

Course Evaluation 2021, reported 01.02.2022

MOL300 Practical Biochemistry and Molecular Biology (20 ECTS)

Hee-Chan Seo, Course-in-charge

MOL300 is a master-level lab-based course and the main enrolment comes from the incoming molecular biology-majoring MSc students for whom the course is compulsory. Occasionally, non-MSc students such as exchange students, PhD students and technicians who want to brush up their skills also take the course. The enrolment during the last four years were 19 (2018), 19 (2019), 24 (2020), 16 (2021), respectively. (MOL300 has a practical maximum capacity of 24.) MOL300 students are required to perform project-oriented experiments, and to write a full scientific report after each lab topic.

The main goal of MOL300 is to equip students with basic knowledge and practical experience in modern molecular biology and biochemistry. The course has two main areas of emphasis: hands-on experience and report writing. Tightly knitted lab schedules allow the students to perform as many experiments as possible. The students also receive intensive training on report-writing, with helps from the teaching staff, which include detailed feedbacks on submitted reports.

The aims of MOL300 are: 1) to plan and conduct experiments, 2) to document the experimental results and analyse the data, 3) to learn to communicate the outcome, both orally and as a written report. In all, the course aims that the students be well versed in both hands-on practical skills and scientific communication skills.

MOL300 students conduct various experiments in the areas of protein biochemistry, gene technology and cell culture. Prior to each lab exercise (or module), flowchart, a condensed summary of what to do in the lab, is required. Flowcharts help the students to prepare for their conducting experimental steps and understanding of 'the theories' behind the topics. Experiments are to be carried out by the students whenever possible, with close supervision by the teaching staff. There are also Q&A sessions that answer/discuss practical and relevant questions, such as data-gathering and analysis. (The two pandemic years of 2020 and 2021 influenced the overall course plan much. See below own description.) Students are to submit a total of five IMRaD-modelled scientific reports. Submitted reports are thoroughly reviewed and commented. The quality of the reports, which is a measure of student accomplishments, has increased gradually as the course proceeded. The overall understanding of the subjects that have been covered in MOL300 is tested by a written examination.

MOL300 gives a formal letter-based grade, which is based on a formal written exam (aka, 'school exam', 70%) and an overall report evaluation (30%). This bifurcated evaluation scheme was first used in MOL300 and is to date one of the most thorough and fair evaluation form used in the evaluation of a traditional lab-based practical course. The scheme is now used in other practical courses in the MOL programs. The proportion of the A and B grades in MOL300 lie about 40-50% (of which A, 10-20% and B, 25-40%). A clear relationship between the report grades and the written exam grades exists: that is, students who had done well in report writing did also well in the written exam.

MOL300 students say that, although the course was intensive and demanding, it was well worth of their time and investment. This is supported by student evaluations in which the overwhelming majority (over 90%) expressed their satisfaction with the course. Course satisfaction is further supported by the statements of former MOL300 students who, upon completion of their MSc thesis work or in their professional work, say the course helped them much both in practical skills and in report/thesis writing. In addition, students who have completed MOL300 are also well sought-after as master student candidates in various research groups (mainly BIO and BioMed, but also Sars, Haukeland Hospital, IMR)

<On teaching lab and teaching staff>

The teaching lab that MOL300 uses is relatively well equipped. However, some instruments are old and worn out and thus require regular check-up or replacement. The issue with the teaching staff (here mainly teaching assistants), after years of understaffing and uncertainties, is now stabilised. But since many of the teaching staff are PhD candidates (i.e., time-limited appointees), the staffing issue requires full attention each semester. MOL300 is an advanced course. To achieve the best outcome for the students and the teachers alike, new teaching staffs are paired up with old/experienced ones. By doing so, PhD candidates with teaching duty can teach the same subjects/topics during their 4-year appointment period.

<Comments on student course evaluation>

In MOL300 about 60-80% of enrolled students return the evaluation. The numbers in the period 2018 to 2021 were: 13/19 (68%, 2018), 15/19 (79%, 2019), 14/24 (58%, 2020), 12/16 (75%, 2021). Most students (over 90%) were satisfied. However, there is still room for improvement and the following four main points were mentioned in the evaluations.

