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Examination of Project Courses

General Requirements

Project courses performed at IMBIM aim to give a practical experience of research in any of the focus areas of the Department. The two first cycle courses, 3BL350 (7,5 credits) and 3BL351 (15 credits), aim to provide basic experience of research. The two courses at the advanced level, 3BL352 (15 credits) and 3BL353 (30 credits), will in addition give you knowledge and skills on how to plan, interpret and evaluate scientific experiments.

Depending on which course you have been enrolled in, the requirements and sets of assessment vary.

Brief Summary of Assessments for Each Course

	3BL350	3BL351	3BL352	3BL353
Participation in research seminars	Yes*	Yes	Yes	Yes
Presentation of research article	No	No	No	Yes
Presentation of own results	Yes*	Yes	Yes	Yes
Independent practical assignment	Yes/No*	Yes	Yes	Yes
Oral presentation	No*	Yes**	Yes***	Yes***
Written report	Yes*	Yes**	Yes	Yes

* The 3BL350 short course at first cycle level is mainly an orientation and does not necessarily include an independently performed project. The written report does not have to be in the formal format of a scientific article, but should still describe the task and how it was performed. Thus, the information below may not be relevant, but this depends on your supervisor's/examiner's instruction. A formal oral presentation is not required, and can be replaced by group discussions.

** The written report from 3BL351 should be in a scientific format, but may be significantly shorter than the reports from project courses at the advance level (approx. 10 pages). A formal oral presentation is not required, and can be replaced by group discussions.

*** A final oral presentation should be given at a research group seminar.

Observe: In case you intend to use your project instead of a regular exam in your program (*i.e.* bachelor or master degree) you need to make sure to check the exact requirements in your program and whether you fulfill all parts in order to take your exam.

A. List of Contents

B. General Overview of Presenting Scientific Findings

1. General Aspects on Presenting Science

The idea behind presenting a research project is to increase the overall knowledge in an audience, but also to stimulate discussions and to challenge current hypotheses and dogmas. Thus, it is essential to present the message from the receivers' perspective, based on their background knowledge, interest and possibilities to understand and benefit from the given information. Keep your fellow student in mind as a potential reader for your work.

You must clearly indicate what are *your* results and *your* conclusions. Most likely you have worked in a research group where other persons have contributed with data, and presented ideas might be the result of discussion involving many persons. You must therefore make sure that you properly acknowledge those that have contributed. Regarding summaries of published data, you must follow the rules on how to cite and give proper references. If you feel uncertain, please consult the given information on plagiarism.

2. Overview "How to Write a Project Report?"

It is advisable to start writing as early as possible and not postpone it to the last weeks. A layout of the report can be initiated already at the beginning of your work. References can be collected as you read them, subtitles and desired figures describing your major findings included as the work progresses, notes on conclusions and discussion points added and possibly revised with time. With such a strategy you will see the framework of your study all through your project instead of drowning in details at the end.

Below follows a generic instruction how to write a student report in connection with a project term. The number of pages is not the critical issue and depends very much on the level and length of the project. The number of words suggested below are recommendations based on the average length of a 30/45 credit project course. Depending on the nature of the project, the report may be expanded, but please be concise. The main purpose is to give a helping hand how to structure a report – what is necessary to write in a report and in what way to organize the different parts. In case of uncertainty you can always discuss with your supervisor.

These instructions are very similar to how a manuscript is written which shall be submitted to a journal, *i.e.* your report is meant to train you for writing a scientific article. Take it as chance rather than a burden!

OBSERVE: All reports of examination type (*i.e.* for which you will receive study credits at Uppsala University) will be checked for plagiarism. You are not allowed to copy texts or text parts without citation of the original source. Make sure also to indicate sources for figure material.

3. General Structure of a Scientific Report

Title
List of Contents (facultative)
Abstract
Popular Science Summary (facultative)
Key Words
List of Abbreviations (facultative)
Introduction
Aim
Materials and Methods
Results
Discussion
Figures and Tables (inserted at relevant parts of the text)
Acknowledgements
References
Additional material

Find below detailed instructions how to structure and write your project report

C. Detailed Instructions on "How to Write Project Report"

4. Text, Figures, Tables

4.1. Text

No matter how groundbreaking results you might have obtained, these will not make any impression unless they are presented in an understandable manner. Be extremely careful when planning the structure of your report and even more thorough when writing the actual text. Long sentences without commas might be devastating. Do your sentences really say what you want them to do? Ask your friends or colleagues to read. Make sure that you carefully check your spelling and grammar using available word processor resources. If you have problems writing in English, consult the Language Workshop of the University.

