

## Guidelines for the Master's Thesis in Neuroscience

Revised by the programme board in June 2011

These guidelines are valid for students admitted to the Master of Science in Neuroscience in the academic year 2011/2012 or later.

More information about the master's thesis can be found on the following webpages: [www.ntnu.edu/dmf/studies/master](http://www.ntnu.edu/dmf/studies/master) (in English) / [www.ntnu.no/dmf/studier/master](http://www.ntnu.no/dmf/studier/master) (in Norwegian)

### 1. Objective of the Master's Thesis

The purpose of the master's thesis is to develop the students' scientific problem-focused approach and improve their ability to pursue lifelong learning. In their work on the thesis, the students will train in resolving problems independently, critical assessment of scientific literature and formulating clear research questions.

To acquire a scientific approach and work method, the students must learn to:

- Formulate a scientific research question
- Answer / test / examine the research question experimentally
- Process the results from such a study using adequate empirical methods
- Publish the results in a scientific report

To develop skills in using data and literature searches, the student must learn:

- Methods for searching original literature
- Use of scientific libraries/databases etc.

To develop sufficient levels of fluency in scientific writing and presentation, the student must learn:

- Precise and adequate ways of expression
- Use of support means to write a report.

### 2. Placement in the studies and scope of the Master's thesis

Planning of the thesis should commence as early as possible in the studies, and the Master's Degree Agreement, including a project description (see below), must be submitted no later than 15 March of the first year of studies. The advantage of early planning is that the education can then be adapted so that topics that directly support the work on the thesis can be studied in more detail.

The thesis gives 60 credits and corresponds to one year of full-time work. It is difficult to stipulate a page count because a brief presentation may be no less demanding than a longer one. The thesis paper should improve the student's ability to be concise and succinct. The thesis may be written as a

report or may have the format and the length of a scientific publication with an average length comparable to what is considered standard for the particular field of study. In the latter case the introduction and discussion can be extended to provide a more extensive summary of relevant literature.

### **3. Preparations for the Master's thesis**

The students are encouraged to choose a research topic relating to on-going research and research environments at NTNU, St. Olav's University Hospital or other relevant academic environments. Relevant topics will be made available in the first semester. The students must initiate contact with the research environment and supervisors of their choice. Students may also contact with a supervisor who is not on the list.

The *principal supervisor* is the project leader of the master's thesis project. He / she must be employed by NTNU within the timeframe of the thesis, and must have competence on the doctoral degree level or other documented scientific competence. A student may also have a *subject supervisor*. In cases where the subject supervisor is employed by another institution than NTNU, the student must cover any travel costs between the institutions. An external supervisor cannot assume that she or he will be paid for the supervision.

The Master's Degree Agreement, signed by both the student and the principal supervisor, including a project description, must be submitted to the Department of Neuroscience for approval at the latest on 15 March of the first academic year.

The project description should comprise two to three pages, and must include:

- The preliminary title of the thesis
- The rationale for choosing the research question (with references to relevant works)
- Methodology
- Reference list
- Any ethical issues the research raises

The faculty will provide feedback in writing as to whether the agreement, project description and supervisor have been approved. If the project description is *not* approved, the student will get a written explanation with recommendations for improvements, and a new deadline for submission of a revised (or new) project description.

### **4. Supervision of the Master's Thesis**

Each thesis is entitled to supervision corresponding to a total of 50 supervisor hours. When planning the framework for working on the thesis, it is important that the student considers delays of a practical nature, for example a supervisor's absence. A student may not demand more supervision time than the maximum time for supervision even if she or he works on the thesis more than one year.

We point out that the supervisor and the student must agree on the scope of the work and that the student shall receive assistance in realistically estimating the time required for completion. From an educational point of view, the *process* is the most important factor, i.e. the student must participate as much as possible in the planning, implementation and presentation of a research project.

