistics for example)

* has insight into the possibilities for alternative methods (reduction, refinement and replacement).

Literature
The core textbook in Dutch (less expensive than English copy):
Zutphen, L.F.M. van, V. Baumans & F.Ohl, 2009. Handboek Proefdierkunde. proefdieren, dierproeven, alternatieven en ethiek. Uitgeverij Elsevier gezondheidszorg, Maarssen. Vijfde druk. ISBN 9789035229815.
The core textbook in English:
Zutphen, L.F.M. van, Baumans, V. & Beynen, A.C. (eds.), 2001. Principles of Laboratory Animal Science: A contribution to the humane use and care of animals and the quality of experimental results. Elsevier Science Publishers, Amsterdam, 2nd (revised) edition. ISBN-13: 978-0444506122.

* A module guide will be available.

Examination
The examination is based on a written exam and the evaluation of the groupwork (design of an animal experiment; critical analysis of an article).

Extra information
The course is not an obligatory part of the study Biology.
The course on Laboratory Animal Science is organised by the Central Animal Laboratory (http://www.umcn.nl/cdl). The course is lectured in English.
The course is scheduled for:

- September 6th - 20th, 2010
- November 1th - November 15th, 2010
- January 10th - 24th, 2011
- March 7th - 21th, 2011

The application form can be found on:

http://www.umcn.nl/scientist/afdelingen/cdl/laboratory_animal_science_course
You can apply by emailing the application form to LAS@CDL.umcn.nl
Requests for further information may also be sent to LAS@CDL.umcn.nl.

Oriëntatiestage Educatie (in Dutch)

Vakcode: **FE0001B** *3 ec*

Werkvormen
- Stage in het voortgezet onderwijs 60 uur
- Voorbereiding, stageopdrachten en verslag 24 uur

Vereiste voorkennis
Vakinhoudelijke kennis op bachelorniveau

Leerdoelen
De Oriëntatiestage Educatie biedt studenten de mogelijkheid om zich tijdens de masterfase te oriënteren op de lerarenopleiding (de Educatieve variant of postmaster).

Beschrijving
Inhoud: De deelnemer aan de Oriëntatiestage Educatie wordt ondergedompeld in de praktijk van een eerstegraads leraar, waarbij de voorbereiding, het geven en de nazorg van lessen veel aandacht krijgen, maar ook andere taken van leraren in het zicht komen. Na de stage heeft de student een realistisch beeld van de taken van een leraar en is goed in staat om te bepalen of het voor hem of haar zinvol is om te kiezen voor de lerarenopleiding.
Planning: De scholen voor voortgezet onderwijs bieden twee periodes voor de oriëntatiestage aan, te weten van 1 oktober tot 1 december en van 1 februari tot 1 mei. Deze periodes zijn ruim genomen om de student en de school de gelegenheid te geven om de stage flexibel in te roosteren in de masterfase.
Begeleiding: De begeleiding vanuit de universiteit wordt verzorgd door een vakdidacticus van het Instituut voor Leraar en School (ILS). Deze instituutsdocent verzorgt een inleidende bijeenkomst, onderhoudt de contacten met de scholen, levert literatuur en opdrachten, en beoordeelt het verslag. De instituutsdocent komt alleen als daar aanleiding voor is naar de stageschool voor overleg ter plekke, al dan niet aangevuld met een lesobservatie. Een leraar van de stageschool begeleidt de student en geeft een schriftelijke beoordeling, waarin de vraag of de student geschikt is voor een loopbaan in het onderwijs centraal staat.

Literatuur
Ebbens, S. en S. Ettekoven. *Effectief leren. Basisboek.* Wolter-Noordhoff, 2e of latere druk. Deel 1, dat zijn de hoofdstukken 1 en 2. Het boek kan geleend worden bij het ILS.

Bijzonderheden
De schoolstage bestaat niet alleen uit meelopen en observeren, maar ook uit zelf lesgeven (4 tot 8 lesuren) en de (eigen) lessen nabespreken met de begeleidende docent. De Oriëntatiestage Educatie kan binnen twee weken gelopen worden (4 tot 5 dagen per week op school). De ervaring leert echter dat uitspreiden over langere periode (met dan 2 of 3 dagen per week op school) leidt tot een betere leerervaring. Het staat de student vrij om in overleg met de stageschool een eigen rooster te maken.
Stageplaatsen worden geregeld door het stagebureau van het ILS. Het gebruik van een OV-weekkaart kan nodig zijn.

Deze Oriëntatiestage Educatie is niet verplicht maar zeer aan te raden voor iedereen die de eerstegraads bevoegdheid tot leraar wil halen.

Neem voor verdere informatie contact op met het Secretariaat, Instituut voor Leraar en School, Erasmusplein 1, 6525 HT Nijmegen tel.024-3615573 of 3615572.

Computational drug discovery

Course ID: **CMBI101** *3 ec* Spring dr. J. de Vlieg
dr. G. Schaftenaar
dr. S.B. Nabuurs

Teaching methods
Two weeks of lectures and computer practicals.

Prerequisites
Basic bioinformatics and (medicinal) chemistry knowledge; preferentially specific knowledge on 3D protein structures and ligands

Objectives
- The course will improve the participants understanding of how drugs are discovered, and the crucial role played by computational methods in this process.
- After attending this course students will be able to better understand why drug-receptor interactions and other physical-chemical characteristics are important to drug efficacy.
- Finally the course will provide a basic practical understanding of a number of standard and advanced computational drug design tools, such as applied molecular modelling, gene expression analysis, virtual screening, QSAR, molecular dynamics computer simulations, structure-based drug design, homology modeling, and so on.

Contents
It is the intent of the course to describe some of the recent advances in drug discovery informatics, with a focus on the application of *e-science* to real life problems. Topics include the process of in-silico gene hunting, toxicogenomics, pharmacogenetics, virtual screening and structure-based molecular design. Also, the tools and scientific concepts that are part of the modern genomics-based drug discovery pipeline from target discovery and validation to lead discovery and optimization will be discussed. The different hands-on sessions will provide participants with the opportunity to work with the various *in silico* tools and databases available to a modern *in silico* drug hunter. The course is given in close collaboration with the pharmaceutical company MSD.

Literature
Material is handed out during the course.

Examination
Presence at lectures and practicals mandatory.
There will be a final team presentation at the end of the course.

Projectmanagement

Vakcode: **FMT015B**	*3 ec*	eerste semester en tweede semester	drs. J.G.J. van den Broek H. Vreugdenhil-de Klerk

Werkvormen

Opzet/werkvorm

Theorie en inleiding opdrachten (16 u.), vaardigheidstrainingen (24 u.), zelfstudie en opdrachten (46 u.)

Inleidingen, zelfstudie, opdrachten, vaardigheidstrainingen, presentaties, werkstukken.

Vereiste voorkennis

Studenten die na hun afstuderen kiezen voor een baan buiten de wetenschap krijgen meestal direct te maken met een projectmatige manier van werken. Deze cursus is bedoeld voor studenten uit de laatste fase van hun betastudie (vijfdejaarsstudenten) ter voorbereiding op hun beroepstoekomst.

Leerdoelen

De cursus beoogt studenten op een actieve wijze te laten kennismaken met de uitgangspunten van projectmatig werken. Hierbij gaat het enerzijds om aan- en bijsturingsprincipes (faseren, plannen, bijsturen) en anderzijds om een aantal vaardigheden op het gebied van leidinggeven aan en professioneel samenwerken in projectteams.

Inhoud

Project Start Up
Faseren en plannen
Bijstuurtechnieken
Projecten met een afdwingbaar resultaat
Projectmanagement en de inrichting van adviestrajecten
Basisvaardigheden voor de beta als adviseur en/of projectleider
Problem solving
Vergadertechnieken en onderhandelen
Omgaan met weerstanden en conflicthantering
De persoonlijke effectiviteit van de projectleider

Beschrijving

Training is in Dutch.

Een deel van deze cursus bestaat uit vaardigheidstrainingen. Hierbij is de nuance in de interactieve processen cruciaal. Voor de diepgang en kwaliteit vereist dit van alle betrokkenen taal op het niveau van "native speaker". Daartoe bedienen we ons bij dit **keuzevak** van de **Nederlandse taal.**

Doelgroep.

Studenten die na hun afstuderen keizen voor een baan buiten de wetenschap krijgen meestal direct te maken met een projectmatige manier van werken. Deze cursus is bedoeld voor studenten uit de laatste fase van hun betastudie (vijfdejaarsstudenten) ter voorbereiding op hun beroepstoekomst.

Maximale groepsgrootte: inschrijving en plaatsing.

In verband met de vaardigheidstrainingen kunnen slechts **16 studenten per cursus** deelnemen. Aanwezigheid is verplicht. Plaatsing geschiedt aan de hand van de volgorde van inschrijving via Blackboard.

Tentaminering

Actieve participatie vaardigheidstrainingen (aanwezigheid verplicht), schriftelijke opdrachten en tentamen.

Bijzonderheden

Toetsing en beoordeling

Actieve participatie vaardigheidstrainingen (aanwezigheid verplicht), schriftelijke opdrachten en tentamen.

Cursusdata in studiejaar 2010-2011

Cursus 1	najaarsemester	vrijdagmiddagen (13.45 - 17.30 uur)
Cursus 2	voorjaarsemester	dinsdagmiddagen (13.45 - 17.30 uur)

3.14 Overview of courses for the C-orientation

For a total overview of courses and information on the field of Science Communication we refer to http://www.isis.science.ru.nl/ and to http://www.studiegids.science.ru.nl/2009/science/

These courses can be part of your Master Biology or Medical biology when you've chosen for the C-orientation. These courses can also be part of the free space of your Master Biology or Medical biology/R-orientation.

Science & Societal interaction

Course ID: **FC002B** *3 ec* third quarter dr. J.G. van den Born

Website
www.ru.nl/sciencecommunication/

Teaching methods
- 14 hrs lecture
- 1 hrs personal study counseling
- 69 hrs individual study period

Prerequisites
Basic articles from the reader of the course: 'Introduction Science communication'.

Objectives
The student:
1. develops knowledge and understanding in the field of public participation, regarding natural-scientific topics in societal processes.

2. applies this knowledge by developing a participation-plan. Attention is paid to different levels of participation and methods and tools of participation. Also, a distinction of the different stakeholders is made, and ways to reach them are explored.

3. is able to present this participation-plan to the group.

Contents
Science communication is usually not a linear process, but comes into being through interaction. In this course is dealt with ways to involve citizens and other stakeholders in an interactive process when scientific topics are on the agenda. Questions as why would you involve stakeholders and why not, who would you involve and on which level are under discussion. With regard to the question who to involve it is important to get a grip on 'the public'; who will and can be involved? And what are the benefits for people to participate in such a process? Finally, we learn about the different methods and tools that can be used in the planning of a participation project, such as debates and focus groups.

In this course the students are introduced in the basic principles of stakeholder participation, students design a participation plan themselves and debate with experts on the field of participation on an actual case.

Literature
Literature will be made available on Blackboard

Examination
An assignment.

Extra information
Thursday
Foreign students should contact the teacher 6 weeks in advance.

Framing Knowledge

Course ID: **FC0010C** *3 ec* first quarter dr. J.G. van den Born
S.A.J. Segers

Website
www.ru.nl/sciencecommunication/

Teaching methods
- 14 hrs lecture
- 70 hrs individual study period

Prerequisites
The course 'risk communication' is recommended.

Objectives

The student:
- will be introduced in the theory of frames and framing (knowledge)
- will have insight in the role of perceptions, interests and strategies in conflict situations (knowledge)
- can cooperate in a group of fellow students with regard to the assignment (skills)
- can design an interview guide, learn to interview, and to work out and interpret the interview results (skills)

Contents
Framing knowledge is an introduction into perceptions; frames that individuals use to look at and understand the world around them. It is important to be conscious of the fact that everyone has their own background and knowledge structures. For example, a farmer has a different idea of what nature is than a city dweller, and a scientist has a different perception of a laboratory animal than an ethicist. Besides, this so called cognitive approach, we distinguish the interactional paradigm. This approach centers on how parties negotiate meaning in interaction.
When looking closer at laborious and failed negotiations, it is not impossible that different perceptions are underlying the whole matter, perceptions the stakeholders are often stuck to. To recognize these frames is the first step of understanding and solving a conflict. Connected to these frames are individuals (or groups) interests and strategies to act and negotiate. In these negotiations frames may develop and shift during the process.
We work with a recent case study (closely connected with PhD research performed at our ISIS institute) to explore the idea of frames. In this course the students are also introduced to the basic principles of interviewing. They learn to design an interview guide and to perform an interview with a stakeholder in the case we investigate during the course.

Literature
Literature will be made available on Blackboard

Examination
An assignment.

Extra information
Foreign students should contact the teacher 6 weeks in advance.

Knowledge Society

Course ID: **FC0011C** *3 ec* third quarter dr. R.P. Verhoeff
dr. J.G. van den Born
S.A.J. Segers

Website
www.ru.nl/sciencecommunication/

Teaching methods
- 7 hrs lecture
- 1 hrs personal study counseling
- 7 hrs problem session

Prerequisites
The course builds on previous courses from the Mastertrack Science Communication (especially Risk Communication), and is part of the obligatory part of the Mastertrack. In addition, the course is open as an optional course for all MSc. Students.

Objectives
- Students are familiarised with the different roles of scientists in the Knowledge Society
- Students are familiarised with the implications for science communication
- Students are familiarised with shifts in the knowledge infrastructure and with techniques and strategies to analyse these shifts
- Students are familiarised with the pro's and con's of multi-, inter-, and transdisciplinary-settings they will encounter in professional contexts

Contents
Present day society has been characterized as developing towards a 'Knowledge Society'. Scientific knowledge has become more important and new technologies have a sometimes unprecedented impact. At the same time, the position of (academic) science is under pressure and apparent shifts take place in the role and authority of science in society. Knowledge is an issue.
In this course we reflect on these changes and discuss the possible implications of these shifts for MSc. students in their future professional life. We ground these discussions in actual working practice brought to the classroom by guest speakers, and complement these by models and approaches that are currently used in assessments of the Knowledge Society.