In general, there are just a few specific grammatical rules for scientific reports:
• Commonly accepted facts are presented in the present tense. *"Adenoviruses are non-oncogenic in humans."*
• The results obtained should be in past tense. "*Inhibition of DNA replication prevented virus production."*
• Methods are described in passive past tense. "*Immunoprecipitated capsid proteins were separated by 12 % SDS-PAGE".*

Write your text in A4 format with 2.5 cm margins. Use uniform font of size 12 throughout the main text. Line separation 1.0.
Headings of sections: Bold 14
Subheadings within sections: Bold 12
Figure legends: Plane text 10
Table text: 12
Pagination: 10

4.2. Figures and Tables

Make sure figures resolve in print and that your pictures are of a size and resolution readable in print. Remember to mark all axes, curves, figure details with explanations. Use Helvetica or Arial as a font in figure drawings and 2 mm of final height in the printed product. Do not forget figure legends to all figures (to be placed below the figure) and titles and, if necessary explanatory text, to tables (placed above the table)!

It is essential that you provide sufficient data for the reader to judge whether your statements and conclusions are justified. All data should be organized into numbered tables, figures, graphs and photographs, and have descriptive titles. The legends must be self-explanatory, so that the reader can understand them without having to read the entire report. Symbols and abbreviations should be explained. Avoid using only numbers or letters to designate *e.g.* lanes in gels or bars in graphs.

5. Cover Page

The cover page shall contain "Title", "Student's name", "Supervisor's name", "Date of report (term and year)", "Course", and "Department(s) at which performed".

5.1. Title (max 120 characters)

The title is what a reader first meets and tells the message of the report in a distinct, but not lengthy manner. Therefore, it should be relatively short, but sufficiently long to describe the most important results and of course be an appetizer for further reading. Note that the title might very well have changed as your work has progressed, mainly depending on the results you have obtained. You must not use abbreviations except generally accepted ones (*e.g.* DNA).

6. List of Content (facultative, mainly applicable for long reports)

Indicate subtitles and page of first appearance.

7. Abstract (max 250 words)

An abstract shall describe in short form the goal of the study, the approach taken, some key results and conclusions. No references are given and abbreviations should not be used unless absolutely essential.

When people search for data on PubMed for example, the abstract might be the only part of a scientific article that they read. To write the abstract is often the most difficult to accomplish, and although very important, the abstract is usually the last section to be written. Make sure that you give it thorough consideration!

7.1. Popular Science Summary of the Study (facultative, depending on course)

A popular science summary shall be a short summary (abstract) of your project that also a layman would understand. In student theses this is usually written in Swedish.

8. Key Words (4 - 6 terms)

With careful choice of keywords your publication can be picked up by interested readers with help of literature search motors. It is therefore worth to pick broad, yet distinct terms for your project.

9. List of Abbreviations (facultative, depending on how many used)
Use abbreviations only if a term reappears more than 3 times in the text and benefits the reading flow. But once used, use consequently. All abbreviations shall be introduced the first time mentioned. Make a list if you have more than just a few, else list them in the footer of the page of first occurrence.

10. Introduction/Background (~1500-2000 words)
Shall summarize the background literature based on which a scientific question has been identified, and the reason why the study was performed. Shall also contain the working hypothesis/question addressed and purpose of the study. Include relevant references.

