

Laboratoire intégré en sciences de la vie I

Course Manual

BIO-203 Autumn 2024

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Course Overview and Organization

Purpose

- To introduce basic techniques in molecular and cellular biology and biochemistry
- To learn good laboratory practices
- To learn how to keep an electronic laboratory notebook and how to write a scientific report
- To build skills in acquiring and analyzing experimental data

Content

The ultimate goal of biomedical research is to develop novel therapeutics. As a first hand-on experience of how molecular biology and biochemical experiments are used in research, you will complete the wet lab project: **Cloning, expression and purification of pancreatic α -amylase in mammalian cells**. The enzyme α -amylase plays an important role in carbohydrate metabolism in bacteria and eukaryotes. Pancreatic α -amylase catalyzes the hydrolysis of polysaccharides into maltose, thereby affecting physiological glucose levels in mammals. To develop treatments for patients with diabetes, α -amylase is a target for drug design of inhibitors blocking enzymatic activity. During this practical course, you will first clone the cDNA of mouse pancreatic α -amylase into a mammalian expression plasmid (BIO-203 LISV I: laboratory 1-5, fall semester), followed by expression of tagged α -amylase in mammalian cells to produce active purified recombinant protein (BIO-204 LISV II: laboratory 6-11, spring semester). Such a purified protein could for instance further be used for screening of chemical compounds to identify novel enzymatic inhibitors. Another application is in the food industry where α -amylases (from other origins) are used for example during the production of oat milk and beer.

BIO-203 autumn semester

Laboratory 1: Micropipetting

Laboratory 2: RNA extraction

Laboratory 3: PCR

Laboratory 4: Ligation and Transformation

Laboratory 5: Plasmid isolation and restriction analysis

BIO-204 spring semester

Laboratory 6: DNA Sequencing

Laboratory 7: Transient transfection of mammalian cells

Laboratory 8: Affinity purification

Laboratory 9: SDS-PAGE and Western Blot (Part 1)

Laboratory 10: Western blot (Part 2) and Enzyme assay

Laboratory 11: Enzyme kinetics

Organization

Introduction: During the first week of the semester there will be an introductory session **for all students** on biosafety, electronic lab notebook and Benchling (see Moodle).

Groups: Students will work in small subgroups (usually 3 people) to perform the experiments in alternating weeks. Each student will be assigned to one of four laboratory groups A, B, C, D (see Moodle).

- Group A Tuesday September 17th
- Group B Friday September 20th
- Group C Tuesday September 24th
- Group D Friday September 27th

Practical sessions will be conducted in the SSV TP lab ([AI0111](#)). Rooms available for **exercises** and **data analysis** are indicated on the schedule (see Moodle top page). The weeks without practical are reserved for personal work (preparation, lab notebook and data analysis).

Preparation before each lab session is essential to carry out the experiments properly. Students are expected to carefully read the protocols, watch videos and theoretical background information **before** each lab session (consult textbooks if needed).

Workshops and Support (dates will be communicated on Moodle)

- Getting started with Benchling
- Support for electronic lab notebook (ELN)
- How to design scientific figures for ELN and report
- How to write figure legends
- How to write a scientific report/ poster

Time investment: BIO-203 corresponds to 3 ECTS (~ 90 hours total workload during 14 weeks). You will have five practical lab sessions that require on average 1 h preparation and ~4-5 h in the lab, corresponding to ~30 h. In addition, four hours of personal work per week are expected on average (lab notebook (recording experiments and data analysis, exercises), workshops, preparation of exam and writing scientific lab report/ poster) ~56 h.

All course documents will be posted on Moodle in advance. Raw experimental data will be on Moodle after the lab session.

Language: All course documents are in English since this is the common scientific language. We encourage you to write in English (lab notebook, reports) to get used to communicating science in English. The exam is bilingual (F/E).

Attendance

The presence at practical sessions is **mandatory**. In case you cannot attend a TP session, you must inform the teachers (Alexandra Bezler) **in advance** by email of the reasons. Without regular participation in the practical it will be difficult to complete the lab notebook.

Good laboratory practice

Be prepared! This helps to run experiments smoothly and saves time and reagents.

Work clean and safe, respecting yourself, your colleagues and the environment. Be careful with instruments and reagents: they are fragile and expensive.

Rules for working in the lab

- Always wear a lab coat. Lab coats are provided and shared among students and should not be marked.
- Gloves and safety goggles are available
- Wear closed shoes and long trousers
- No food or drinks (also bottles are not allowed)
- Clean up and switch off equipment after each laboratory session
- Ask assistants for waste treatment
- In case of accidents contact the teacher

Evaluation

All lab notes should be entered into your electronic **lab notebook**. Each student keeps a personal notebook, which will be continuously evaluated during the semester (see SIMS/ Moodle). Lab notebooks have to be completed for feedback and grading one week after each practical session.

Questions and **exercises** in the lab manual should help you to analyze your results and understand key theoretical concepts. They can be discussed during the practical with your group and/or assistant. Never hesitate to ask questions: You are here to learn and the assistants to help!

Lab report or poster should summarize the experiments that were performed, as well as data analysis and discussion of the results obtained. Detailed guidelines will be provided in due time.

Be aware that plagiarism is not acceptable and will lower your grade! Both the lab notebook and lab report or poster should be expressed in your own words, indicating references and sources.

Note LISV I+II is an annual course with one final grade at the end of the spring semester. The **final grade** is calculated based on a **weighted average** of the laboratory notebook, lab report or poster (1 per semester) and an exam at the end of each semester, as indicated below:

Lab notebook	40%
Lab report or poster	30%
Exams	30%

Theoretical background

- Biologie Générale (BIOENG-110)
- Biologie moléculaire et cellulaire I (BIO-205)

Bibliography

- Alberts B. et al., (2014). Molecular Biology of the Cell, Sixth Edition. Garland Science.
- Reece, Jane B., et al. (2021) Campbell Biology. Twelfth Edition. Pearson Education.