The course primarily focuses on theoretical reflection, but features discussions among students, teachers and guest speakers. These are matched with analyses of current scientific insights on the Knowledge Society, mainly from the field of STS (Social Studies of Science). The course is completed with a written exam.

Literature
Literature will be made available on Blackboard

Examination
written exam

Extra information
The course is taught Thursday
Foreign students should contact the teacher 6 weeks in advance.

Science & Media: strategies and trends

Course ID: **FC0013C** *3 ec* second quarter drs. H.M. Dresen
drs. R.P.M.M. Welters

Website
www.ru.nl/sciencecommunication/

Teaching methods
- 1 hrs personal study counseling
- 20 hrs problem session
- 63 hrs individual study period

Prerequisites
This course is part of the Mastertrack Science Communication, and also open as optional course for all MSc. students.
In either case, having completed the course **Introduction Science Communication** is a **pre-requisite** for taking part in this course**.**
Dutch language:
Part of this course (i.e. the training in media-oriented writing) will be given and examined in Dutch, as it is aimed at gaining access to the Dutch media landscape. Participants who do not write Dutch need to **register six weeks in advance of the start of this course** by sending an email to the coordinating lecturer (H.M. Dresen) **asking for an English language arrangement**.
Limited number of participants:
The number of participants for this course is limited, due to the character of the training in media-oriented writing. Students will be accepted in the order of their registration. Students of the Science Communication mastertrack have priority in placement, if they **register six weeks in advance of the start of this course**.

Objectives
- students will increase their abilities in media-oriented writing.
- students will increase their knowledge of strategical considerations and ethical codes involved in the process of transmitting information from the academic to the public arena.
- students will get acquainted with academic perspectives on (a) the current state of science reporting in the media, and (b) developments and trends in reporting about science and technology over the last few decades.
- students will get acquainted with different methodologies for (a) studying trends in science reporting and (b) studying public responses to media content.
- students will increase their abilities in research design.

Contents
The course consists of two interrelated parts:
1. A training in media-oriented writing (given in Dutch), which will address both the process of writing itself and the broader considerations involved (both strategical and ethical) in the process of transmitting information from the academic to the public arena.
2. An introduction to the study of Science-in-the-Media, as a subfield within the academic field of Science Studies. We will look at classic and new studies that investigate the state of science reporting in the media. While studying these examples, students will also get acquainted with different methodological alternatives for researching how media represent scientific expertise.

Literature
Handbook on media-oriented writing (in Dutch; can be bought, or library copies can be used at the FNWI library)
Additional reading material will be made available at the start of the course

Examination
Journalistic writing assignment & research design assignment

Extra information
Classes once a week, Thursday 13.30-15.30 from november 11 (2010) till january 27 (2011). (Schedule details may be subject to change; always check http://schedule.ru.nl/ for latest version of schedule)

Risk Communication

Course ID: **FC003B** *3 ec* second quarter dr. R.P. Verhoeff
dr. J.G. van den Born
S.A.J. Segers

Website
www.ru.nl/sciencecommunication/

Teaching methods
- 1 hrs personal study counseling
- 20 hrs problem session

Prerequisites
The course builds on the introductory course on Science Communication from the Mastertrack Science Communication, and is part of the obligatory part of the Mastertrack. In addition, the course is open as an optional course for all MSc. Students.

Objectives
- Students are familiarised with the place of risk in society, its characterisation, and the implications for communication
- Students are familiarised with actual cases and practices in Risk and Uncertainty Communication
- Students are familiarised with determinants of public perception of Risk and Uncertainty
- Students are familiarised with the role of the different actors and stakes in Risk Communication (for instance companies, government, local population) and how to position themselves among these actors

Contents
Present day society has been characterised as a Risk Society. In the last decade, the risk society has been hugely influential, serving as a stimulus for academic, environmental and political dialogue. The communication of risk and the public understanding of risk have become important issues in Science Communication. This course aims to prepare students to actively engage in risk communication and to analyse, reflect on and assess risk communication practices (e.g. HPV-vaccination, the Mexican flu, global climate change). The course combines a practical and theoretical component. Discussions among students, teachers and guest speakers are matched with analyses of current scientific insights on issues of risk communication, risk perception and uncertainty.

Literature
Literature will be made available on Blackboard

Examination
assignment

Extra information
Thursday 15.30-17.30
Foreign students should contact the teacher 6 weeks in advance.

Research project (Masterthesis) Mastertrack Science Communication

Course ID: **FC0006B** *30 ec* dr. J.G. van den Born

Website
http://www.ru.nl/sciencecommunication/curriculum/graduation_project_0/

Prerequisites
Students who want to start with their research project, must have finished four of the seven obligatory courses of the Science Communication mastertrack and their (beta) bachelor thesis.

Contents
For more information see:
http://www.ru.nl/sciencecommunication/curriculum/graduation_project_0/

Introduction Science Communication

Course ID: **FC001B** *3 ec* first quarter dr. J.G. van den Born
drs. E. van Rijswoud
S.A.J. Segers

Website
www.ru.nl/sciencecommunication

Teaching methods
- 14 hrs lecture
- 70 hrs individual study period

Prerequisites
This is the first course of the Mastertrack Science Communication. It is part of the obligatory programme of the Mastertrack. In addition the course is open as an optional course for all MSc. students.

Objectives
- Students are acquainted with science communication practices and theories
- students are able to use these theories to analyse classic examples of science communication
- Students are trained by a professional in presentation skills

Contents
Nowadays every scientist gets involved in science communication in his or her professional life. In this course we give an overview of science communication strategies and of seminal views on science communication practices and theories.
Focus is on communication with the public and with target groups within the general public on issues that involve scientific knowledge. Scientific communication (communication among scientists for instance at scientific meetings) is not the main issue, although the training in presentation techniques applies to those communication practices as well.
Students will also study and present classic examples of succesful popularization of scientific insights, in the shape of TV documentaries, films, fiction and non-fiction books, and 'visitables'.

Literature
Literature will be made available on blackboard

Examination
Written exam, participation and presentation

Extra information
This course will be taught in Dutch.

Visible Scientists

Course ID: **FC0040C** *3 ec* fourth quarter dr. B. Smelik
S.A.J. Segers

Website
www.ru.nl/sciencecommunication/

Teaching methods
- 16 hrs lecture
- 1 hrs personal study counseling

Objectives
After the course the student will be able to
- substantiate the terms 'visible' and 'invisible' in the framework of this course
- identify important scientists and to identify 'visible' and 'invisible' scientists in his own field of study and to argue why they are (in)visible.
- understand the way visibility works
- have a basic knowledge of qualitative content analysis as method of research

- substantiate benefits and restraints of visibility in the academic world (f.e. by addressing the reliability and relevance of research) and gain insight in the problematic nature of societal interaction

- find primary and secondary sources on scientists.

Students will be required to read carefully, to formulate clearly and unambiguous, to present the material in a systematic manner and to unfold a good solid argumentation based on a correctly defined problem. These academic skills will be involved when reading, writing and presenting research results during the course.

Contents
A highly influential stereotypical view of scientists depicts them as invisible laboratory researchers, working silently and at a safe distance from their societal and cultural environment, communicating their findings to a small circle of fellow experts. Reality is often completely at odds with this stereotypical view. Quite often, prominent scientists are acutely aware of the importance of societal communication and interaction, and sometimes they are quite good at it and / or invest a substantial amount of time in this aspect of their work. They know how to involve broad audiences in this research, how to gain public attention, how to raise public support. On the other hand, visibility may backfire on the scientists or make their involvement in societal interaction less or even counter productive. Societal interaction may also greatly affect the course of their research activities and the development of their research agenda. We will take a more or less biographical approach, focusing on the research as well as the societal communication of particular scientists, and the benefits and restraints of using (in)visible scientists in science communication.

Literature
p.m.

Examination
Essay & presentation
This is an elective course within the Science Communication track, but can be chosen in any master as elective course.

Extra information
Foreign students should contact the teacher 6 weeks in advance.

Boundary-Work: The Tension between Diversity and Sustainability

Course ID: **FC0041C** *3 ec* fourth quarter prof. dr. F.W.J. Keulartz
S.A.J. Segers

Website
www.ru.nl/sciencecommunication/

Teaching methods
- 20 hrs lecture
- 4 hrs personal study counseling

Objectives
Students should gain some basic insights in the tension between the heterogeneity of actors that (should) have a stake in natural resources management on the one hand and the need for an integrated approach and close cooperation among these various stakeholders on the other. They should be able to specify and discuss general strategies of so-called 'boundary work' to deal with this tension between diversity and sustainability.

Contents
Climate change, air pollution, deforestation, loss of biodiversity, stratospheric ozone depletion, land and freshwater degradation - all these environmental problems have effects that transcend national boundaries; they cannot be solved by the unilateral decisions of individual states but require international cooperation. Moreover, these problems are interconnected and cannot be solved in isolation but require an integrated approach. But such an approach is frustrated by the existing multiplicity of communities with diverse and sometimes diverging ethical visions and moral vocabularies. So, there is a strong tension between on the one hand the diversity of actors that have a stake in sustainable development and on the other hand the need for a close cooperation between these various stakeholders. This tension between sustainability and diversity can only successfully be resolved through processes of communication, conflict management and consensus building across the lines that separate communities and their social and moral worlds. Such 'boundary work' is the central topic of this course.

Literature
Will be distributed.

Examination
Students should study the literature, participate in discussions, make at least one presentation, and write a brief essay.

Extra information
Foreign students should contact the teacher 6 weeks in advance.

3.15 Overview of courses for the MT-orientation

Here you find a description of some courses on the field of Science, Management and Technology/MT-orientation.

For a total overview of courses and more information about the MT-orientation we refer to http://www.studiegids.science.ru.nl/2009/science/ and for your convenience visit http://www.isis.science.ru.nl

These courses can be part of your Master Biology or Medical biology when you've chosen for the MT-orientation. These courses can also be part of the free space of your Master Biology or Medical biology/R-orientation.

Business & Society

Course ID: **FMT001C** *5 ec* first semester dr. G.A.N. Vissers
dr. J.W. van Rooij
H. Vreugdenhil-de Klerk

Teaching methods
- 28 hrs lecture

Prerequisites
Master student FNWI

Objectives
Business & Society is concerned with the processes of mutual influence that exist between firms, the economy and society. It specifically focuses on three industrial revolutions that fundamentally reshaped firms, technologies, and societies. Business & Society tries to understand how companies work, and it places them firmly in their context. By doing so, Business & Society introduces theories, models and concepts that aim to understand the relations between firms, the economy, and society.
Business & Society has the following specific objectives:
1. After completing this course, students understand the effects of society on business, and the effects of business on society, i.e.
a. Students are able to relate the behavior and characteristics of firms to characteristics of societies.
b. Students are able to analyze this relation using theories, models, and concepts from management science, business history, and institutional economics.
2. After completing this course, students understand the relevance of history for understanding business and society, i.e.
a. Students are able to analyze how events of the past have enabled and constrained future events, and as such have shaped the present.
b. Students are able to evaluate the role of history in the theories, models and concepts used to explain the relations between firms, the economy and society.

Contents
The master track Management & Technology focuses on the interface between science, technology and business. Subsequent courses focus on one aspect of this interface, but in Business & Society we focus on the interface itself, and provide a helicopter view of firms in their environment. It is essential to take a broad view of the workings of business. Inside firms, different disciplines do not work in isolation, but work together to provide value on a market. Moreover, firms do not operate in a vacuum, but operate in a context that shapes them; vice versa, firms shape their environment. Business & Society sets the scene for the courses of Management & Technology that follow.
Business & Society focuses on four leading capitalist nations, and particularly on leading firms from those nations, over a the course of three industrial revolutions up to the twenty-first century. The study of history provides the means to understand how firms and their environments shape each other. The study of history also underlines that each firm and each

society is different, and underlines that firms and their environments change. In this way, students are introduced into the workings of business in its economic, technological and societal context.
Subjects that are covered in this course include:
· Industrial revolutions;
· Innovation systems, business systems, and varieties of capitalism;
· Business history, particularly of leading firms in the 19th and 20th centuries;
· Entrepreneurship;
· The role of the state in the economy.

Literature
T. K. McCraw, Ed. (1997). Creating modern capitalism: How entrepreneurs, companies, and countries triumphed in three industrial revolutions. Harvard University Press.

Examination
Written exam, group work and individual assignments make up the final grade for this course. More details will be announced on Blackboard at the start of the course.

Finance & Accounting

Course ID: **FMT005C** *5 ec* spring semester drs. R.A. Minnaar
H. Vreugdenhil-de Klerk

Teaching methods
- +/- 15 lectures (see for detail Black Board)
- practices

Prerequisites
Master student FNWI

Objectives
The financial accounting part should give you a firm understanding and working knowledge of:
- The basic accounting terminology and the process for recording, summarizing and reporting economic events of a business enterprise;
- The interpretation and analysis of financial statements as a basis for business decisions.

The management accounting part is to develop the student's knowledge of the process of evaluating performance and decision making using accounting information as a basis. After taking this course you should be able to interpret, use and evaluate internal accounting information.

Contents
Accounting information is an integral part of the business environment and an understanding of accounting information is an essential tool in the process of making business decisions. The primary objective of this course is to develop the student's knowledge of accounting as a tool in making business decisions. The emphasis in this course will be on both the user and the preparation of accounting information in a business context.
Content:
This course consists of two parts. Financial- and management accounting.
In the financial accounting part, you will be introduced to accounting theory and practice using the models of sole proprietorships and corporations, with an emphasis on merchandising companies. The emphasis and focus of financial accounting is on financial information used by parties' external to the firm. Specific topics will include: the definition and scope of accounting; systems used to account for and control transactions; inventory costing; the measurement of income and equity; and a special emphasis on financial reporting and the analysis of financial statements.
The management accounting part of this course emphasizes the use of accounting information for internal planning and control purposes. As business managers, you will be involved in a variety of management decisions. Some examples of the issues that you might encounter include: "How much should we charge for this product or service?"; "What elements contribute the most to this business?"; "How is my company doing compared to the competitors?"; "Is this person a good manager?"; "Are my costs under control?" "Does this capital investment make sense?" A range of information may influence such decisions and management (internal) accounting information is among the most significant.