Finding the level of background information for the introduction requires thorough consideration of whom the report is addressed to. Generally, writing a paper for a specialist journal hardly requires a detailed description of a particular main topic (*e.g.* what a virus is if you write for a virology journal), yet if you expect a broader readership, you may need to introduce your topic also to the non-specialist reader (*i.e.* the non-virologist). As we here consider a project report (analogous to bachelor or master level), you must ask whether your objectives are general or if they require specific background information that your average reader is unlikely to have obtained. In general, though, the introduction should include sufficient background of the research area, a summary of the most relevant results that have been published earlier, and any enigmas or inconsistencies that have been evoked from the current work. You should expand on the part required to understand the aim of your study: Why is it important and what determined the choice of methods or model systems? Sometimes latter parts will be more suitable to present in the *Result section*, in particular if your project concerns development of new methods, exploring new systems etc. Although the introduction in published papers rarely is divided into subsections, you can do so to increase readability. Note that this section often has a large number of references. Be careful when choosing these! Use original reports when referring to specific observations. Review articles may be used sparingly when referring to commonly accepted facts, which are based on many years of investigations. When it comes to assessment of your thesis, this part should demonstrate your overall knowledge and understanding of the research area, your ability to integrate facts and to critically formulate problems and how to address those.

11. Aim
Here you should formulate the

- overall aims
- specific objectives of the project

12. Materials and Methods ("How were experiments performed?")
In this section you shall describe how you have performed your experiments in a way that a trained researcher can understand exactly how you have performed and, if necessary, also can repeat your experiments to confirm findings. If you performed an experiment according to a published method you indicate the reference and give those details that may be varied (such as *e.g.* dilution of antibodies). Indicate which and wherefrom materials originate (source) and describe the model systems used. If statistics are applied to validate your data, explain how these were done. Here, you also have to state ethical permits if performed research requires (human or animal experiments).

The *Materials and Methods* section must give sufficient information to readers who need to *e.g.* compare conditions and/or to repeat an experiment. It should be separated into subsections

where you group similar materials and techniques. Avoid repetitions!

It is often practical to start by describing growth conditions for tissues, cells, bacteria, viruses etc. Specific mutants can be described in tables by nucleotide positions, but often the reader will get a better understanding if you present these by drawings in combination with the results presented in the figures. Primer sequences can be written directly in the text, but if you have used a large number, it is more practical to include a table. For all methods, solutions and buffers must be described with recipes (exact content of buffers in parenthesis), amounts of biological materials given as exact mass or final concentration rather than volumes, and temperatures, times clearly stated. It is generally considered that the information given in the materials and methods section should be detailed enough so that the reader can reproduce every single step. This would require many pages and therefore it is acceptable to exclude description of the most common methods and instead indicating only lab-specific modifications. Similarly, standard media and solutions can be referred to standard laboratory manuals. Consult published (full-length) papers and your co-workers and supervisor for advice. If you have used laboratory kits, you must briefly explain their principle. (For you own sake, you *must* understand how buffers "A", "B" and "C" work!).

In this section, refrain from discussing why you chose a specific method or material: *Materials and Methods* should be very concise; background, results, interpretations or conclusions do not belong there.

13. Results ("What are the results?", ~2-4 pages)

Describe your results clearly and in a logical order to give a good flow to the description of the project outcome. Subtitles can be used to structure the text. Use figures and tables to present data and explain in the text. Do not go into extensive discussing and validating findings at that point. Observe to refer to figures and tables in the text with consecutive numbers. Your ability to plan and perform the assigned project within a given time frame should be clear from this section. Also, your choice and understanding of adequate methods, as well as ability to interpret result and based on these design appropriate experiments to verify or disprove your hypotheses, will be assessed.

The *Results* section can be written like a good story separated into "chapters", *i.e.* subsections, with separate subtitles. Do not hesitate to give the result directly in the subheadings if possible. Each subsection must start with a short aim or a specific question, continued with a description of what you did and usually also why, followed by the obtained result (usually supported by figures/tables). Do *not* rely on the information given in *Materials & Methods*. It must be possible to understand *why* you did something and also *how* by reading only the *Results* and without consulting *Materials & Methods*. A brief conclusion is often appropriate, helping the reader to understand the subsequent steps. Extensive interpretations and implications should be left for the discussion section.

