Final Exams (BIO520/BIO516) -
General instructions (specific information for Master thesis supervisor see page 5-6)
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BIO 520 "Integrated Knowledge in Biology / Themenübergreifende Fachkompetenz"

Description
This module, common to all other Master specializations, is designed as a self-study period of the Master program, comprising a total of 300 study hours (corresponding to about 2 months). It allows students to consolidate and demonstrate a comprehensive understanding primarily of the area of their chosen MSc specialization - here "Cancer Biology" - but also of general fundamental biological concepts. In general, it is expected that the student uses the opportunity to acquire a broad and solid overview in Cancer Biology (for instance by working through an actual textbook like R.A.Weinberg, "The Biology of Cancer", 2nd ed.), but also reviewing all scientific information acquired via published articles and relevant seminars attended during the Master thesis. At the end of the self-study period, the examination of the learning outcomes takes the form of a three-hour written and an approx. 30 minute oral examination within 1-2 weeks (see details below). For each student, the Master coordinator and the supervisor of the Master thesis discuss, design and evaluate the content of the BIO520 exam.

Learning Outcomes
By the end of this module students should be able to
- demonstrate their understanding and command of relevant biological facts, methods and concepts in Cancer Biology
- identify and explain relationships between the various facts, methods and concepts in Cancer Biology
- summarize and review - critically and effectively - scientific literature in Cancer Biology

Format of the exams
The three-hour written and the oral examination should take place within 1-2 week. While an approximate date is already determined in the Learning Agreement at the start of the MSc Program, the precise dates have to be arranged on an individual basis between the MSc coordinator, the thesis supervisor and the student. In general, The MSc coordinator will contact student and supervisor shortly after official delivery of the MSc thesis, and the exams will be scheduled about 8-10 weeks after completion of the Master thesis. The final grade will be the arithmetic mean (rounded to half grades) of the grades obtained in the two parts.

Part 1: Written examination

The written examination lasts 3 hours. Unless otherwise agreed, the exam takes place in the office of the MSc coordinator assistant, who will handle supervision of the exam. The candidate brings "blank" copies of the three papers mentioned below (i.e., no written notes on the papers, no underlining or memo stickers on the pages). Not permitted: other documents, devices such as laptop, calculator, cell phone or other communication forms, unannounced/unaccompanied visits to the bathroom.
The written exam comprises two parts:

1.1 *Analysis of primary literature*

The candidate will be given **three primary literature papers** - selected by the thesis supervisor, in agreement with the MSc coordinator - **exactly one week before** the agreed date of the written exam, usually in electronic form (pdf). The candidate has to read and acquire in-depth understanding of these papers until the exam. At the exam, she/he will be asked a **series of "journal club style" questions about these papers**. These should be answered completely and succinctly.

Examples of previously asked primary literature questions (obviously, the questions make no sense without the paper, but you get a general idea…):

- How did the authors confirm the specificity of their siRNAs?
- If you were the author of this paper, what would be the next experiment(s) that you would perform? Explain briefly why, and how you would perform these experiments.
- Explain the principle of ^{35}S-Met pulse-chase assays. What do these assays measure?
- Do p53 and SUSP4 compete for binding to the same domain of Mdm2?
- What is the mechanism of action of actinomycin D?

1.2 *Open questions on Cancer Biology*

The candidate will need to answer 5 open questions on Cancer Biology topics. The chosen questions belong to a large pool of integrated knowledge questions elaborated by different PIs belonging to the Master Program, and will concern topics that are covered in the basic text book of the Master Program (R.A.Weinberg, "The Biology of Cancer", 2nd ed.). Each question can/should be answered in half A4 page (approximately 200 words, including any relevant drawing).

Examples of general questions for BIO520 written exams can be found *here (link)*

Part 2: Oral examination

For practical reasons, the BIO520 oral exam will usually follow the public presentation and discussion of the Master thesis (BIO516, see below) and thus takes place at the Institute where the Master thesis has been performed. However, this closed examination session with the thesis supervisor and the coordinator of the Cancer Biology MSc program - which typically lasts for 30min - **is not meant to further discuss the master thesis, but rather to assess the general knowledge in Cancer Biology**, the ability to integrate fundamental concepts and methods in biology, and the awareness of the student of new, groundbreaking discoveries that were published in the wide area of Cancer Biology during attendance of the Master Program.

BIO 516 "Master Thesis"

The written Master thesis has to comply formally with the usual standards applied to scientific publications (Summary, Introduction, Materials and Methods, Results, Discussion/outlook) and is typically limited to approximately 50 pages. The student has to hand in the final version of his Master thesis to the Studienkoordination on the date fixed in the Learning Agreement. Additional copies will have to be given to the Master thesis supervisor and to the MSc coordinator for evaluation.
The MSc thesis defence takes place on the same day as the BIO520 oral exam, i.e. 8-12 weeks after the end of the MSc thesis. It consists of a 20-25' public presentation of the thesis, covering key points of background, results, methods, results and discussion/outlook. This is followed by 5-10' question time on the MSc thesis work from the public, which typically includes other members of the same lab/Institute. Any questions inherent to the MSc thesis from the thesis supervisor and MSc coordinator should also be asked during this public question time. After the Master thesis defence, the public and the MSc student will leave the room and the supervisor will discuss with the MSc coordinator a suggestion for an appropriate grade for BIO516. The coordinator has the right to ask for revisions of Master theses that do not fulfil formal standards, as well as to modify the suggested grade.