In this part, the fundamentals of managerial accounting, profit and cost accumulation are introduced. Specific topics covered include: cash flows, capital budgeting, cost allocation, product costing, differential costing for short and long-term decisions, performance evaluation, and the concepts related to the time value of money.

Literature

Horngren, Harrison and Oliver (2009). Accounting. Eighth edition. Pearson International Edition. ISBN: 0-136-11290-0

Examination

- A final written 3 hour exam with multiple choice questions.
- Online Assignments in MyAccountingLab

Innovation management

Course ID: **FMT003C** *5 ec* fall semester

prof. dr. B. Dankbaar
H. Vreugdenhil-de Klerk
ir. L.J. Lekkerkerk
dr. R.A.W. Kok

Teaching methods
- 32 hrs lecture

Prerequisites
- Master student FNWI
- BEM & Organisatiekunde in completion with a minimum of a 6

Objectives
The purpose of the course is for students to :
- Acquire knowledge in the field of innovation management including Research and Development and New Product Development
- Apply this knowledge in theoretical cases, eventually acquire sufficient knowledge to apply this knowledge in 'real life' settings
- Judge the value of scientific knowledge in the field of innovation management including Research and Development and New Product Development
- Learn how to design a research project in this field

Contents
Innovation determines the dynamics of the economy. Organizations innovate to stay viable. This course focuses on issues of innovation from a management perspective. The main issues concern the dilemmas of innovation management and innovation enhancement: how (and to what extent) are these processes manageable? In these processes different factors play an important role, such as creativity, enterpreneurship, structure, linkages, and a bit of luck. This course offers the student knowledge about the structure and nature of the innovation process (product as well as process innovation). Furthermore, it offers the students instruments to cope with the different dilemmas of innovation management.
Content:
The following themes will be treated:
- Managing for innovation
- Strategy
- Establishing effective external linkage
- Building effective implementation mechanisms
- Creating the innovative organization
- Assessing and improving innovation management

Literature
To be determined (See Black Board)

Examination
assignments and a written exam

Organization Theory

Course ID: **FMT002C** *5 ec* spring semester prof. dr. B. Dankbaar
H. Vreugdenhil-de Klerk

Teaching methods
- 30 hrs question session

Prerequisites
MT Course Business & Society

Objectives
- Students acquire knowledge of the main concepts and approaches in organization theory
- Students are able to apply this knowledge to issues of organizational design and change

Contents
This course offers an introduction into the fundamental insights of organization theory dealing with questions like: What are organizations? How are they structured? How do they interact with their environment? What is organizational culture? And how are organizations designed and managed? Organizations are complex systems and consist of people with different interpretation-schemes. As a result, organizations have to deal with a variety of problems and dilemmas. The course offers students methods and instruments to diagnose organizational problems and to deal with the problems and dilemmas of organizing.
Content:
Apart from studying and discussing a text on organization theory, the students will make presentations of their analysis and views on selected business cases

Literature
To be determined

Examination
Written examination and discussion of a business case

Strategy & Marketing

Course ID: **FMT004C** *5 ec* fall semester dr. P.E.M. Ligthart
dr. ir. N.G. Migchels
H. Vreugdenhil-de Klerk

Teaching methods
- 30 hrs question session

Prerequisites
- Master student FNWI
- BEM & Organization Theory in completion with a minimum of a 6 ECTS

Objectives
After completion of the course, students are familiar with market oriented views of innovation and with several important forms of market research; they are able to describe the circumstances in which market orientation will influence innovation processes and to discuss the nature of such influence for business and product development. Students will also be familiar with strategy formation, with different types of strategy and the related perspectives, and with the relationships between general business strategy and innovation strategy.
Prime course objectives are that:
- participants acquire updated insights regarding challenges and opportunities in high-tech markets
- participants understand the virtue and limitations of traditional strategic marketing thinking and tools in emergent, high-tech markets, and
- participants apply their understanding of strategy and marketing concerning High-Technology to develop a well-founded business plan within their own technological discipline.

Contents
Description:
Marketing is the business function that deals with discovering and meeting customers' unfulfilled needs and wants. Strategy underlines the need to align this function to the objectives of the business, the other business activities and -last but not least- to the external market environment of the firm. Strategic marketing in high technology environments poses its own unique challenges due to the complexity and novelty of the technology. Some of those challenges include articulation of the value proposition, decision making with limited information on customers, and coordination with other market players. In order to succeed in this environment, firms need to be able to understand unarticulated needs, forecast the development of nascent markets, and position themselves appropriately in the competitive landscape.
High-tech firms operate under conditions characterized by high degree of market and technological uncertainty. Technological changes can occur rapidly. Products offered are novel and for buyers often difficult to evaluate. Moreover, high-tech firms often operate in emergent industries with "fuzzy"and rapidly changing industry boundaries. Such conditions - deviating from those captured in most marketing texts- represent specific challenges for high-

tech firms to survive and prosper. It should also be noted that the rapid developmentes in modern technologies within science (e.g. biotechnics, informatics, chemics, mathematics, etc.) exert influence on markets and marketing practices only superficially dealt with in traditional strategic marketing textbooks. The "driving question" that arises form the situation described above is: "Provides strategic marketing added value for firms operating in high-tech markets?"And, if so, "why and how ?"
The focus of this course will be on the strategic marketing to accompany a technology and not on the technical or scientific aspects of the high-tech products. Besides lectures, students will work on a group project (i.e. to set up a High-tech Business Development Plan) throughout the term to analyze the marketing strategy for a technology-based product or service.

This course focuses on issue related to strategy and marketing of firms, such as:
- Technology and market
- Relation between R&D and Marketing
- Business strategy and product strategy
- Market research
- Relation with customers
- Distribution, supply chain and pricing

Literature
Mohr, Sengupta, Slater (2005) **Marketing of High-Technology Products and Innovations** (2nd international edition) Pearson Prentice Hall, ISBN 0-13-123023-9
Reader (links of articles will be published at Blackboard)

Examination
- Written exam (literature)
- Business Development Project (presentation and report)

Research Strategy and Management

Course ID: **FMT011B** *3 ec* spring semester prof. dr. J. de Wit

Teaching methods
- 20 hrs question session

Prerequisites
Master student FNWI

Objectives
The student will be informed on the following aspects of Research Strategy and Management:
- career development possibilities
- industrial strategies
- research strategy and management (from 1st to 4th generation)
- organization of research
- project management
- knowledge management
- cooperation between university and industry
- case studies on radical innovation
- the Balanced Score Card method
- project selection methods
- roadmapping
- measurement of R&D performance
- innovation and venturing
- sustainable development in the 3rd world

All information will be illustrated with examples from the practical experience of the teacher during more than 20 years in industrial research management.

Contents
Research Strategy and Management is an important discipline in many forms of research. It is the intention to inform Master students and junior researchers on all aspects of R&D management in relation to business strategies. The class is mainly intended for students who want to start a research management career relatively soon after getting their MSc or PhD diploma and therefore follow the MT variant as their Master education. This career can start in industry but also in government, a consultancy firm or as owner of a private company. The class is also suited for students whose first choice is not the MT variant but still want to receive general information on the aspects of modern R&D management

Literature
After each lecture a task is formulated consisting of usually 3 questions. To answer the questions use can be made of Internet or of a list of books that will be given during the first lecture of the series. Other forms of knowledge gathering are of course also possible.

Examination

One week after the last lecture a written examination is given. This examination takes 3 hours.

Extra information

Examination

One week after the last lecture a written examination is given. This examination takes 3 hours. One month later there is an oral exam of about 1 hour for those who failed the written exam.

Master-thesis Management & Technology-track

Course ID: **FMT010B** *27 ec* dr. J.W. van Rooij

Teaching methods

- 40 hrs personal study counseling

Prerequisites

The master thesis Management & Technology is open to master students who have successfully completed

- the compulsory courses of the master track Management & Technology, and
- the compulsory courses in their own discipline, including a research project if applicable.

Students need to show that they are eligible to enroll in the final research project by providing the coordinator with a list of completed courses.

Contents

The master thesis is the final step in the master track Management & Technology. Students perform research, focusing on problems on the interface of science, business and society. Preferably, students combine knowledge acquired in their discipline with knowledge acquired in the master track Management & Technology. We encourage students to perform their research in companies, but students can also work in non-profit organizations if they prefer, and if the problem fits with the objective, and contents of Management & Technology.
After students have shown that they are eligible to enroll, the project consists of the following stages.

- In the first stage, students find an organization willing to host and coach them, and, in consultation with this organization, write a research proposal. In the research proposal students outline the topic of the research and its goals, the research questions, and the methods that will be used to answer these questions. All parties need to reach an understanding of their respective roles and responsibilities; a standard contract is available to formalize this understanding. At the end of the first stage, finally, the coordinator assigns to the student a coach who will supervise the final two steps of the project.
- In the second stage, students perform research and write their thesis. In this stage, students meet regularly with their coaches from the host organization and the university to discuss progress and planning, as well as possible problems. At the end of stage 2, the coach from the university assigns an additional reader to the project; this reader acts as a quality check on the work of students and coaches.
- In the final stage, the results of the research are presented at the university, and at the host organization if desired.

A manual is available on Management & Technology's website with more details, help, examples and literature.

Literature
See the manual on the website of Management & Technology.

Examination
Coaches and reader together decide on the grade of the thesis. Coaches and reader determine their grade on the text of the master thesis, on the performance of the student during research and writing (stage 2), and on the form and content of the presentation (stage 3). The manual on the website of Management & Technology details the criteria that will be used.

3.16 The doctoral/master's examination

The registration for your master's examination takes place completely separate from the registrations for preliminary examinations and must therefore occur separately at the Faculty Students Administration/Examinations Department (*see Important addresses and telephone numbers for the address* - opening hours: Mon through Thurs 13.00h-16.00h and Fri 9.00h-12.00h).
You will need:

- valid student card
- the approved combination of subjects for your Master programme must be present at the FSA/Examination department. NOTE!: this combination must be handed in not later than 3 months prior to applying for the master's examination in connection with the assessment by the examining board.
- valid passport or identity card
- if you've passed your bachelor's degree at another dutch university or abroad or you have a bachelor diploma from a Higher Vocational Education you must bring with you the original diploma

It is required that you were registered as a student or as an institute student (this is a student who is not entitled to student grants) during the academic year (or academic years) during which you participated in practical lessons. The same applies to thesis/traineeship supervision.
First you have to ask to apply for the master's examination at the FSA. You should do that not later then 14 days */prior/* to the date of the examination (this is the date upon which the exam is to be held). Upon applying, all of your marks must already be processed in ISIS. Other arrangements have been made for the final exam date of the year (namely **31-8-2011**). You are to register for this exam not later than *May 31, 2011*. Some of your marks may not be known at that time. The last mark must be reported to the FSA/Examination department (during opening hours) not later than *August 31, 2011*.
After you have made your application for your master exam at the FSA you will get a letter with a declaration of the Examination Board that you may apply for the exam. With this letter you have to go to the the Central University Bureau of Exams at the Comeniuslaan 4 (Opening hours: 10.00h- 12.00h daily) to complete your application. They check several things, for example if you were subscribed as a student etc. Because of these checks the

Bureau of Exams needs about 30 days to prepare your master diploma and grading list.

The master's examination is held 11 times per year. The 'holding of the examination' is mainly an administrative affair: verifying that you have met all of the requirements and whether or not you took all of your subjects that are stated as the subjects that you have chosen. The presentation of the master's degrees takes place every two months on the last Tuesday of the month. Concerning the precise dates of the examinations: see the notification board at the Secretariat Biology or at the FSA/Examination department or have a look at the website www.ru.nl/biowetenschappen.

You can register for your master's exam Biology or Medical Biology up to and including the dates as indicated on the notification boards of Biology and at the FSA! If you require proof of your graduation *prior to* the presentation of the diplomas (in connection with a job interview, for example), then a written statement to that end can be obtained via the secretariat Biology.

Graduated? The university would very much like to keep in touch with you. There are a numbers of ways to do so. You could, for example, become a member of the former students' association, which will allow you the use of network facilities and render you eligible for discount facilities. An excellent way in which to maintain contact with your former fellow students, make new contacts and to exchange experiences. Would you like to know more? Visit the website of the Alumni Bureau http://www.ru.nl/alumni (only in Dutch).

3.17 Exploring the job market

It is important to explore your job possibilities well before the date of your graduation. Of course, within the main orientation of your choice, ample attention is paid to finding a position that relates to your orientation, along with practical exercises. You will furthermore have to make efforts on your own and in doing so, you can make use of the training opportunities that the university offers for job interviews and how to find a suitable position. In addition, the following are interesting:

'Beta Company Fair' (in Dutch: BBB)

The purpose of the BBB foundation, which consists of students of the B-faculties, is to give students and research assistants an adequate and realistic impression of the job market. To that end, a company fair is organised every year. Here, you can familiarize yourself with companies and institutions where you may find a job following your graduation (or upon obtaining your doctoral degree). A few weeks after the fair, it is possible to participate in so-called Discussion days, during which you can obtain additional information from representatives of the companies concerned. A selective interview, as the first round of a job interview, is sometimes possible as well. Additional information is available: BBB foundation, (T: 3652388), http://www.bbb.science.ru.nl/

NIBI-Job Market Information Day

The Dutch Institute for Biology - of which each biology student will be a member during the master period through a membership that is offered for free by the Educational Institute Biosciences, of course - organises an annual Job Market Information Day in one of the seven cities where an academic education in biology is settled. Particulars and information concerning this day will be mailed to certain student groups in the spring of 2011. The purpose of this day is to familiarize yourself with the job market. Various job situations from actual practice are presented. Take a look at www.nibi.nl (only in Dutch).