1. Consistent evaluation of reports

This is an ever-appearing issue. MOL300 has tried to address it by having teachers' meetings and making clearer guidelines. However, as the course have many teachers, it is a daunting task to have only one voice. (Here we are dealing with small personal differences.) It is very understandable that students want only one way/rule to follow, with NO exceptions. But this is not only possible, but also not desirable. For the former, unless we have only one teacher throughout the semester, this is not attainable. To ameliorate students' concern and frustration, the grading criteria have been straightened out and made clear. Furthermore, the course-in-charge reviews the grading results of each report to see if there is an 'unusual' aspect. For the latter, each topic/project require a (slightly) different emphasis on report format and content. This is evident on the existence of various scientific journals after the disciplines/subjects. MOL300 has a special session on report writing and each topic/project ends with a Q&A session about report writing of the topic/project concerned. Further and continuous efforts are being made to address this consistency issue.

2. New methodologies and topics

Fuelled by rapid development of technology and instrumentation, methods and techniques in modern biochemistry and molecular biology are changing rapidly. Although some 'old' methods are still used, many have become obsolete just after a few years in use. Therefore, it is both exciting and challenging for the experimentalists to keep updated with new methodologies. In MOL300, we try hard to 'be current', but some obvious challenges remain. One is the shortage of competent personnel (due to ever more sophisticated methods). The other is the lack of state-of-the-art equipment in the teaching lab (we would need several of these if the students wanted direct hands-on experience). Another issue, which is not often mentioned, is making a lab protocol requires big efforts. (Here, the issue is not if the experiments are working, rather if they will be working on student's hands.) Regardless, updating and/or replacing of existing lab protocols are continuously discussed.

Occasionally, there are differences between what a teacher wants to teach and what students want to learn. Enzymology is the case. Many students regard the topic difficult and not useful. But enzymology, more specifically enzyme kinetics, which includes receptor-ligand interactions, is an important topic for biochemists and molecular biologists. The MOL section in BIO thinks enzymology ought to be continuously covered in MOL300 because it is no longer covered in the bachelor level of MOL courses. MOL300 emphasises data analysis, and for the last two years the topic ran digitally. If the pandemic restrictions eases, the topic will become a more interactive in-class data analysis session.

3. Textbook and required literatures

For syllabus, MOL300 has a textbook (Wilson and Walker: Principles and Techniques of Biochemistry and Molecular Biology, 8th Ed. 2018. Edited by A. Hofmann and S. Clokie) and other relevant materials, such as lab protocols. Because the information needed for the topics in MOL300 is not fully covered by the textbook, detailed lab protocols and lectures are used. (The relevant book chapters and sections are clearly mentioned in the lab protocols.) Specific topics are also covered in Q&A or symposium sessions. On the other hand, an opposite issue of the same challenge exists; namely, relatively a small portion of the textbook is directly used in the course.

4. Exam questions

Exam questions in MOL300 prefer 'Why' to 'What'. One has to think when answers 'Why', which in turn requires to know 'What' first. Another emphasis is on the analysis of experimental data. Students are often asked to justify their answers. If the defence (i.e., the logic) is good/strong, one gets considerable points even if the answer is factually wrong.

An example is a question about PCR-based conventional cloning. Here, one designs a primer pair for a fusion protein construct. (If the starting material is RNA, it should first be converted to DNA.) To be able to answer the question, one should know what are required in making a fusion protein (in framing is a must), what/how is base-hybridisation, annealing, polymerase

activity, restriction enzyme digestion, ligation, compatible ends, etc. The question is thus rather simple, but it contains/requires much information, and as such it is worth many points. Because it is not easy to find a textbook that covers all subjects taught in MOL300 (see above Point 3), exam questions are also based upon lab protocols, lectures, common Q&A sessions, and old exam questions. Each year, an old exam review session is held about a week before the written exam. (Students are expected to have worked on the old questions prior to the session.)

<Impact of the pandemic on MOL300>

The covid-19-caused pandemic of 2020 and 2021 has greatly influenced MOL300 by interrupting the time-honoured neatly planned lab schedules. Due to the infection control measures, most lectures and Q&A sessions were held digitally. Many experiments were either not performed or performed by the teaching staff before or during the experiments. (As there were slight loosening of the measures, the last two lab topics of the 2021 semester were largely carried out as a full lab.) The current expectation is that the restrictions imposed by the pandemic will ease up. If that is the case, MOL300 could return to a normal plan.