In the event that one of the parties does not satisfy his/her obligations in a satisfactory manner and in accordance with the descriptions in this document, or should the relation between the supervisor and the student become difficult, the person in question may use this as grounds for requesting to

be released from the Master's Degree Agreement. The student may then contact the Section of Student and Academic Affairs at the Faculty of Medicine, and request that a new supervisor is appointed.

### **5. Form and Content of the Master's Thesis**

The aim of the thesis is that the student should demonstrate insight into a scientific problem oriented approach and all the phases of the scientific work process. This includes formulating the research question, searching in literature, structuring, collecting any data, analysis, and presentation and critical assessment of the work. Therefore, great importance is attached to having the student proceed through all these phases when working on the thesis. To keep the focus on the scientific approach and work process, the thesis should be given a form and a language that reflect what is used in scientific articles dealing with the same topic and methodology.

The thesis may be written as a report or may have the format and the length of a scientific publication with an average length comparable to what is considered standard for the particular field of study. In the latter case the introduction and discussion can be extended to provide a more extensive summary of relevant literature. The master's thesis must be written in English with a word processor.

### **6. Tips and Advice about the Master's Thesis**

The following is intended as assistance in the work with the protocol and the master's thesis in accordance with the logic of a scientific presentation.

*Introduction:* Presentation of the issue or phenomenon the thesis intends to examine, the context where the issue has arisen or the phenomenon is found, and references to previous research with particular emphasis on whether current knowledge is lacking or contradictory.

*Common shortcomings:* *The issue is imprecisely defined or formulated incorrectly; references to previous research are incomplete.*

*Purpose and aim:* The rationale for the thesis, i.e. what one intends to achieve by increasing knowledge on the issue or phenomenon.

*Common shortcomings:* *The purpose is not mentioned, not linked to previous research in the field or does not agree with what the work discusses.*

*Questions and hypotheses:* Research questions that require answers to satisfy the purpose of the thesis; hypotheses that are made on the basis of valid theories in the field or hypotheses in the form of innovative guesswork one wishes to test.

*Common shortcomings:* *Absent or flawed research questions; not a good relation between the questions provided; poorly formulated hypotheses; questions that cannot be answered.*

*Methodology:* Choosing an adequate method, materials and practical implementation based on the purpose of the study, its research questions and hypotheses.

*Common shortcomings:* *Choosing a method that is inappropriate; (patient) sample that is not representative of the population one wishes to study.*

*Results/findings:* Answers to the questions asked using the collected data.

*Common shortcomings:* Lack of logical relation between the results presented and the question or hypotheses provided; confusion between results and discussion; presentation of more data than what is relevant to illuminate the issue.

*Discussion:* Brief summary of the most important results/findings; whether or not they support the hypothesis or hypotheses. Critique of the methodology applied and the reliability and relevance of the results/findings; comparison with other research findings.

*Common shortcomings:* Conclusions that cannot be supported by the findings, such as guesswork without any basis in the study data; introduction of new questions and subsequent discussion of these.

*Conclusion:* Consequences of findings in relation to the formulated purpose, such as consequences for further research, development of new theories or practical application.

*Common shortcomings:* Conclusions not warranted by the findings or building on other data than what stems from the study; conclusion shows no connection to the purpose/aim.

## **7. Ethics**

### *Human Studies*

Medical and health research ethics is regulated by the Health Research Act (2008, no. 44).

Such research must be organised and carried out in a responsible manner. Research must be based on respect for the research participants' human rights and dignity. The participants' welfare and integrity shall have priority over scientific and social interests. Medical and health research must take into account ethical, medical, health, scientific and privacy factors.

Master's thesis projects which include medical and health research on human beings, human biological material or personal health data should be submitted to the Regional Committee for Medical and Health Research Ethics (REK) for a statement and approval. The student's principle supervisor (project leader) is responsible for determining whether the project must be submitted to REK. If in doubt, contact the REK secretariat.

When the Faculty of Medicine has approved the student's Master's Thesis Agreement and project description, an application for prior approval must be submitted to REK. This is done by the principal supervisor. REK undertakes a standard evaluation of the research ethics of the project and decides whether the project satisfies the requirements laid down in the Health Research Act. REK may specify conditions for approval.