The subsections should be organized in a logical way, which may not at all reflect the order by which you performed the experiments. Make sure that the figures and tables also follow the order of your text so that the reader does not have to switch back and forth between the pages. The included figures must be clearly referred to in the text and if not, they should not be shown at all. Control experiments are often included with the aim to "kill your darlings", meaning that they are designed to disprove your conclusion or hypothesis, rather than directly supporting it. Although the figures are there to help the readers to understand and to make their own conclusions, it should be possible to understand what you have done from the text alone, without looking at the figures. And *vice versa*, it should be possible to get an idea about the project by looking at the figures and reading the legends!

14. Discussion ("What does it mean?", ~ 1500-2000 words)
In the discussion you should put your own results into perspective of what has been shown by others, and your conclusions and hypothesis in relation to current views. Remember to clearly cite the original reports. Discuss first your own results integrating the different parts to one another. Discuss the results with respect to the methodological aspect – strengths and weaknesses of the used methods, potential reason for inconsistencies related to your results. Integrate your own findings to what is known from earlier (literature) and taken up in the background. What are your overall conclusions? What are the perspectives of your study, what should be done next and what could your results lead to?

In addition to the above, the *Discussion* should also show that you have reached the learning outcomes regarding ability to relate the performed research to relevant societal and ethical aspects.

How can you explain contradictory results? Are there any flaws in previous results or do your data have any drawbacks or sources of error? How would you proceed to resolve identified problems? To make the discussion understandable in itself, you will need to recapitulate some crucial results, but make sure that this is done as briefly as possible to avoid unnecessary repetitions.

Finally, summarize the discussion with a conclusion where you speculate on the significance of your results. End by trying to identify issues that remain to be addressed. What kind of experiments would a continuation of the project include?

15. Acknowledgments
Acknowledgments are made to those who have helped to perform the study, persons who have given intellectual support, financial resources, resources of gifted reagents.

16. References
Indicate all references used in the study and mentioned in the report. No limitation (a typical manuscript usually contains 30-50 references).

Although already mentioned, it is essential to assign proper references to all facts. If you use a reference handling system (*e.g.* EndNote) the program will allow you to reformat the reference list according to the instructions. If you handle the references manually, use the following format for citation in the running text:
"As shown by Wright (1988)…" or "Extraordinary efforts are required to perform top notch research (Wright, 1988)….". Separate multiple references in the same sentence by commas within a parenthesis (Wright, 1988; Wron, 1989) and identify two papers by the same author the same year by a letter index (Wright, 1988a; Wright 1988b). The letter indices must appear also in the reference list. Both names are written if the paper only has two authors (Wright and Wron, 1987), but if there are more than two authors you should replace all but the first author with *et al*. (Wright, *et al.,* 1987).
If you have obtained permission, you can also refer to unpublished data such as (W. Wron, unpublished data) or (W. Wron, personal communication) in the text, but these are not included in the reference list.
Web addresses to data banks and programs are given directly in the text.
The reference list must include all authors as well as the title of an article and should be in alphabetical order, *e.g.* Wright, R., Best, B. and Wron, W. (1988). How to get the Nobel Prize.
J. Sublime Res. (1), 1-10

For a book, or pages within a book, include the editor and publisher, *e.g.* Brown, B. and White, W. In "Nobel Prize for beginners", pp 200-240. Ed. James Watson, Sublime Press.
You may of course also use a numbered reference list if you find this more to your liking.

17. Attachments

In case you have huge data sets that are better organized in an attachment (*e.g.* a table) or additional control experiments that you want to provide to the critical reader, but do not necessarily need for the sake of the 'main' story, attach them to the end of your report with title, explanatory legends and data on the same page.

D. Oral Presentation

During the last days of the course, you will present your work at an exam-symposium, alternatively, to your project group as a seminar. Your programme administrator will provide the exact time for this. In principle, you only have one chance to deliver your message! Therefore, it is necessary that you simplify and select the most important results. Aim at delivering a clear concept of your research and try to stimulate an interest to learn more, rather than leaving the audience in complete bewilderment!

Consider the following:

- Try to catch the interest as soon as possible during your presentation
- You should not present a mystery story. Start by presenting the aim.
- Your slides must be simple but informative. If you must show complicated figures with lots of data, try to highlight the parts you are pointing at.
- Use slide headlines that conclude your results or ask a question.
- Do not add length sections of text.
- Conclude your most important findings.
- Check your slides and practice before.
- Keep your allotted time!