EVALUATION OF THE BACHELOR AND MASTER PROGRAMS IN *MOLECULAR BIOLOGY* AT THE DEPARTMENT OF MOLECULAR BIOLOGY (MBI), UNIVERSITY OF BERGEN (UIB)

ANNUAL REPORT FROM PROGRAM AUDITOR FOR 2011-12

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Programs evaluated: Bachelor and Master Programs in *Molecular Biology* at the Department of Molecular Biology (MBI), Faculty of Mathematics and Natural Sciences, University of Bergen (UiB)

I. Introduction

In the first annual evaluation (for 2007-08; dated 30.06.08), the focus was on an overall evaluation of the of the Bachelor and Master Programs in *Molecular Biology* at the University of Bergen (UiB), in addition to a more detailed evaluation of the two introductory courses in the Bachelor Program, MOL100 (Introduction to Molecular Biology) and MOL200 (Metabolism). In the second annual evaluation (for 2009-10; dated 21.12.09), the two laboratory courses MOL202 (Experimental Molecular Biology) and MOL300 (Practical Molecular Biology), both of which are compulsory for a Master degree in molecular biology, were evaluated, in addition to three non-compulsory courses MOL231/MOL311 (Project in Molecular Biology) and MOL219 (Nano-Bio-Technology). The third annual evaluation (for 2010-11; dated 28.01.11) focused largely on two Bachelor Program courses, MOL201 (Molecular Cell Biology) and MOL203 (Gene Structure and Function) and the Master Program course MOL310 (Structural Molecular Biology), all three of which are compulsory for a Master degree in molecular biology.

The present annual evaluation (for 2011-12) focuses primarily on reviewing the quality and grading of Master degree theses and the overall quality of the curriculum and education given at the Department of Molecular Biology (MBI). In addition, possible strategies for optimizing the use of MBI's teaching resources are discussed.

II. Quality and grading of Master degree theses

The evaluation of the quality and grading of Master degree theses is based on reading and evaluating six Master degree theses by students that graduated from MBI in the period from November 2009 to November 2010, and on the distribution of grades given to Master degree students – grades based on the quality of their Master degree thesis – graduating between fall semester 2004 and fall semester 2011.

Upon evaluating a Master degree thesis at the Department of Molecular Biosciences (IMBV), University of Oslo (UiO), there are always two examiners, one internal (not the student's supervisor) and one external. Moreover, the impression that the student's supervisor has of the student (i.e. the supervisor's opinion of the students independence, initiative, knowledge, maturity, and ability to comprehend) accounts for 15% of the grade, whereas the examiners' impression of the student based on the student's oral 30 minutes presentation of the thesis and the students ability to defend the thesis during the following thesis-examination also accounts for 15% of the grade. When comparing my grade with the grade the MBI student actually received, one must take into account that I have not examined the students about their thesis nor have I heard their oral thesis presentation nor obtained any information from the student's supervisor. I have also not had a co-examiner to discuss with. As a consequence, some differences may be expected in my grade/evaluation and the grade/evaluation the student

actually received at MBI, but the differences should not exceed more than one grade. It should also be mentioned that I have evaluated and graded these six dissertations without knowing beforehand the actual grade they received.

Of the six dissertations, I found the SNE-thesis to definitely be of lower quality than the five other dissertations, and gave it grade C. It was altogether well written (i.e. the language part), but otherwise of fair to good quality. Altogether a straightforward C; the student presentation/examination and supervisor's opinion of the student would thus probably not have altered that grade. My grade was in complete agreement with the grade of C which was given to the student.

I thought that the TAG-thesis was of somewhat better quality than the SNE-thesis, although the latter was better written. I thought the TAG-thesis to be on the border line between a C and a B, the final grade (either a C or a B) depending on student's presentation/examination and the supervisor's opinion of the student. My grade of C to B was in good agreement with the grade of C which was given to the student.

