

Guidelines for the Master's Thesis in Molecular Medicine

Revised by the Programme Board in 2011

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

More information about the master's thesis can be found on the following web pages:
www.ntnu.edu/dmf/studies/master (English) / www.ntnu.no/dmf/studier/master (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, undertaking critical assessment of scientific literature and formulating clear research questions.

As stages in acquiring a scientific approach and work method, the students must learn to:

- Formulate a scientific research question
- Answering / testing / examining the research question experimentally
- Process the results / findings from such a study
- Publish the results / findings in a scientific report

As stages in developing skills in using data and literature searches, the student must learn:

- Methods for searching original literature
- Utilisation of a scientific library

2. Placement in the Studies and Scope of the Master's Thesis

Planning of the thesis should commence as early as possible, and the Master's Degree Agreement, including a project description (see below), must be submitted no later than 15 March of the first academic year. 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.

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 the Faculty of Medicine (DMF), St. Olav's University Hospital or other relevant academic environments.

The students must initiate contact with the research environment and supervisors of their choice. Another option is to inquire at the Department of Laboratory Medicine, Children's and Women's Health for assistance in finding a supervisor.

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, including a project description, must be submitted to the Department of Laboratory Medicine, Children's and Women's Health (LBK) 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 of Medicine 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 student 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 factors in delays of a practical nature, for example a supervisor's absence.

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 supervision agreement. The student may then contact the department where his/her supervisor is employed or the Department of Laboratory Medicine, Children's and Women's Health

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 a research question, searching in literature, structuring, collecting any data, analyses, 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 master's thesis must be written in the form and structure of an article and it must be possible to assess it in the same way as a manuscript submitted for publication in a scientific journal / periodical. However, the data material is not expected to be of the same scope.

In contrast to a regular scientific article, the thesis will be expected to have a more comprehensive introduction/theoretical section and discussion.

The master's thesis must be written in English..

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 to 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. Non-licensed 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 Forsøksdyrvalget before the project is initiated.

8. Submission and Assessment of the Master's Thesis

The *nominal* length of study is two years. The master's thesis should therefore be submitted by 10 June in the fourth semester. If submitted by the deadline, the final oral examination will be held by 30 June.

The *maximum* time of study is eight semesters. If not completed by the eight semester, the student's admission will be terminated.

The master's thesis will be printed by NTNU-Trykk (www.ntnu.no/trykk). The principal supervisor's department will cover the costs of printing ten copies. The student may keep one copy, while the other nine copies must be submitted to The Department of Laboratory Medicine, Children's and Women's Health's administration. Together with the copies of the master's thesis, a form must be submitted to register for the final master's degree examination. This form can be obtained at the following webpage: www.ntnu.edu/dmf/studies/master. Here you will also find an agreement on copyright. The Department of Laboratory Medicine, Children's and Women's Health will distribute the master's thesis for assessment and ensure that the deadline for assessment is met.

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 has two parts.

1. Public 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. Public examination: The examiners examine the candidate for up to 40 minutes. If a student has objections to an open examination, he/she must apply, on individual grounds, for a closed examination. The audience may not ask the candidate any questions during the examination.

The master's thesis will be assessed in accordance with the NTNU grading scale (A–F). Two examiners, of which at least one should not have any formal ties to NTNU, are required for the assessment of the master's thesis (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). In the event of disagreement between the two examiners on the assessment of the master's thesis, the assessment of the external examiner shall prevail.

9. 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.

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. The final grade may be better, worse or the same as the initial grade.

10. Funding

The department of the principal supervisor covers the cost of printing ten 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.

11. 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 the Faculty of Medicine. Published articles should be issued by the supervisor's department and must comply with the general rules for authorship (such as the Vancouver rules).