In general, the following six criteria (A.1-3, B.1-3) are most important for grading BIO516:

A. Thesis: Overall style, presentation, logic, language and completeness
A.1 Introduction:
- Concise overview of the research field relevant to the Master thesis focussed towards an explanation of the significance of the Master thesis research within this field
- Clear description of the problem addressed in the thesis, and clear statement of the project goals

A.2 Results and Methods:
- Clear description of the logic and hypotheses underlying the choice of performed experiments
- Clear presentation and correct interpretation of the experimental results
- Clear description of the methods used such that all experiments can be reproduced by others

A.3 Discussion and Conclusions:
- Concise discussion of the obtained results with respect to the original goals
- Discussion of the results into a more general context within the research field
- Formulation of new hypotheses, outlook for future work

Note that **the supervisor should base his/her grade recommendation on a version of the Master thesis that has not yet been corrected by the supervisor** or (other experienced scientists) and that is considered to be the final version by the student. Upon request, the MSc coordinator is entitled to inspect this first final version. However, subsequent revision in response to comments by the supervisor (or experienced scientists) is permitted and in fact an important element of learning and teaching of the MSc program.

B. Practical work in the laboratory: Overall attitude, motivation, input, independence

B.1 Lab work:

- High quality and conclusiveness of experimental work
- Independent organization of experimental procedures
- Solid understanding of the theory behind experimental techniques
- Detailed and traceable documentation of the experimental work in the lab book

B.2 Experimental design:

- Independent interpretation and design of experiments
- Understanding of the purpose, possibilities and limitations of the applied experimental techniques

B.3 Communication:

- Communicative attitude in the laboratory
- Ability to ask for and make constructive use of advice
- Initiation of and contribution to scientific discussions
- Clear presentation of the project and the results in group meetings and during a contingent Master thesis defence

Practical Instructions for Master thesis supervisor

1. Who selects the publications for the BIO520 written exam?
The publications will be selected by the Master thesis supervisor but selection by the MSc coordinator is not excluded. **Two weeks before the BIO520 written exam**, the Master thesis supervisor presents three papers as suggestions to the coordinator (pdfs by e-mail), who either accepts them or replaces one or all of them. The final papers are sent via e-mail to the student by the MSc coordinator assistant exactly **one week before** the BIO520 written exam.

2. By which criteria should the papers be selected?
The papers should address important matters within Cancer Biology. They **should cover three different topics and they should be not too close to the topic of the Master thesis**, but they can be from the **wider** area of the Master thesis research. They should be max. 2 years old and from high impact journals. (I.F. >15.0)

3. Who formulates the specific questions concerning the selected publications for the written exam? 3 specific questions concerning each of the selected publications are formulated by the Master thesis supervisor, but it is not excluded that they are partly contributed by the MSc coordinator. The Master thesis supervisor presents his/her suggestions for these questions **one week before the BIO520 written exam** to the MSc coordinator ahead of the exam, who either accepts them or modifies/replaces one or all of them. **The Master thesis supervisor is responsible** that the papers and questions are communicated on time to the MSc coordinator.

4. Who selects the open questions for the written exam?
The MSc coordinator will select five general questions from the pool of questions received from the PIs affiliated to the Master Program, covering different aspects of Cancer Biology.

5. Who organizes the time/room for the BIO520 written exam and for the BIO520/BIO516 oral presentation/examination?
The BIO520 written exam will take place in the office of the MSc coordinator assistant, who will contact the student to arrange time and location. As a rule, the BIO520/BIO516 oral presentation/examination should follow the written exam within 7-10. Hence, once the MSc coordinator, the MSc student and the MSc thesis supervisor have identified a date for the final MSc exams (MSc thesis defence + BIO520 oral exam, typically taking place 8-12 months after thesis delivery), the MSc coordinator assistant will contact the student to fix an earlier date for the written exam. The Master thesis supervisor should be generally available in the period of the year when these MSc exams are planned, which is known at least a year before (while signing the Learning Agreement). Once a date is found, the student and the Master thesis supervisor are responsible to find a room for it at their Institute, where the Thesis oral presentation/discussion (BIO516) and the BIO520 oral exam can take place (max. 90 min in total). They are also responsible to advertise in due time the public thesis presentation, in order to secure sufficient attendance. Senior scientists (e.g. postdocs, senior research assistants) who have been direct supervisors of the MSc thesis are encouraged to join the oral exam but cannot replace the MSc supervisor (PI)!

6. Who corrects and grades the BIO520 written and oral exams?
The Master thesis supervisor corrects the written BIO520 exam. He/she will get from the MSc coordinator assistant the original solutions written by the candidate and, by the day of the BIO520 oral exam, should have corrected the written exam and be able discuss with the MSc coordinator a suggestion for an appropriate grade for it. The MSc coordinator will also read the written exam and has the right to modify the suggested grade. The grade for the BIO520 oral exam is agreed between MSc coordinator and Master thesis supervisor. The final grade for BIO520 is the average of written and oral exams, approximated to the closest half point.

7. Who grades the BIO516 Master thesis?
At the end of the MSc thesis presentation (i.e. before the student returns to the room for the BIO520 oral exam), MSc coordinator and Master thesis supervisor evaluate the public discussion of the Master thesis, and discuss the mark suggested by the thesis supervisor based on all points described above (A.1-3, B.1-3). A final mark for the Master thesis (BIO516) is thereby agreed between the Master thesis supervisor and the MSc coordinator. Grades for this module can exceptionally include quarter marks (e.g. 4.75, 5.25), and – in case of positive outcome – they can/should cover the full range of positive evaluation (4.0 - 6.0), to properly differentiate talent and performance of the students. 6.0 are meant to mark only exceptionally good Master thesis (top 5%).