Of somewhat higher quality was the HMS-thesis, which I thought was a very good B. Might have considered it to be a weak A if the student had obtained just about full score on the student presentation/examination and the supervisor's opinion parts (assuming they count 30% of grade). My grade of a very good B was in complete agreement with the grade of B which was given to the student.

I thought that the HF-thesis was perhaps a little better than the HMS-thesis. The Results and Discussion sections of the HF-thesis was of somewhat lower quality than the rest of the thesis, and altogether I thought the HF-thesis to be on the border line between a B and an A. The final grade (either a B or an A) would depend on the student's presentation/examination and the supervisor's opinion of the student. My grade of B to A was in fair agreement with the grade of A which was given to the student.

I would have given both KF and KA an A, if also the students' presentations/examinations were of A quality and the supervisor's opinion was in agreement with this. I thought the KF-thesis to be a very well written thesis where all the sections and results and result presentation were of very high quality. The KA-thesis was written in a somewhat unusual style – it lacked a description of aims, abstract contained references and the thesis (especially the abstract) was written in the "we-form" which I did not like – but the thesis was otherwise impressive. I gave both an A, which was in complete agreement with the grade of A given to KA, but not in agreement with the grade of B which was given to KF.

Altogether, there was a reasonable agreement between the grade I would have given the students and the grade the student actually received (Table 1). A comparison of the distribution of grades given to Master degree students at MBI (UiB) and IMBV (UiO) (Table 2) also indicates that there is in fact a good agreement in the evaluation of Master degree theses at the two departments.

I thought that all six students whose theses I evaluated had been involved in research projects of high relevance to research in the fields of biochemistry and molecular biology, both with respect to the subject area and the research methods used. Altogether, it is my general impression that the type of projects, the quality of the projects, and the evaluation and grading of the projects given to Master degree students at MBI is similar to that at IMBV UiO.

Table 1: Comparison of grade given to candidate and the grade I gave after reading the thesis

Candidate (thesis)	Grade given at MBI	My grade
SNE	C	C
TAG	C	C to B[1]
HMS	B	B
HF	A	B to A[2]
KF	B	A
KA	A	A

[1] On the border line between a C and a B, the final grade (either a C or a B) depending on student's presentation/examination and the supervisor's opinion of the student

[2] On the border line between a B and an A, the final grade (either a B or an A) depending on student's presentation/examination and the supervisor's opinion of the student

Table 2: Evaluation of Master degree theses at MBI (UiB) [1] and IMBV (UiO) [2]. Comparison of grade distribution at the two departments

Grade	% at MBI (UiB)	% at IMBV (UiO)
A	31%	30%
B	50%	52%
C	17%	14%
D	2%	2%
E	0%	1%
F	0%	1%

[1] From fall 2004 to spring of 2011; a total 107 candidates at MBI

[2] From spring of 2005 to fall 2011; a total 263 candidates at IMBV

III. Overall quality of the curriculum and education given at MBI

The evaluation of the overall quality of the curriculum and education given at MBI is based on my assessments over a four year period (2008-2012) of (i) course-evaluations, -reports (emnerapporter), -hand-outs (such as course experimental protocols) and -descriptions (found on MBI's home pages), (ii) the department's evaluations (instituttsledelsens vurderinger) and (iii) a site-visit that included an assessment of course laboratories, instrumentation and interviews with course instructors and Master degree students.

For more details (than that given below) regarding my overall evaluation of the of the Bachelor and Master Programs in *Molecular Biology* at the University of Bergen – and for a comparison of these two programs to those at IMBV, UiO – refer to the first (for 2007-2008) annual evaluation report. The report for 2007-2008 also contains a more detailed evaluation of

the two introductory courses in the Bachelor Program, MOL100 (Introduction to Molecular Biology) and MOL200 (Metabolism). For comments about and a more detailed evaluation of MOL202 (Experimental Molecular Biology), MOL231/MOL311 (Project in Molecular Biology), MOL219 (Nano-Bio-Technology), and MOL300 (Practical Molecular Biology), refer to the second (for 2009-2010) annual evaluation report; and for comments about and a more detailed evaluation of MOL201 (Molecular Cell Biology), MOL203 (Gene Structure and Function) and MOL310 (Structural Molecular Biology), refer to the third annual evaluation report (for 2010-11).