Foundation Integrand

This national non-profit organisation mediates between companies and master programme students in an advanced stage of their studies for temporary job assignments on an academic level. You can apply your knowledge in the business community, with immediate feedback on the usefulness of your ideas. And so you not only devise a solution to a problem, but you also implement the solution in an organisation, as a result of which you learn to interact with people of different disciplines and different levels of training. You will receive financial compensation for practical assignments of this kind. In addition, you will gain experience in applying for positions on the job market. You can register free of charge and the mediation efforts are made up to one year following your graduation. Integrand is active for all academic programmes. For more information: Foundation Integrand, Gymnasion Noordgebouw -1.270, 3616127, nijmegen@integrand.nl (only in Dutch).

Alumni-department

The university would like to stay in contact with its students after their graduation. The Alumni department page - www.ru.nl/alumni (only in Dutch) - offers all kinds of information on a membership, the activities and the facilities that are offered alumni.

4 Appendices

4.1 Appendix 1: Honours programme

For students with a broad view of the world
The Honours Programme of the RU Nijmegen will start again in the academic year 2008-2009. With this programme, the Radboud University Nijmegen offers students from every training programme the opportunity to have a look beyond the boundaries of their own field of study in a structured fashion and under intensive supervision. The idea is not to superficially study a randomly chosen subject, but rather to independently examine significant scientific, cultural and philosophical themes with an open-minded and broad view, without letting yourself be limited in advance by the perspective of your own scientific field.

Who can participate?
The Honours Programme is intended for all of the students of the RU Nijmegen who have completed their foundation course and who are extra motivated to acquire a broad outlook in a manner that is not without obligations. There are no costs involved in participating. The programme is not part of the regular training programmes of the faculties.

The students who apply will be offered a prestigious programme that will prove to be an added value in the course of their further studies and career.

A prestigious programme
The courses are provided by top-class teachers of the faculties of the RU Nijmegen. During their courses, they often include guest speakers from other sciences and, in some cases, reputable speakers from social or cultural fields as well. The number of participants per course is generally limited to a maximum of 25 students. And so the students are provided intensive and personal supervision.

Workshops, study weekends, excursions and working visits will make up part of the programme as well, if such is useful for the study of the themes. It goes without saying that a lot of attention will be paid to the quality of the course aids that will be made available to the students free of charge.

A prestigious programme also means that active studying and involvement is expected of the students who participate. The total scope of the Honours Programme is around 600 hours, which are divided between four courses (one course per semester). Of course, it is possible to take more than two years to complete the programme in the event of a traineeship abroad or some other valid reason. It is explicitly expected that the students who begin with the programme do actually complete it.

The courses generally take place on Tuesday or Wednesday evening during the academic year from 18.00h until not later than 21.00h in the Aula-Conference Hall. The students will be offered sandwiches during the break.

Composition of your choice
The student is offered various courses per semester. You are free to choose what you prefer. This will allow you to determine for yourself what you want to focus on in your personal version of the Honours Programme. For the sake of coherence, it is sometimes desirable to take some of the courses that are scheduled in successive periods in the order as proposed. But you can also include these courses in your own personal Honours Programme as separate components. Of course, if you would like advice concerning the composition of your Honours Programme, then you can always call upon the programme instructor who, if desired, can put you in contact with the teachers who are to give a course in the semesters to come.

Tests
Each course is completed with a test. The educational goals and the method of testing are both explained in the comprehensive description of the courses. These are available at the Honours Programme department. The student is obligated to be present during the lectures and to participate in the workshops and excursions. The Honours Programme department keeps a record of the attendance lists and the test results. You will have completed the Honours Programme upon successfully completing four tests.

Honours degree
If you complete the Honours Programme, then you will receive a special Honours degree from the rector during an official academic ceremony stating the nature and the number of credits of the programme. The university will propagate the major significance that it attaches to the Honours Programme to grant-issuing authorities in the Netherlands and abroad. Moreover, students who obtain their Honours degree can apply for a letter of recommendation from the rector at the Honours Programme department for the purpose of arranging a traineeship at a foreign university, for example.

More information
If you would like more information regarding the Honours Programme, the courses and how to apply, then contact the Honours Programme department that is located in the Gymnasion, third floor, room number N.03.110A. The desk is open on Tuesday and Thursday morning from 9.00h until 13.00h and on Wednesday from 9.00h until 17.00h. Much information is available on www.ru.nl/honoursprogramma. Of course, you can also call or e-mail:

Honours Programme Department
024-3615955
honours@honours.ru.nl

4.2 Appendix 2: Rules on Teaching and Examination of the Master of Biology

Note: The Rules for study year 2010-2011 are under construction and will be posted in a few weeks
Section 1 General provisions

Article 1.1 Applicability of the regulations

These regulations apply to the education and examinations of the Master's programme Biology, hereinafter called: the programme.

This programme is offered by the educational institution Biosciences (hereinafter called: the educational institution) within the Faculty of Natural Sciences, Mathematics and Information Science (hereinafter called: the faculty).

Article 1.2 Definitions

The concepts as referred to in these regulations, insofar as these are also specified in the Higher Education and Research Act (abbr. in Dutch: WHW), will have the same meaning as is the case in said act.

The following words in these regulations are understood to mean:

a. the act: the Higher Education and Research Act, abbr. WHW as it currently reads;
b. programme: the master's programme as referred to in article 7.3a, paragraph 1 under b of the act;
c. student: he or she who is enrolled at the Radboud University Nijmegen for an education programme and/or for the purpose of taking the preliminary examinations and the examinations of the programme;
d. bachelor's degree programme: the programme as referred to in article 7.3a of the act;
e. practical: a practical assignment as referred to in article 7.13, paragraph 2 under d of the act, in one of the following forms:

- writing a thesis;
- writing a paper or draft design;
- carrying out a design or research assignment;
- conducting a literature study;
- writing a computer programme
- obtaining work experience (traineeship);
- taking part in fieldwork or an excursion;
- carrying out tests and experiments;
- or taking part in some other educational activity aimed at acquiring certain skills;

f. preliminary examination: an examination regarding the knowledge, understanding and skills of the student with respect to a certain unit of study, as well as the assessment of this examination by at least one examiner who has been designated by the examining board for that purpose;
g. examination: a review of the student's performance in which the examining board assesses whether or not the student has successfully completed all of the preliminary examinations of all of the units of study that make up the master's programme, insofar as the examining board has not determined that the examination is to also include an examination by the examining board itself into the knowledge, understanding and skills of the candidate as well as the assessment of the results of this examination (in accordance with article 7.10 of the act);

h. examining board: the examining board of an education programme as established in accordance with article 7.12 of the act. The reader is also referred to the Structure regulation RU;
i. examiner: the person as designated by the examining board in accordance with article 7.12 of the act for the purpose of administering preliminary examinations;
j. EC: credits in accordance with the European Credit Transfer System;
k. working day: Monday through Friday, with the exception of official holidays;
l. study guide: the guide for one of the education programmes as referred to in article 1 containing specific information regarding the master's programme;
m. institution: Radboud University Nijmegen

Article 1.3 Aim of the programme

The aim of the programme is:

- to have students acquire knowledge, understanding and skills in the sphere of biology;
- b. to offer students a university education;
- c. for the research variation (O-variation), supplementary to that stated under a and b: preparations for doctoral research
- d. for the management and technology variation (MT-variation), supplementary to that stated under a and b: knowledge, skills and understanding with respect to relevant fields regarding business administration and social administration;
- e. for the science communication variation (C-variation), supplementary to that under a and b: knowledge, skills and understanding with respect to relevant fields in the sphere of communication;
- f. for the education variation (E-variation), supplementary to that stated under a and b: acquiring necessary competencies in order to be a teacher.

Article 1.4 Type of programme

The education programme is a full-time programme.

Article 1.5 The examinations of the programme

1. The education programme includes the following examinations:

a. the examination for a master's degree

Article 1.6 Study load

- 1. The study load is expressed in ECs. One EC equals 28 hours of study.
- 2. The study load of the master's examination amounts to 120 ECs.

Article 1.7 Language

1. The programme is offered in the English language; the preliminary examinations and examinations are administered in the English language as well.
2. The code of conduct foreign language of the RU Nijmegen applies to the education

programmes that are offered in the English language (see appendix)
3. In order to participate in the English-language education programme and in the preliminary examinations, it is essential that the student has a sufficient knowledge of the English language. The student will be considered to meet this requirement if:

1. He/she has obtained a diploma in a pre-university education (vwo-diploma); or
2. He/she has obtained a secondary education diploma at an English-language institution for secondary education either within the Netherlands or elsewhere; or
3. He/she has obtained a higher vocational education diploma (HBO); or
4. He/she has obtained a bachelor's degree at a Dutch university; or
5. He/she has successfully completed one of the following tests:

* the TOEFL with a score of 550 or higher for the paper version;
* the TOEFL with a score of 215 or higher for the computer version;
* the IELTS with a score of 6 or higher.

The examining board may, should the occasion arise, assess for itself whether the student sufficiently masters the English language.

Section 2 The Master's programme

Article 2.1 Composition master's programme (O-variation)

The master's programme O-variation includes the following components with the corresponding study load:

1. Two scientific research traineeships, each corresponding to 45 ECs. One of the two traineeship periods is to take place under the supervision of a university teacher who belongs to a chair group that is part of the educational institution of BioSciences. *(Note: An overview of these chair groups is included in the study guide)*. The second scientific research traineeship is to take place under the supervision of a university teacher who belongs to a chair group of the Radboud University Nijmegen that has been designated for this purpose by the Examining board *(Note: An overview of these chair groups can be found in the study guide as well)*. The two research traineeships are to take place under the supervision of two different chair groups.

Each of the two research traineeships includes:

1. A practical component (consisting of practical work and a report) equalling 36 ECs
2. A theoretical component (including a test) equalling 3 ECs
3. A thesis (in writing) equalling 6 ECs

(Note: the content of the theoretical component and the thesis are to be determined by the teacher who is responsible for the traineeship in constitution with the student).

2. Bio-scientific master programme equalling a total of 12 ECs. The student is to choose from a number of compulsory courses that will be made known at the beginning of the academic year. These will in any case include:

- Trends in Plant Science
- Estuarine Ecology (once every two years)
- Ecology and management of large rivers (once every two years)
- Population Ecology
- Microbiology
- Adaptation Physiology
- Biodiversity (once every two years)
- Community Ecology
- Course working with radionuclides (Level 5B)
- Orientation towards a career as a researcher
- Human fertility and infertility
- Biochemistry; Apoptosis
- Metabolism, transport and motility
- Molecular biology; Gene expression, chromatin and disease
- Adaptation physiology
- Oncology
- Molecular and cellular neurobiology
- Signal transduction and transport
- Post-transcriptional regulation in health and disease
- Endocrinology
- Molecular aspects of host defence, tissue destruction and repair
- Laboratory animal science and alternatives
- Comparative genomics
- Computational drug discovery
- Laboratory animal science

To attend other courses approval of the Examining Board is needed in advance.

3. A course of a philosophical nature (3 ECs) with respect to which the student is to choose from:

- a. Evolution and Philosophy
- b. Science and Literature
- c. Global ethics and sustainable society
- d. Philosophy of Landscape and nature
- e. Evolution and the mind
- f. Bio-ethics for Life scientists
- g. Philosophy of Watermanagement

4. Optional courses (15 ECs) consisting of components that one can choose freely. Of these, 6 ECs can be chosen at will (provided the course(s) is of an academic level and testable), whereas the other 9 ECs must be scientific in nature (and also on an academic level and testable), this subject to the approval of the examining board. The student is allowed to link his/her optional components to the research traineeships either completely or partially.

5. Students who want to specialize in bioinformatics, can do the Bioinformatics track in their research profile (O-variant). Both of the traineeships must have a clear bioinformatics "character". At least one of the traineeships has to be carried out at the CMBI. In their bachelor programme these students must have done bioinformatics courses for at least 9 ec and in their master programme for at least 16 ec. The list with bioinformatics courses will be announced at the start of the study year.

Article 2.2 Composition master's programme (MT-variation)

The master's programme MT-variation includes the following components with the corresponding study load:

1. One scientific research traineeship corresponding to 45 ECs. This traineeship period is to take place under the supervision of a university teacher who belongs to a chair group that is part of the educational institution of Biosciences.

The research traineeship includes:

1. a practical component (consisting of practical work and a report) equalling 36 ECs
2. a theoretical component (including a test) equalling 3 ECs
3. a thesis (in writing) equalling 6 ECs

(Note: the content of the theoretical component and the thesis are to be determined by the teacher who is responsible for the traineeship in constitution with the student).

2. Bio-scientific master programme equalling 9 ECs. It is mandatory that the students choose from the courses shown below:
the reader is referred to article 2.1.2 for an overview

3. A course of a philosophical nature (3 ECs) with respect to which the student must choose from:
the reader is referred to article 2.1.3 for an overview

4. Optional courses (6 ECs) to be determined by the student (provided these are of an academic level and testable).

5. MT-components equalling a total of 57 ECs, consisting of:

a. Compulsory components (basic subjects):

- Business & Society (5 ECs)
- Organization theory (5 ECs)
- Innovation management (5 ECs)
- Strategy & Marketing (5 ECs)
- Financel & Accounting (5 ECs)

b. MT-optional courses (5 ECs) to be selected from:

- Science and entrepreneursip (3 ECs)
- Research strategy and management (3 ECs)
- Industrial precision chemistry (3 ECs)
- General management skills (2 ECs)
- Or a course to be chosen at the discretion of the student and subject to the approval of the responsible teacher

c. Master Thesis Management & Technology (27 ECs)

Article 2.3 Composition master's programme (C-variation)

The master's programme C-variation includes the following components with the corresponding study load:

1. One scientific research traineeship corresponding to 45 ECs. This traineeship period is to take place under the supervision of a university teacher who belongs to a chair group that is part of the educational institution of Biosciences.