More information about REK can be found on the following webpage:

<http://helseforskning.etikkom.no>

### *Animal Studies*

All animal studies should comply with local, national, and international regulations in line with the requirements laid out by Forsøksdyrutvalget (<http://www.mattilsynet.no/fdu/>).

Students are responsible to comply with those regulations and can only work with animals independently when they have been licensed by the local responsible veterinarian to do so. If not, students can only work with animals under continuous supervision of a licensed NTNU employee.

All work on animals is confidential, no pictures can be taken without permission of the supervisor and no material can be moved outside the premises of NTNU/the lab without permission. Nonlicensed persons are not allowed to enter animal facilities without being accompanied by a licensed NTNU employee.

The student's supervisor is responsible to assure that all experiments have been approved through an application to Forsøksdyrutvalget before the project is initiated.

### **8. Submission and Assessment of the Master's Thesis**

The nominal length of study for the master's programme is four semesters, calculated from the semester in which the student was granted admission to the master's programme. The nominal deadline for submission of the master's thesis is 14 June of the fourth semester.

If the student submits the master's thesis after the nominal deadline, this is to be taken into account in an overall assessment when the grade is determined. Documented delays (for example, due to authorized leave of absence, authorized reduction in the progress of the studies, or problems in data collection/laboratory work) are to be deducted, and are not to affect the determination of the grade.

The *absolute deadline* for submission is 15 June in the eighth semester. If the absolute deadline for submission is missed, the student's admission to the master's programme will be terminated. In such cases, the student must apply for admission to the master's programme again, and begin a new master's thesis.

Students have to apply for their examination in the semester they plan to submit their thesis. Deadline for this application is 1 April or 1 October of the respective semester.

The master's thesis has to be printed by NTNU-Trykk. The principal supervisor's department will cover the costs of printing seven copies. The student may keep one copy, while the other six copies must be submitted to the Department of Neuroscience. Together with the copies of the master's thesis the student must register for the examination in NEVR3901 on StudentWeb.

Examiners are appointed in consultation with the principal supervisor. In addition to the assessment of the written master's thesis, there will also be an oral examination ("final master's degree examination"). The oral examination takes place within three months after submission of the thesis, and has two parts:

1. Open lecture: The candidate spends 20-30 minutes presenting his/her work. This part of the examination is open for any interested parties, but no questions may be asked to the candidate.
2. Closed examination: The examiners examine the candidate for up to 40 minutes. The supervisor(s) are allowed to attend the examination.

At least two examiners are required, whereof at least one must have no formal ties to NTNU (external examiner) (cf. Chapter 6 section 37 no. 2 of the Regulations relating to studies at NTNU, and section 50 no. 2 of the Act relating to Universities and Colleges). No supervisor(s) of the student may be an examiner. The determination of the grade is to be a decision involving shared

responsibility in which the assessments of both the examiners are weighted equally. The examiners determine a provisional grade for the master's thesis before the oral examination. The provisional grade is determined on the basis of the supervisor's account as well as the descriptions of grades for the master's thesis (see below). The final grade shall be available immediately after the oral examination has been held. The student is informed only of the final grade.

#### *Criteria for assessment of the Master's thesis*

When assessing the master's thesis decisive importance shall be attached to the following quality criteria:

1. A precise and thoroughly considered formulation of the research issue based on a general introduction to the field with clear specifications of the questions and/or hypotheses that will be illuminated
2. A systematic collection of relevant literature including whether current knowledge is lacking or contradictory
3. A systematic collection of own observations / data, if relevant
4. A clear and structured presentation of the material
5. A clear critical discussion of the material with a presentation of appropriate conclusions
6. A brief and succinct presentation in accordance with the norm for scientific articles within the topic and methodological area of the master's thesis. The title and the grade of the thesis will be referenced on the examination diploma, but no other details of the assessment will be provided on this document.

In determining the grade, the examiners are to undertake an overall assessment of the student's work/performance. The following grade descriptions are to be used as the basis.