The research traineeship includes:

1. a practical component (consisting of practical work and a report) equalling 36 ECs
2. a theoretical component (including a test) equalling 3 ECs
3. a thesis (in writing) equalling 6 ECs

(Note: the content of the theoretical component and the thesis are to be determined by the teacher who is responsible for the traineeship in constitution with the student).

2. Bio-scientific master programme equalling 9 ECs. It is mandatory that the students choose from the courses shown below:
the reader is referred to article 2.1.2 for an overview

3. A course of a philosophical nature (3 ECs) with respect to which the student must choose from:
the reader is referred to article 2.1.3 for an overview

4. Optional courses (6 ECs) to be determined by the student (provided these are of an academic level and testable).

5. C-components equalling a study load of 57 ECs, consisting of:

a. compulsory courses during the first year:

- Introduction Science Communication (3 ECs)
- Science and Societal Interaction (3 ECs)
- Risk Communication (3 ECs)
- Boundary Work (3 ECs)

b. compulsory courses during the second year:

- Framing Knowledge (3 ECs)
- Knowledge Society (3 ECs)
- Science & Media: strategies and trends (3 ECs)

c. C-optional courses, to be approved by the responsible teacher, equalling a study load of 9 ECs

d. Traineeship and reporting (27 ECs)

Article 2.4 Composition master's programme (E-variation)

The master's programme E-variation includes the following components with the corresponding study load:

1. One scientific research traineeship corresponding to 45 ECs. This traineeship period is to take place under the supervision of a university teacher who belongs to a chair group that is part of the educational institution of Biosciences.

The research traineeship includes:

1. a practical component (consisting of practical work and a report) equalling 36 ECs
2. a theoretical component (including a test) equalling 3 ECs
3. a thesis (in writing) equalling 6 ECs

(Note: the content of the theoretical component and the thesis are to be determined by the teacher who is responsible for the traineeship in constitution with the student).

2. Bio-scientific master programme equalling 9 ECs. It is mandatory that the students choose from the courses shown below:
the reader is referred to article 2.1.2 for an overview

3. A course of a philosophical nature (3 ECs) with respect to which the student must choose from:
the reader is referred to article 2.1.3 for an overview

4. Optional courses (6 ECs) to be determined by the student (provided these are of an academic level and testable).

5. E-components totalling a study load of 57 ECs, consisting of two traineeship periods in the form of integrated learning projects.

Article 2.5 Approval of the composition of the master's programme

The composition of the master's programme as determined by the student is submitted to the examining board for approval beforehand.

Section 3 Preliminary examinations and examinations

Article 3.1 Sequence of the preliminary examinations

1. MT-variation:
A student cannot participate in the preliminary examination "Innovation management" and "Strategy & Marketing" until he/she has successfully completed the preliminary examination "Business & Society" and "Organization theory".
The final project regarding the MT-variation cannot be carried out until the student

- has acquired a satisfactory mark for and/or has been exempted from components pertaining to the master's programme concerned equalling at least 45 ECs, including the practical work within the scope of the research traineeship of the programme;
- has acquired a satisfactory mark for at least three of the five MT basic courses as referred to in article 2.2.

2. C-variation:
The traineeship period regarding the C-variation cannot be carried out until the student

- has acquired a satisfactory mark for and/or has been exempted from components pertaining to the master's programme concerned equalling at least 45 ECs, including the practical work within the scope of the research traineeship of the programme;
- has acquired a satisfactory mark for the majority of the compulsory courses as referred to in article 2.3.

3. E-variation:
The traineeship periods regarding the E-variation cannot be carried out until the student has acquired a satisfactory mark for and/or has been exempted from components pertaining to the master's programme concerned equalling at least 30 ECs, including the practical work within the scope of the research traineeship of the programme.

Article 3.2 Time schedule and frequency of the preliminary examinations

1. A student will be given the opportunity to participate in the preliminary examinations regarding the components as referred to in articles 2.1 through 2.4 at least twice a year, with the exception of practical work or the practical part of components, as these are administered only once per academic year. Preliminary examinations are administered immediately following the course concerned, as well as during a period to be determined later but preferably immediately prior to the beginning of the subsequent academic year. The Participation limitation regulation applies here (see the appendix).

2. Contrary to that stated in the first paragraph, a student will be given the opportunity at least once to participate in the preliminary examination regarding a certain component, the corresponding course of which was not available in a certain academic year.

Article 3.3 Form of the preliminary examinations

1. The preliminary examinations regarding the components as referred to in article 2 can be completed as follows:

- a. In writing and/or
- b. Practical assignments + report and/or
- c. Computer practical and/or
- d. Computer preliminary examination and/or
- e. Verbal presentation.

2. The examining board may allow the student, at his/her request, to participate in a preliminary examination in a manner other than those referred to above.

3. Students with a functional disorder will be given the opportunity to participate in preliminary examinations in a fashion that is adjusted as much as possible to their individual handicap. If necessary, the examining board may opt to obtain expert advice prior to making its decision. Should the students concerned require certain facilities during an examination, then they are to request this of the teacher concerned not later than two weeks prior to the preliminary examination.

Article 3.4 Verbal preliminary examinations

1. Verbal preliminary examinations will be conducted one student at a time, unless the examining board decides otherwise.
2. Verbal preliminary examinations are not public, unless the examining board or the examiner concerned has decided otherwise, and/or if the student objects to this.

Article 3.5 Assessment of and notification of results of preliminary examinations

1. The examiner is to determine the result of the verbal preliminary examination immediately afterwards and will provide the administration of the faculty with the necessary information for the purpose of providing the student with written proof of the result of the examination.
2. The examiner is to determine the result of a written preliminary examination within 30 days after the date upon which the examination took place - or earlier if such is necessary to allow for 10 working days prior to the date of the re-examination - and will provide the administration of the faculty with the necessary information for the purpose of providing the student with written proof of the result of the examination.
3. Concerning preliminary examinations that are conducted in a fashion other than verbally or in writing, the examining board will determine beforehand how and within which period of time the student can expect to receive a statement regarding the result.
4. The statement regarding the result of a preliminary examination also refers the student to his/her right of inspection, as referred to in article 3.7, first paragraph, as well as to his/her right of appeal to the Appeals Tribunal Examinations.
5. The period during which students can lodge an appeal with the Appeals Tribunal Examinations against a decision on the part of the examining board is four weeks (as established in the Structure regulation RU).

Article 3.6 Term of validity

1. The term of validity of examination components that have been successfully completed is unlimited.

2. Contrary to that stated in the previous paragraph, the examining board may stipulate additional and/or substitute requirements for a certain component, if the board is of the opinion that the requirements pertaining to the component concerned deviate considerably from those stipulated at the time of the preliminary examination.

Article 3.7 Right of inspection

1. The student, at his/her request, is allowed the right of inspection of his/her assessed work for a period of at least six weeks after having been informed of the result of a written examination. In addition, the student can obtain a copy of his/her work upon request and at the cost price.
2. During the period referred to in the previous paragraph, any interested party will be allowed access to the questions and assignments included in the preliminary examination, as well to information on the standards that applied with respect to the assessment.
3. The examining board may determine that the inspection or supplying of information is to take place at a fixed location and at a minimal of two fixed times. If the party concerned can demonstrate that he/she failed to appear at the location or time as designated due to circumstances beyond his/her control, then the student concerned will be allowed an alternative opportunity, this within the period specified in the first paragraph if possible.

Article 3.8 Exemption

1. At the request of the student and after having consulted with the examiner concerned, the examining board may allow the student exemption from a preliminary examination, if the student:

- has completed components of a university of higher vocational education that correspond to the examination concerned in terms of content and level;
- can demonstrate that he/she has sufficient knowledge and skills regarding the component concerned due to work experience and/or professional experience.

Article 3.9 Final examination

1. The student will be allowed to participate in the (final) examination once he/she has sufficiently proven to have successfully completed the preliminary examinations and to have acquired a university education.
2 The examining board is to determine the result of the examination, as well as the rules and regulations that apply with respect to the manner in which the result of the examination is determined.
3. Before determining the result of an examination, the examining board may opt to independently evaluate the knowledge of the student with respect to one or more components or aspects of the education programme, if and insofar as the results of the preliminary examinations concerned give cause to do so.

Article 3.10 Degree

1. The student who successfully completes the master's examination will be granted the degree of "Master of Science".
2. The degree will be recorded on the diploma of the examination concerned.
3. The student who successfully completes the O-variation as referred to in article 2.1 will receive the supplementary differentiation Research in addition to the master's degree.
4. The student who successfully completes the MT-variation as referred to in article 2.2 will receive the supplementary differentiation Management & Technology in addition to the master's degree.
5. The student who successfully completes the C-variation as referred to in article 2.3 will receive the supplementary differentiation Science communication in addition to the master's degree.
6. The student who successfully completes the E-variation as referred to in article 2.4 will receive the supplementary differentiation Education in addition to the master's degree and will be granted a comprehensive teaching qualification by the Institute for Teacher and School.

Section 4 Prior education

Article 4.1 Requirements for admission to master's programme

1. Without prejudice to that stated in article 4.3, the following persons will be admitted to the education programme:

- a. Those who have successfully completed the final examination of the bachelor's programme Biology at the RU Nijmegen;
- b. Those in possession of proof of admission as issued by the Governing Body for the academic year concerned (article 4.2).

Article 4.2 Proof of admission

The following persons are eligible to receive proof of admission:

- a. Those in possession of a diploma that at least equals the diploma as specified in article 4.1 under a,
- b. Those who, in the opinion of the examining board, have demonstrated in some other way to be suitable to participate in the education programme, for example by completing the (Higher vocational) transitional education programme (of 30 ECs from the BSc, this at the recommendation of the study advisor and the committee for the higher vocational education sector).
- c. And who have demonstrated to sufficiently master the Dutch or English language as specified in article 1.7

Article 4.3 Flexible intake into master's programme

1. The examining board may, insofar as the available student capacity allows, decide that a student who is registered for the bachelor's programme Biology at the RU can be admitted to the master's programme Biology before the student concerned has successfully completed the final examination of the bachelor's programme Biology.

2. Admission is only possible if the student meets the following conditions:
- He/she ahs achieved a satisfactory mark for and/or has been exempted from the components of the bachelor's examination with a study load of 162 ECs;
- Contrary to that stated under paragraph 2.a, students who began the programme on September 1, 2002 can be admitted if they achieve satisfactory results for and/or have been exempted from the components of the bachelor's examination with a study load of 150 ECs;
- The foundation course must be successfully completed, themes 5 and 6 must be completed and furthermore as many optional courses in the differentiation phase as required to meet a total of 162 ECs;
- The student must have successfully completed the mini-traineeship before he/she is allowed to commence with the research traineeship.

3. The student who is admitted to the programme pursuant to this article is to successfully complete the final examination of the bachelor's programme as referred to in the first paragraph not later than one year after being admitted. If the student fails to meet this condition, then he/she will be excluded from participation in the preliminary examinations of the programme until the final examination of the bachelor's programme has been successfully completed.

Section 5 Student counselling

Article 5.1 Monitoring of students' progress

1. The faculty records the individual study results of the students.
2. The faculty will provide each student with an overview of the study results achieved, this at least once a year.

Article 5.2 Student counselling

The programme is to see to the introduction and the student counselling of the students who are enrolled in the education programme, this partly for the benefit of their orientation of possible courses of study within their own programme and elsewhere.

Section 6 Transitional and final provisions

Article 6.1 Preliminary examinations and examinations for students who began their studies prior to September 1, 2002

1. Students who began their studies prior to September 1, 2002, will be given the opportunity up until September 1, 2008 to take the preliminary examinations as well as the final examination of the education programme medical biology as laid down in the Education and examination regulations that became effective on September 1, 2002.
2. In special cases, the examining board may grant students other than those referred to in the first paragraph permission to take preliminary examinations and examinations in accordance

with the education and examination regulations as referred to in the first paragraph. That stated in the first paragraph remains in full force in this respect.

Article 6.2 Switch from undivided programme to bachelor/master structure

A student as referred to in article 6.1 may participate in the education programme pursuant to these education and examination regulations subject to the following conditions:

a. study results achieved may be evaluated as exemption from corresponding components "new style";
b. participation is possible insofar as the implementation in phases of the programme and the preliminary examinations allows in accordance with these regulations.

Article 6.3 Determining the EER / Changes

(Note: the reader is also referred to the Structure regulation articles 11 and 18 and Regulation UGV and FGV article 3.3.1.)

1. These regulations and changes to these regulations are decided separately by the dean after consulting with the education programme board and with the approval of the FGV.
2. Any changes to these regulations will not concern the present academic year, unless such is not, with reason, in the interest of the students.
3. A change may furthermore not negatively influence some other decision that has been made by the examining board pursuant to these regulations with respect to a student.

Article 6.4 Publication

1. The dean is to ensure that these regulations, as well as the rules and guidelines as established by the examining board, as well as any amendments to these documents, are properly made public to those concerned.
2. Any interested party can obtain a copy of the documents referred to in the first paragraph at the faculty offices.

Article 6.5 Effective date

These regulations will become effective as of September 1, 2008.
Drawn up by the dean on June 25, 2008.