#### Grade A (excellent)

- The student has submitted an *excellent* and *creative* thesis within the prescribed time, corrected for documented delays.
- The student demonstrates broad theoretical understanding of the subject area and is able to discuss his/her contribution in relation to the development of the subject and the latest research.
- The student has *himself/herself* generated important problem formulations and methods for solution and has used these in a relevant way in the thesis.
- The student demonstrates a very good understanding of the choice of methods and can discuss the advantages and disadvantages of the methods.
- The presentation is precise and well-structured; the quality of the language is high.
- The student possesses all the relevant technical skills for the thesis, and can work highly independently with good academic follow-up.

#### Grade B (very good)

- The student has submitted a *very good* thesis within the prescribed time, corrected for documented delays.
- The student demonstrates very good theoretical understanding of the subject area and is able to discuss his/her contribution in a broader context.
- The student demonstrates a very good understanding of the choice of methods and can discuss the advantages and disadvantages of the methods.
- The presentation is precise and well-structured; the quality of the language is high.
- The student has mastered a variety of technical skills, and can work highly independently with good academic follow-up.

### Grade C (good)

- The student has submitted a *good* thesis within the prescribed time, corrected for documented delays.
- The student demonstrates good theoretical understanding of the subject area and of the choice of methods in the thesis.
- The presentation is generally good, but has some shortcomings.
- The student demonstrates good technical skills and can work independently with good academic follow-up.

### Grade D (satisfactory)

- The student has submitted an acceptable thesis with *some significant shortcomings*.
- The student demonstrates a limited degree of theoretical understanding of the subject area and of the choice of methods in the thesis.
- The presentation is unstructured and shows signs of being incomplete.
- The student reveals a lack of technical skills and the ability for independent work under supervision is limited.

### Grade E (sufficient)

- The student has submitted a thesis that meets the minimum criteria, but no more.
- The student demonstrates very limited theoretical understanding of the subject area and of the choice of methods in the thesis.
- The presentation is poorly structured and difficult to understand.
- The student lacks important technical skills and has limited ability to work independently under supervision.

### Grade F (fail)

- The student has submitted a thesis that does not meet the minimum academic criteria.
- The student has not developed an adequate theoretical understanding of the subject area and of the choice of methods in the thesis.
- The presentation is not clear and has shortcomings in most aspects.
- Even with considerable supervision, the student has not succeeded in completing the thesis in an acceptable manner.

### *Explanation of the grades*

The student may request a written explanation of the grade. The request for an explanation must be submitted to the faculty within three weeks after the oral examination. The explanation should cover the following aspects:

1. Was the master's thesis completed within a reasonable period?
2. To what extent is the master's thesis creative and excellent?
3. To what extent does the candidate show theoretical understanding of the subject area?
4. To what extent is the candidate capable of discussing his or her contribution in relation to the development of the subject and the latest research?
5. Has the student himself/herself generated important problem formulations and methods for solution and used these in a relevant way in the thesis?
6. Is the presentation precise and well-structured?
7. If possible and relevant, assess the potential for further research.

### *Appeal of the assessment*

Students can make an appeal of the assessment within three weeks after the oral examination. Two new examiners, which should not have any information about the initial grade, the explanation for it or the basis for the student's appeal, will be appointed. The new examiners will assess the written thesis. A new oral examination will be held only if the new grade is different from the initial grade.

### **9. Funding**

The department of the principal supervisor covers the cost of printing seven copies of the thesis, while the student has to pay for any extra copies she or he wishes to print. Guidelines for coverage of other expenses in connection with the master's thesis will be drawn up in relation to the department's financial situation at the time in question.

### **10. Publication of the Master's Thesis**

If the manuscript is submitted to a scientific journal for consideration for publication, this must be done in cooperation between the student and the supervisor. The rights to any data collected during the work with the master's thesis belong to NTNU. Published articles should be issued by the supervisor's department and must comply with the general rules for authorship (such as the ICMJE rules: [www.icmje.org](http://www.icmje.org)).