Appendix

Code of conduct foreign language, within the meaning of section 7.2 sub-section c of the Higher education and Scientific Research Act (abbr. in Dutch: WHW) (established by the Governing Body)

The following code of conduct applies within the RU

- Article 1
  It is possible within the organisation of the Radboud University Nijmegen for one to follow the educational programme and to take preliminary examinations and examinations in a language other than Dutch in the event that the specific nature, organisation or quality of the programme and/or the origin of the student renders this necessary.
- Article 2
  The decision to opt for the use of a foreign language is at the discretion of the dean of the faculty concerned, this after having consulted with the education board. The dean will consider the following principles in reaching this decision:

- The necessity to make use of a language other than Dutch must be clearly evident;
- Preliminary examinations and examinations can be taken in Dutch at the request of the student; preliminary examinations and examinations of the English-language educational programmes are held in English, unless the examination board of the programme concerned decides otherwise;
- The use of a foreign language is not to result in an increase of the study load of the programme;
- The non-native educational programme is to meet the same quality requirements as those pertaining to programme provided in the Dutch language.

- Article 3
  The decision on the part of the dean is incorporated in the education and examination regulations of the educational programme.
- Article 4
  The dean of the faculty is to provide the Governing Body with a report of his decisions on a yearly basis.

Education board

Pursuant to section 9.18 of the Higher Education and Scientific Research Act, there is an education board. It is the responsibility of this board to:

- a) Advise the parties concerned on the education and examination regulations,
- b) To annually evaluate the execution of the education and examination regulations and
- c) To advise the programme director and the dean, either upon request or on its own initiative, on any and all matters regarding the educational aspects of the programme.

Participation limitation regulation with respect to preliminary examinations

The Participation Limitation Regulation for preliminary examinations as described below applies to all of the preliminary examinations that are held within the faculty. This regulation was laid down by the faculty management on January 7, 2004 after having consulted with the Education management team.

- Students may participate in a preliminary examination a maximum of 3 times. Students are obligated to electronically register for a preliminary examination via KISS, not later than 5 days prior to the preliminary examination. The observer is to verify certain information and additions to the list of participants are not allowed. The university

teacher may only issue the examination assignments to students who have been registered beforehand.
- Students are to sign themselves out if they do not intend to participate in a preliminary examination:
- In Kiss not later than 5 working days prior to the preliminary examination,
- Or, after that, not later than 1 working day prior to the date upon which the preliminary examination is to be held. A late cancellation of this kind can only be realised by means of informing the university teacher concerned either in writing or electronically.

Should a student fail to participate in a preliminary examination without timely signing him/herself out, then he/she will forfeit a chance (1 of the 3) to complete a preliminary examination.

- In the event that the student fails to successfully complete the preliminary examination after 3 tries, then the student must submit a written request to the examining board of his/her educational programme for each subsequent time that he/she wishes to participate in the preliminary examination.
- It is the responsibility of the students' administration to register the number of times that a student has participated in a preliminary examination.
- This regulation applies to both written and verbal preliminary examinations.
- This regulation applies to all of the students who are registered at the Faculty of natural Sciences, Mathematics and Information Science.
- If the student can demonstrate that he/she failed to participate in a preliminary examination and/or failed to timely report his/her absence beforehand due to circumstances beyond his/her control, then the examining board can decide not to consider the registration as an actual participation.
- This regulation comes into effect as of February 1, 2004 with respect to preliminary examinations for which students registered for the first time after this date.

Further rules for the proper course of events during preliminary examinations (pursuant to section 7.12, sub-section 4 WHW)

The examining board establishes rules regarding the proper course of events during preliminary examinations and concerning the measures to be taken in that respect. These measures may imply that, in the event of fraud on the part of a student, the examining board may opt to deprive the student concerned of the right to participate in one or more (preliminary) examinations at the educational institution for a period to be determined by the examining board, this up to a maximum of one year.

4.3 Appendix 3: Rules on Teaching and Examination of the Master of Medical biology

Note: The Rules for study year 2010-2011 are under construction and will be posted in a few weeks
Section 1 General provisions

Article 1.1 Applicability of the regulations

These regulations apply to the education and examinations of the Master's programme Medical Biology, hereinafter called: the programme.
This programme is offered by the educational institution Bio-sciences (hereinafter called: the educational institution) within the Faculty of Natural Sciences, Mathematics and Information Science (hereinafter called: the faculty).

Article 1.2 Definitions

The concepts as referred to in these regulations, insofar as these are also specified in the Higher Education and Research Act (abbr. in Dutch: WHW), will have the same meaning as is the case in said act.

The following words in these regulations are understood to mean:

a. the act: the Higher Education and Research Act, abbr. WHW as it currently reads;
b. programme: the master's programme as referred to in article 7.3a, paragraph 1 under b of the act;
c. student: he or she who is enrolled at the Radboud University Nijmegen for an education programme and/or for the purpose of taking the preliminary examinations and the examinations of the programme;
d. bachelor's degree programme: the programme as referred to in article 7.3a of the act;
e. practical: a practical assignment as referred to in article 7.13, paragraph 2 under d of the act, in one of the following forms:

- writing a thesis;
- writing a paper or draft design;
- carrying out a design or research assignment;
- conducting a literature study;
- writing a computer programme
- obtaining work experience (traineeship);
- taking part in fieldwork or an excursion;
- carrying out tests and experiments;
- or taking part in some other educational activity aimed at acquiring certain skills.

f. preliminary examination: an examination regarding the knowledge, understanding and skills of the student with respect to a certain unit of study, as well as the assessment of this examination by at least one examiner who has been designated by the examining board for that purpose.
g. examination: a review of the student's performance in which the examining board assesses whether or not the student has successfully completed all of the preliminary examinations of all of the units of study that make up the master's programme, insofar as the examining board has not determined that the examination is to also include an examination by the examining board itself into the knowledge, understanding and skills of the candidate as well as the assessment of the results of this examination (in accordance with article 7.10 of the act).
h. examining board: the examining board of an education programme as established in accordance with article 7.12 of the act. The reader is also referred to the Structure regulation RU.

i. examiner: the person as designated by the examining board in accordance with article 7.12 of the act for the purpose of administering preliminary examinations;
j. EC: credits in accordance with the European Credit Transfer System;
k. working day: Monday through Friday, with the exception of official holidays;
l. study guide: the guide for one of the education programmes as referred to in article 1 containing specific information regarding the master's programme;
m. institution: Radboud University Nijmegen

Article 1.3 Aim of the programme

The aim of the programme is:

- a. to have students acquire knowledge, understanding and skills in the sphere of medical biology;
- b. to offer students a university education;
- c. for the research variation (O-variation), supplementary to that stated under a and b: preparations for doctoral research
- d. for the management and technology variation (MT-variation), supplementary to that stated under a and b: knowledge, skills and understanding with respect to relevant fields regarding business administration and social administration;
- e. for the science communication variation (C-variation), supplementary to that under a and b: knowledge, skills and understanding with respect to relevant fields in the sphere of communication;
- f. for the education variation (E-variation), supplementary to that stated under a and b: acquiring necessary competencies in order to be a teacher.

Article 1.4 Type of programme

The education programme is a full-time programme.

Article 1.5 The examinations of the programme

- 1. The education programme includes the following examinations:
  a. the examination for a master's degree

Article 1.6 Study load

1. The study load is expressed in ECs. One EC equals 28 hours of study.
2. The study load of the master's examination amounts to 120 ECs.

Article 1.7 Language

1. The programme is offered in the English language; the preliminary examinations and examinations are administered in the English language as well.
2. The code of conduct foreign language of the RU Nijmegen applies to the education programmes that are offered in the English language (see appendix).
3. In order to participate in the English-language education programme and in the preliminary examinations, it is essential that the student has a sufficient knowledge of the English language. The student will be considered to meet this requirement if:

1. He/she has obtained a diploma in a pre-university education (vwo-diploma); or
2. He/she has obtained a secondary education diploma at an English-language institution for secondary education either within the Netherlands or elsewhere; or
3. He/she has obtained a higher vocational education diploma (HBO); or
4. He/she has obtained a bachelor's degree at a Dutch university; or
5. He/she has successfully completed one of the following tests:

* the TOEFL with a score of 550 or higher for the paper version;
* the TOEFL with a score of 215 or higher for the computer version;
* the IELTS with a score of 6 or higher.

The examining board may, should the occasion arise, assess for itself whether the student sufficiently masters the English language.

Section 2 The Master's programme

Article 2.1 Composition master's programme (O-variation)

The master's programme O-variation includes the following components with the corresponding study load:

1. Two scientific research traineeships, each corresponding to 45 ECs. One of the two traineeship periods is to take place under the supervision of a university teacher who belongs to a chair group that is part of the educational institution of Bio-Sciences. *(Note: An overview of these chair groups is included in the study guide)* and the other is to take place under the supervision of a university teacher who belongs to a chair group of the UMC that has been designated for this purpose by the Examining board *(Note: An overview of these chair groups can be found in the study guide as well)* or who belongs to the chair groups of Biomolecular Chemistry, Bio-informatics, Bio-physics or the FC Donders Institution. The two research traineeships are to take place under the supervision of two different chair groups.

Each of the two research traineeships includes:

1. A practical component (consisting of practical work and a report) equalling 36 ECs
2. A theoretical component (including a test) equalling 3 ECs
3. A thesis (in writing) equalling 6 ECs

(Note: the content of the theoretical component and the thesis are to be determined by the teacher who is responsible for the traineeship in constitution with the student)

2. Bio-scientific master programme equalling a total of 12 ECs. It is mandatory that the student choose courses from a list that will be made known at the beginning of the academic year. The courses will in any case include:

- Human fertility and infertility
- Biochemistry; Apoptosis
- Metabolism, transport and motility
- Molecular biology; Gene expression, chromatin and disease

- Adaptation physiology
- Oncology
- Molecular and cellular neurobiology
- Signal transduction and transport
- Post-transcriptional regulation in health and disease
- Endocrinology
- Microbiology
- Molecular aspects of host defence, tissue destruction and repair
- Course working with radionuclides (Level 5B)
- Laboratory animal science
- Orientation towards a career as a researcher
- Comparative genomics
- Computational drug discovery

To attend other courses approval of the Examining Board is needed in advance.

3. A course of a philosophical nature (3 ECs) with respect to which the student must choose from:

- Evolution and philosophy
- Science and Literature
- Global ethics and sustainable society
- Philosophy of Landscape and nature
- Evolution and the mind
- Bio-ethics for Lifescientists
- Philosophy of Watermanagement

4. Optional courses (15 ECs) consisting of components that one can choose freely. Of these, 6 ECs can be chosen at will (provided the course(s) is of an academic level and testable), whereas the other 9 ECs must be scientific in nature (and also on an academic level and testable), this subject to the approval of the examining board. The student is allowed to link his/her optional components to the research traineeships either completely or partially.

Article 2.2 Composition master's programme (MT-variation)

The master's programme MT-variation includes the following components with the corresponding study load:

1. One scientific research traineeship corresponding to 45 ECs. This traineeship period is to take place under the supervision of a university teacher who belongs to a chair group that is part of the educational institution of Bio-sciences (*Note: An overview of these chair groups is included in the study guide*) or under the supervision of a teacher who belongs to a chair group of the UMC that has been designated for this purpose by the examining board (*Note: An overview of these chair groups is included in the study guide*) or who belongs to the chair groups of Biomolecular Chemistry, Bio-informatics, Bio-physics or the FC Donders Institution. The research traineeship includes:

1. a practical component (consisting of practical work and a report) equalling 36 ECs
2. a theoretical component (including a test) equalling 3 ECs
3. a thesis (in writing) equalling 6 ECs

(Note: the content of the theoretical component and the thesis are to be determined by the teacher who is responsible for the traineeship in constitution with the student).

2. Bio-scientific master programme equalling 9 ECs. It is mandatory that the students choose from the courses shown below:
the reader is referred to article 2.1.2 for an overview

3. A course of a philosophical nature (3 ECs) with respect to which the student must choose from:
the reader is referred to article 2.1.3 for an overview

4. Optional courses (6 ECs) to be determined by the student (provided these are of an academic level and testable)

5. MT-components equalling a total of 57 ECs, consisting of:

a. Compulsory components (basic subjects):

- Business & Society (5 ECs)
- Organization theory (5 ECs)
- Innovation management (5 ECs)
- Strategy & Marketing (5 ECs)
- Finance & Accounting (5 ECs)

b. MT-optional courses (5 ECs) to be selected from:

- Knowledge and entrepreneursip (3 ECs)
- Research strategy and management (3 ECs)
- Industrial precision chemistry (3 ECs)
- General management skills (2 ECs)
- Or a course to be chosen at the discretion of the student and subject to the approval of the responsible teacher

c. Master Thesis Management & Technology (27 ECs)

Article 2.3 Composition master's programme (C-variation)

The master's programme C-variation includes the following components with the corresponding study load:

1. One scientific research traineeship corresponding to 45 ECs. This traineeship period is to take place under the supervision of a university teacher who belongs to a chair group that is part of the educational institution of Bio-sciences (*Note: An overview of these chair groups is included in the study guide*) or under the supervision of a teacher who belongs to a chair group of the UMC that has been designated for this purpose by the examining board (*Note:*

An overview of these chair groups is included in the study guide) or who belongs to the chair groups of Biomolecular Chemistry, Bio-informatics, Bio-physics or the FC Donders Institution. The research traineeship includes:

1. a practical component (consisting of practical work and a report) equalling 36 ECs
2. a theoretical component (including a test) equalling 3 ECs
3. a thesis (in writing) equalling 6 ECs

(Note: the content of the theoretical component and the thesis are to be determined by the teacher who is responsible for the traineeship in constitution with the student)

2. Bio-scientific master programme equalling 9 ECs. It is mandatory that the students choose from the courses shown below:
the reader is referred to article 2.1.2 for an overview

3. A course of a philosophical nature (3 ECs) with respect to which the student must choose from:
the reader is referred to article 2.1.3 for an overview

4. Optional courses (6 ECs) to be determined by the student (provided these are of an academic level and testable).

5. C-components equalling a study load of 57 ECs, consisting of:

a. compulsory courses during the first year:

- Introduction Science Communication (3 ECs)
- Science and Societal Interaction (3 ECs)
- Risk Communication (3 ECs)
- Boundary Work (3 ECs)

b. compulsory courses during the second year:

- Framing Knowledge (3 ECs)
- Knowledge Society (3 ECs)
- Science & Media: strategies and trends (3 ECs)

c. C-optional courses, to be approved by the teacher responsible for the variation, equalling a study load of 9 ECs

d. Traineeship and reporting (27 ECs)

Article 2.4 Composition master's programme (E-variation)

The master's programme E-variation includes the following components with the corresponding study load:

1. One scientific research traineeship corresponding to 45 ECs. This traineeship period is to take place under the supervision of a university teacher who belongs to a chair group that is

part of the educational institution of Bio-sciences (*Note: An overview of these chair groups is included in the study guide*) or under the supervision of a teacher who belongs to a chair group of the UMC that has been designated for this purpose by the examining board (*Note: An overview of these chair groups is included in the study guide*) or who belongs to the chair groups of Biomolecular Chemistry, Bio-informatics, Bio-physics or the FC Donders Institution. The research traineeship includes:

a. A practical component (consisting of practical work and a report) equalling 36 ECs
b. A theoretical component (including a test) equalling 3 ECs
c. A thesis (in writing) equalling 6 ECs

(Note: the content of the theoretical component and the thesis are to be determined by the teacher who is responsible for the traineeship in constitution with the student)

2. Bio-scientific master programme equalling 9 ECs. It is mandatory that the students choose from the courses shown below:
the reader is referred to article 2.1.2 for an overview

3. A course of a philosophical nature (3 ECs) with respect to which the student must choose from:
the reader is referred to article 2.1.3 for an overview

4. Optional courses (6 ECs) to be determined by the student (provided these are of an academic level and testable).

5. E-components totalling a study load of 57 ECs, consisting of two traineeship periods in the form of integrated learning projects.

Article 2.5 Approval of the composition of the master's programme

The composition of the master's programmes as chosen by the student is to be submitted to the examining board beforehand for approval.

Section 3 Preliminary examinations and examinations

Article 3.1 Sequence of the preliminary examinations

1. MT-variation:

A student cannot participate in the preliminary examinations Innovation management and Strategy & Marketing until he/she has successfully completed the preliminary examinations "Business & Society" and "Organization theory".

The final project regarding the MT-variation cannot be carried out until the student

- has acquired a satisfactory mark for and/or has been exempted from components

pertaining to the master's programme concerned equalling at least 45 ECs, including the practical work within the scope of the research traineeship of the programme;
- has acquired a satisfactory mark for at least three of the five MT basic courses as referred to in article 2.2.

2. C-variation:

The traineeship period regarding the C-variation cannot be carried out until the student

- has acquired a satisfactory mark for and/or has been exempted from components pertaining to the master's programme concerned equalling at least 45 ECs, including the practical work within the scope of the research traineeship of the programme;
- has acquired a satisfactory mark for the majority of the compulsory courses as referred to in article 2.3.

3. E-variation:

The traineeship periods regarding the E-variation cannot be carried out until the student has acquired a satisfactory mark for and/or has been exempted from components pertaining to the master's programme concerned equalling at least 30 ECs, including the practical work within the scope of the research traineeship of the programme.

Article 3.2 Time schedule and frequency of the preliminary examinations

1. A student will be given the opportunity to participate in the preliminary examinations regarding the components as referred to in articles 2.1 through 2.4 at least twice a year, with the exception of practical work or the practical part of components, as these are administered only once per academic year. Preliminary examinations are administered immediately following the course concerned, as well as during a period to be determined later but preferably immediately prior to the beginning of the subsequent academic year. The Participation limitation regulation applies here (see the appendix).
2. Contrary to that stated in the first paragraph, a student will be given the opportunity at least once to participate in the preliminary examination regarding a certain component, the corresponding course of which was not available in a certain academic year.

Article 3.3 Form of the preliminary examinations

1. The examinations regarding the courses as referred to in article 2 can be completed as follows:

- In writing and/or
- Practical assignments + report and/or
- Computer practical and/or
- Computer preliminary examination and/or
- Verbal presentation.

2. The examining board may allow the student, at his/her request, to participate in a preliminary examination in a manner other than those referred to above.

3. Students with a functional disorder will be given the opportunity to participate in preliminary examinations in a fashion that is adjusted as much as possible to their individual handicap. If necessary, the examining board may opt to obtain expert advice prior to making its decision. Should the students concerned require certain facilities during an examination, then they are to request this of the teacher concerned not later than two weeks prior to the preliminary examination.

Article 3.4 Verbal preliminary examinations

1. Verbal preliminary examinations will be conducted one student at a time, unless the examining board decides otherwise.
2. Verbal preliminary examinations are not public, unless the examining board or the examiner concerned has decided otherwise, and/or if the student objects to this.

Article 3.5 Assessment of and notification of results of preliminary examinations

1. The examiner is to determine the result of the verbal preliminary examination immediately afterwards and will provide the administration of the faculty with the necessary information for the purpose of providing the student with written proof of the result of the examination.
2. The examiner is to determine the result of a written preliminary examination within 30 days after the date upon which the examination took place - or earlier if such is necessary to allow for 10 working days prior to the date of the re-examination - and will provide the administration of the faculty with the necessary information for the purpose of providing the student with written proof of the result of the examination.
3. Concerning preliminary examinations that are conducted in a fashion other than verbally or in writing, the examining board will determine beforehand how and within which period of time the student can expect to receive a statement regarding the result.
4. The statement regarding the result of a preliminary examination also refers the student to his/her right of inspection, as referred to in article 3.7, first paragraph, as well as to his/her right of appeal to the Appeals Tribunal Examinations.
5. The period during which students can lodge an appeal with the Appeals Tribunal Examinations against a decision on the part of the examining board is four weeks (as established in the Structure regulation RU).

Article 3.6 Term of validity

1. The term of validity of examination components that have been successfully completed is unlimited.
2. Contrary to that stated in the previous paragraph, the examining board may stipulate additional and/or substitute requirements for a certain component, if the board is of the opinion that the requirements pertaining to the component concerned deviate considerably from those stipulated at the time of the preliminary examination.

Article 3.7 Right of inspection

1. The student, at his/her request, is allowed the right of inspection of his/her assessed work for a period of at least six weeks after having been informed of the result of a written

examination. In addition, the student can obtain a copy of his/her work upon request and at the cost price.
2. During the period referred to in the previous paragraph, any interested party will be allowed access to the questions and assignments included in the preliminary examination, as well to information on the standards that applied with respect to the assessment.
3. The examining board may determine that the inspection or supplying of information is to take place at a fixed location and at a minimal of two fixed times. If the party concerned can demonstrate that he/she failed to appear at the location or time as designated due to circumstances beyond his/her control, then the student concerned will be allowed an alternative opportunity, this within the period specified in the first paragraph if possible.

Article 3.8 Exemption

1. At the request of the student and after having consulted with the examiner concerned, the examining board may allow the student exemption from a preliminary examination, if the student:

a. has completed components of a university of higher vocational education that correspond to the examination concerned in terms of content and level;
b. can demonstrate that he/she has sufficient knowledge and skills regarding the component concerned due to work experience and/or professional experience.

Article 3.9 Final examination

1. The student will be allowed to participate in the (final) examination once he/she has sufficiently proven to have successfully completed the preliminary examinations and to have acquired a university education.
2 The examining board is to determine the result of the examination, as well as the rules and regulations that apply with respect to the manner in which the result of the examination is determined.
3. Before determining the result of an examination, the examining board may opt to independently evaluate the knowledge of the student with respect to one or more components or aspects of the education programme, if and insofar as the results of the preliminary examinations concerned give cause to do so.

Article 3.10 Degree

1. The student who successfully completes the master's examination will be granted the degree of "Master of Science".
2. The degree will be recorded on the diploma of the examination concerned.
3. The student who successfully completes the O-variation as referred to in article 2.1 will receive the supplementary differentiation Research in addition to the master's degree.
4. The student who successfully completes the MT-variation as referred to in article 2.2 will receive the supplementary differentiation Management & Technology in addition to the master's degree.
5. The student who successfully completes the C-variation as referred to in article 2.3 will receive the supplementary differentiation Science communication in addition to the master's

degree.
6. The student who successfully completes the E-variation as referred to in article 2.4 will receive the supplementary differentiation Education in addition to the master's degree and will be granted a comprehensive teaching qualification by the Institute for Teacher and School.

Section 4 Prior education

Article 4.1 Requirements for admission to master's programme

1. Without prejudice to that stated in article 4.3, the following persons will be admitted to the education programme:

- Those who have successfully completed the final examination of the bachelor's programme Biology, with a minor in Medical Biology, at the RU Nijmegen;
- Those in possession of proof of admission as issued by the Governing Body for the academic year concerned (article 4.2).
- Those in possession of a bachelor's degree pertaining to some other education programme or with some other minor (university or higher vocational level), provided that, in the opinion of the examining board, any existing deficient can be fulfilled by means of a transition programme in the equivalent of a maximum of 30 ECs and the transition programme that has been arranged for that purpose is indeed successfully completed.

Article 4.2 Proof of admission

The following persons are eligible to receive proof of admission:

- Those in possession of a diploma that at least equals the diploma as specified in article 4.1 under a,
- Those who, in the opinion of the examining board, have demonstrated in some other way to be suitable to participate in the education programme,
- And who have demonstrated to sufficiently master the English language as specified in article 1.7

Article 4.3 Flexible intake into the master's programme

1. The examining board may, insofar as the available student capacity allows, decide that a student who is registered for the bachelor's programme Biology at the RU can be admitted to the components of the master's programme Medical Biology before the student concerned has successfully completed the final examination of the bachelor's programme Biology.
2. Admission is only possible if the student meets the following conditions:

- He/she has achieved a satisfactory mark for and/or has been exempted from the components of the bachelor's examination with a study load of 162 ECs;
- Contrary to that stated under paragraph 2.a, students who began the programme on September 1, 2002 can be admitted if they achieve satisfactory results for and/or have been exempted from the components of the bachelor's examination with a study load of 150 ECs;

- The foundation course must be successfully completed, themes 5 and 6 must be completed and furthermore as many optional courses in the differentiation phase as required to meet a total of 162 ECs;
- The student must have successfully completed the mini-traineeship before he/she is allowed to commence with the research traineeship.

3. The student who is admitted to the programme pursuant to this article is to successfully complete the final examination of the bachelor's programme as referred to in the first paragraph not later than one year after being admitted. If the student fails to meet this condition, then he/she will be excluded from participation in the preliminary examinations of the programme until the final examination of the bachelor's programme has been successfully completed.

Section 5 Student counselling

Article 5.1 Monitoring of students' progress

1. The faculty records the individual study results of the students.
2. The faculty will provide each student with an overview of the study results achieved, this at least once a year.

Article 5.2 Student counselling

The programme is to see to the introduction and the student counselling of the students who are enrolled in the education programme, this partly for the benefit of their orientation of possible courses of study within their own programme and elsewhere.

Section 6 Transitional and final provisions

Article 6.1 Preliminary examinations and examinations for students who began their studies prior to September 1, 2002

1. Students who began their studies prior to September 1, 2002, will be given the opportunity up until September 1, 2008 to take the preliminary examinations as well as the final examination of the education programme medical biology as laid down in the Education and examination regulations that became effective on September 1, 2002.
2. In special cases, the examining board may grant students other than those referred to in the first paragraph permission to take preliminary examinations and examinations in accordance with the education and examination regulations as referred to in the first paragraph. That stated in the first paragraph remains in full force in this respect.

Article 6.2 Switch from undivided programme to bachelor/master structure

A student as referred to in article 6.1 may participate in the education programme pursuant to these education and examination regulations subject to the following conditions:

a. study results achieved may be evaluated as exemption from corresponding components "new style";
b. participation is possible insofar as the implementation in phases of the programme and the preliminary examinations allows in accordance with these regulations.

Article 6.3 Determining the EER / Changes

(Note: the reader is also referred to the Structure regulation articles 11 and 18 and Regulation UGV and FGV article 3.3.1.)

1. These regulations and changes to these regulations are decided separately by the dean after consulting with the education programme board and with the approval of the FGV.
2. Any changes to these regulations will not concern the present academic year, unless such is not, with reason, in the interest of the students.
3. A change may furthermore not negatively influence some other decision that has been made by the examining board pursuant to these regulations with respect to a student.

Article 6.4 Publication

1. The dean is to ensure that these regulations, as well as the rules and guidelines as established by the examining board, as well as any amendments to these documents, are properly made public to those concerned.
2. Any interested party can obtain a copy of the documents referred to in the first paragraph at the faculty offices.

Article 6.5 Effective date

These regulations will become effective as of September 1, 2008.
Drawn up by the dean on June 25, 2008.

Appendix

Code of conduct foreign language, within the meaning of section 7.2 sub-section c of the Higher education and Scientific Research Act (abbr. in Dutch: WHW) (established by the Governing Body)

The following code of conduct applies within the RU

- Article 1
  It is possible within the organisation of the Radboud University Nijmegen for one to follow the educational programme and to take preliminary examinations and examinations in a language other than Dutch in the event that the specific nature, organisation or quality of the programme and/or the origin of the student renders this necessary.
- Article 2
  The decision to opt for the use of a foreign language is at the discretion of the dean of the

faculty concerned, this after having consulted with the education board. The dean will consider the following principles in reaching this decision:
- The necessity to make use of a language other than Dutch must be clearly evident;
- Preliminary examinations and examinations can be taken in Dutch at the request of the student; preliminary examinations and examinations of the English-language educational programmes are held in English, unless the examination board of the programme concerned decides otherwise;
- The use of a foreign language is not to result in an increase of the study load of the programme;
- The non-native educational programme is to meet the same quality requirements as those pertaining to programme provided in the Dutch language.

- Article 3
  The decision on the part of the dean is incorporated in the education and examination regulations of the educational programme.
- Article 4
  The dean of the faculty is to provide the Governing Body with a report of his decisions on a yearly basis.

Education board

Pursuant to section 9.18 of the Higher Education and Scientific Research Act, there is an education board. It is the responsibility of this board to:

- Advise the parties concerned on the education and examination regulations,
- To annually evaluate the execution of the education and examination regulations and
- To advise the programme director and the dean, either upon request or on its own initiative, on any and all matters regarding the educational aspects of the programme.

Participation limitation regulation with respect to preliminary examinations

The Participation Limitation Regulation for preliminary examinations as described below applies to all of the preliminary examinations that are held within the faculty. This regulation was laid down by the faculty management on January 7, 2004 after having consulted with the Education management team.

- Students may participate in a preliminary examination a maximum of 3 times. Students are obligated to electronically register for a preliminary examination via KISS, not later than 5 days prior to the preliminary examination. The observer is to verify certain information and additions to the list of participants are not allowed. The university teacher may only issue the examination assignments to students who have been registered beforehand.
- Students are to sign themselves out if they do not intend to participate in a preliminary examination:
- In Kiss not later than 5 working days prior to the preliminary examination,
- Or, after that, not later than 1 working day prior to the date upon which the preliminary examination is to be held. A late cancellation of this kind can only be realised by means of informing the university teacher concerned either in writing or electronically.

Should a student fail to participate in a preliminary examination without timely signing him/herself out, then he/she will forfeit a chance (1 of the 3) to complete a preliminary examination.

- In the event that the student fails to successfully complete the preliminary examination after 3 tries, then the student must submit a written request to the examining board of his/her educational programme for each subsequent time that he/she wishes to participate in the preliminary examination.
- It is the responsibility of the students' administration to register the number of times that a student has participated in a preliminary examination.
- This regulation applies to both written and verbal preliminary examinations.
- This regulation applies to all of the students who are registered at the Faculty of natural Sciences, Mathematics and Information Science.
- If the student can demonstrate that he/she failed to participate in a preliminary examination and/or failed to timely report his/her absence beforehand due to circumstances beyond his/her control, then the examining board can decide not to consider the registration as an actual participation.
- This regulation comes into effect as of February 1, 2004 with respect to preliminary examinations for which students registered for the first time after this date.

Further rules for the proper course of events during preliminary examinations (pursuant to section 7.12, sub-section 4 WHW)

The examining board establishes rules regarding the proper course of events during preliminary examinations and concerning the measures to be taken in that respect. These measures may imply that, in the event of fraud on the part of a student, the examining board may opt to deprive the student concerned of the right to participate in one or more (preliminary) examinations at the educational institution for a period to be determined by the examining board, this up to a maximum of one year.

4.4 Appendix 4: Additional rules and guidelines from the Examination Board

Note: The Rules for study year 2010-2011 are under construction and will be posted in a few weeks

Rules and guidelines of the Examination Board regarding the Education and Examination Regulation (abbreviation in Dutch: OER) for the Bachelor Biology and the Education and Examination Regulations for the Master Biology, the Master Medical Biology and the Master Environmental Sciences 2009-2010

Component: guidelines concerning evaluations and decisions

article A.1 Fraud

a. If, during an examination, one of the observers suspects fraud or irregularities, then he/she is to inform the examinee concerned that such is the case. The examinee, at the request of the observer in question, is obligated to hand over pieces of evidence either immediately or at the end of the examination period. A refusal on the part of the examinee will be considered fraud.

b. An official report is to be made of the supposed fraud as referred to under section a, this under the responsibility of an observer from the faculty concerned.

c. The examination board, after hearing both the observer and the examinee, may opt to declare the (preliminary) examination invalid and moreover, the board may decide to exclude the examinee in question from participation in the next respective (preliminary) examination.

d. In the event that the evaluating university teacher suspects fraud, plagiarism or other irregularities upon marking a written paper, then he/she is to inform the student concerned that such is the case.

e. Fraud with respect to the writing of a paper in some form or other (such as a thesis, lecture or article) is understood to mean the copying, either completely or for the most part, of a paper (either published or not) by someone else, either by electronical means or otherwise.

f. Plagiarism upon writing a paper in some form or other (such as a thesis, article or lecture) is understood to mean the copying of texts that have been produced by someone else without adequately stating the source.

g. Fraud with respect to writing papers in some form or other (such as theses, lectures or articles), as well as plagiarism, can be punished by means of imposing the obligation to write a new paper on a subject as specified by the responsible professor.

article A.2 Evaluation result examination component

The result of each of the components of the examination as referred to in the Education and Examination Regulation is to be evaluated by the Examination board, insofar as it has not appointed one or more examiners from its midst to that end. The examination board, or an examiner that has been appointed by the board, may consider the results of the corresponding practical assignments and papers in the evaluation of a component. The various parts of a component are weighed as follows:

A 2.1. Practical

1. In addition to training in the form of lectures, seminars, verbal presentations and home study, the examination components may include a (computer) practical. In determining the final mark for the examination component, the examinee's mark for the (computer) practical must be weighed proportionate to the number of EC. A pre-condition in this respect is that the student must obtain at least a 5.50 mark for the practical and at least a 5.50 for the theoretical (preliminary) examination.

2.In the event that the theoretical knowledge behind the (COO-) practical experiments or the knowledge gained during PGO projects is incorporated as part of the (preliminary) theory examination, then the time invested in these forms of education will be recognised as part of the examination mark. It is then no longer necessary to have more than 15% of the mark for the practical contribute to the final mark for the training course. In that case, the student must obtain a pass mark for both the (COO-) practical or the pgo projects, as well as for the (preliminary) theory exam.

3. In the event that the theoretical knowledge behind the (COO-) practical experiments or the knowledge gained during PGO projects is not incorporated as part of the (preliminary) theory examination, because not all students do the same experiments for example, one could consider to have the proportion of the mark for the practical in the final mark equal the relative study load of the practical - for example, the proportion of the mark for the practical should be 25% with respect to a 4 EC course combined with a 1 EC practical. A pass mark must be obtained for both the (preliminary) theory examination as well as for the practical - and so an unsatisfactory mark for the theory examination cannot be compensated for with a high mark for the practical.

article A.3 Multiple evaluation result examination component

In the event that the results of one and the same component are evaluated by more than one examiner, either simultaneously or otherwise, then the Examination board will supervise that the examiners make their evaluation, as much as possible, on the basis of the same standards.

article A.4 Statement of the result

After a (preliminary) examination has been completed, the Examination board or the examiner as appointed by the board will issue a statement (hereinafter called: statement of the result) via the students administration/examination department indicating the result.

article A.5 Consideration result examination component in the event of unsatisfactory mark

In the event that a student takes a (preliminary) examination more than once without obtaining a satisfactory mark, then the Examination board, upon determining the result, will only consider the statement of the result that indicates the highest mark obtained.

If, for example, you score a 5 for an examination and then a 4 for the re-examination, then the 5 will apply. Of course, you will still have to obtain a satisfactory mark upon taking the next re-examination.

article A.6 Consideration result examination component regarding satisfactory mark

Once an examinee has obtained a satisfactory mark or higher for a certain examination component, he/she has the right to take the examination one more time. In such cases, the Examination board will then recognise the most favourable statement of the result.

article A.7 Notice and recommendation

The examinee and/or examined person can request that the Examination board or the examiner, before making a decision with respect to the person concerned, give the supervisor or the student advisor the opportunity to provide the Examination board with information and recommendations.

You can contact the supervisor if you have problems with a preliminary examination with the request to consider the problem in more detail and to advise the Examination board to that end.

article A.8 Determining the result of the examination

1.Once all of the components of an examination have been completed, the Examination board will proceed to determine the result of the examination.

2. The Examination board meets at least twice a year for the purpose of determining the results of examinations. At least two members of the board, along with the chairman or acting chairman, must be present at these meetings. It is also possible to determine the result of an examination by means of a procedure in writing. The judgement of the chairman or acting chairman and at least two members will be required in such cases as well.

3.The Examination board comes to its decisions on the basis of an overview of all of the study results of the person examined as this has been drawn up by the faculty department, meaning the issued statements of the result pertaining to the components that the examinee has taken.

4. The Examination board comes to decisions with a simple majority of votes. The person examined has passed if the required majority is obtained. The person examined will not pass if this majority is not obtained.

article A.9 Final evaluation examination components

The final evaluation, expressed as a number, for each of the examination components is to be indicated in the form of a round number or as 0.5, with the exception that evaluations between 5 and 5.5 will be rounded off to 5.0 and evaluations between 5.5 to 6 will be rounded off to 6.0.

Some examination components may be evaluated with 'fulfilled' or 'unfulfilled' instead of in the form of a number.

Article A.10 Re-examination regulation

1. For each examination component there are offered 3 opportunities to take the examination, this in accordance with the regulation of the Faculty of Science. If a student wishes to take part in a fourth (preliminary) examination, then he/she must request the permission of the

Examination board in writing, stating the reasons, at least three months prior to the date of the examination concerned. The Examination board, in consultation with the teacher concerned, may stipulate specific conditions with respect participating in the examination, such as taking certain components of the course concerned once again. The Examination board will not, in general, lend permission to participate for a fifth time in a (preliminary) examination concerning a component of the foundation course.

Pay attention: by not taking part in an opportunity for an examination you lose one of the three opportunities! This means that if a course is not to be given anymore and three opportunities were offered you cannot in any way make up for this course.

2. In general, there are two (preliminary) examinations per examination component per year; one following the completion of the (training) course concerned and then a re-examination.

3. Under no circumstances may a teacher grant exemption from an examination component, nor may he/she provide recommendations that are inconsistent with the registration regulation as observed by the Faculty.

4. The student has the right of appeal to the faculty of Natural Sciences in the event that the Examination board rejects the student's request.

5. As a rule, verbal examinations do not make up part of any educational programme, this due to the multi-disciplinary nature of the examination components. Requests to that end are to be submitted in writing, stating the reasons, to the Examination board, which may call upon the teacher(s) concerned or an advisor (a medical advisor, for example) for advice on the matter.

6. The examination board is to reach a decision in all cases for which this regulation does not provide.

article A.11 Regulation for qualification for the foundation course examination.

1.The person examined will be considered to have passed the foundation course examination Biology if all of the statements of the result, except for one, pertaining to the components as specified in article 2 of the Education and Examination regulation, insofar as these apply to the candidate in question, are at least 'satisfactory' (rounded off to 6.0 or higher).

2. Contrary to that stated above, the list of marks regarding the foundation course examination may include one 5.0, provided that this mark is compensated for by at least one mark of eight or higher for a course of the same credits or more credits.

3. The examinee for the foundation course examination Biology will in all other cases be considered not to have passed.

4. The Examination board recognises the following classifications:
a. 'with pleasure (bene meritum)'; in the event that all of the components have been evaluated at, on average, at least a 7.0.

b. 'with honour (cum laude)'; in the event that all of the components have been evaluated at, on average, at least an 8.0.
c. 'with the highest honour (summa cum laude)'; in the event that all of the examination components are evaluated at, on average, at least a 9.0.
d. Each of these classifications will be reduced to a lower classification for a 5.0 on the list of marks.

5. The examination components for which the results are not expressed in numbers (but by means of 'fulfilled') are not considered upon ascribing these classifications.

article A.12 Regulation for qualification for the bachelor examination

1. The person examined is considered to have passed the bachelor examination Biology if he/she has passed the foundation examination Biology and if the statements of the result pertaining to all of the components of the post-foundation phase are at 'satisfactory' (rounded off to 6.0 or more).

2. The examinee for the bachelor examination Biology will be considered not to have passed in all other cases.

3. The Examination board recognises the following classifications:
a. 'with pleasure (bene meritum)'; in the event that all of the examination components have been evaluated at, on average, at least a 7.0.
b. 'with honour (cum laude)'; in the event that all of the examination components have been evaluated at, on average, at least an 8.0.
c. 'with the highest honour (summa cum laude)'; in the event that the examination components have been evaluated at, on average, at least a 9.0.
d. Each of the classifications will be reduced to a lower classification for a 5.0 on the list.

4. The examination components for which the results are not expressed in numbers (but by means of 'fulfilled') are not considered upon ascribing these classifications.

article A.13. Master examination

Students are allowed to register for the Master examination if a satisfactory mark has been obtained for all of the components. An exception to this rule concerns the examination date of August 31st. Registration prior to this date is allowed even though the student still awaits the result of one course or mark. The marks concerned must be made known at the latest on the last working day in August (generally Aug 31st).

article A.14 Qualification regulation for the master examination

1. The person examined is considered to have passed the master examination if all of the statements of the result pertaining to the components as specified in article 2.1 of the Education and Examination Regulation, insofar as these apply to the candidate, are at least 'satisfactory' (rounded off to 6.0 or more) and if these examination components are approved by the Examination board (Combination of subjects).

2. The examinee will be considered not to have passed the master/doctoral examination in all other cases.

3. The Examination board recognises and ascribes the classification 'with pleasure (bene meritum)', if:
a. the average evaluation of all of the examination components combined equals at least a 7.0; *and*:
b. the evaluation of the practical assignments and reporting of the mandatory traineeships is at least 7.5.

4. The Examination board recognises and ascribes the classification 'with much honour (cum laude)', if:
a. the average evaluation of all of the examination components combined equals at least an 8.0;
b. the evaluation of the practical assignments and reporting pertaining to all of the mandatory traineeships is at least 8.5.

5. The Examination board may furthermore ascribe the classification 'with the highest honour (summa cum laude)', if:
a. the average evaluation of all of the examination components equals at least 9.0;
and:
b. all of the individual traineeships, in terms of practical assignments and reporting, have been evaluated at a mark of at least 9.0.

7. Examination components of which the results are not expressed in the form of a number, but rather in terms of 'fulfilled' for example, are not to be taken into consideration upon ascribing a classification.

article A.15 Unforeseen circumstances

The Examination board is to decide in any and all cases for which these articles do not provide.

Cluster Bio-Sciences
June 29, 2009

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