Overview of the Bachelor and Master Programs:

The Bachelor and Masters Programs in *Molecular Biology* are somewhat similar to corresponding programs that are given at other high-ranked universities. In terms of courses offered, how they are organized in the programs, and their thematic content, the programs appear overall to have a high quality. Internationally renowned text books are used as course literature, and the courses seem to be up-to-date and cover currently important and relevant areas in molecular biology and related fields, and are consequently appropriate for the programs.

The Bachelor Program and introductory courses

The Bachelor Program at MBI provides students with a good fundamental background in the molecular biosciences and a sound platform for subsequent Master degree studies in molecular biology. The program is somewhat more flexible – has fewer compulsory courses – than that at IMBV UiO. Students at MBI may thus to a greater extent create individual (and possibly more optimal) course profiles/combinations and it is easier for them to take part of their studies abroad. When choosing their non-compulsory courses, MBI students should be encouraged to choose math, statistics, informatics and physical science courses, since bioscience students often lack quantitative skills and have inadequate background in the more quantitative and fundamental sciences.

The Bachelor Program courses, **MOL100** (Innføring i molekylærbiolgi), **MOL200** (Metabolisme; reaksjoner, regulering og kompartmentalisering), **MOL201** (Molecular Cell biology), **MOL202** (Experimental Molecular Biology), **MOL203** (Gene Structure and Function), and **MOL204** (Applied Bioinformatics), all seem to be up-to-date and cover currently important and relevant areas in the molecular life sciences. The thematic content of these courses seems in fact to be similar to courses in general biochemistry, and molecular and cell biology given at other universities.

There seems, however, to be room for improvement with respect to the quality of the teaching in some of these courses. As judged from students' evaluation and course reports for **MOL201** and **MOL203** from 2009, the students gave these courses as a whole a fair to good rating (~50% thought that MOL201 was average and ~43% that it was good or better than average; ~45% thought that MOL203 was average, ~35% that it was good, and ~20% that it was not so good). It appears that the students were happier with the colloquia/study groups, which they find (very) useful and the colloquia teachers were judged to be (very) good, whereas the students are not so satisfied with the lectures. It should be noted that these evaluations are from 2009, and things may have changed since then. I am, however, surprised that there still are so few lectures (30 hours) and colloquia (15 hours) in **MOL201** and **MOL203**, considering that these are 10 stp one-semester bachelor courses. I would have expected that 50-60 lecture hours and 20-25 colloquia hours would be necessary to cover the course curriculum thoroughly and at an appropriate pace.

I see from earlier evaluations of **MOL100** and **MOL200** that students feel that there is a discrepancy between the course curriculum, exams and what's covered in lectures/seminars. Again, these evaluations are from a few years back and things may have changed since then. As mentioned in the first (for 2007-2008) annual evaluation report, a detailed "learning-plan" outlining what one expects the students to learn might be useful. Lectures, seminars and exams should then adhere to the learning-plan. In the first years of their Bachelor studies, students often underestimate to what extent (i.e. how detailed) they are expected to learn the curriculum; with a detailed learning-plan they become more aware of what is expected of them. At IMBV we have used such a "learning-plan" in our biochemistry courses. Course evaluations reveal that just about all our students find the detailed learning-plan very useful. Enclosed (attachment 1) is the learning plan used for our new biochemistry course, MBV1050: *Biokjemi I - Biomolekylers struktur og funksjon*, which was established as a result of restructuring of the biochemistry courses at IMBV in 2011-12

This restructuring has made the biochemistry courses at IMBV more similar to those at MBI in that our previous one-semester course (MBV1030) in general biochemistry has been divided into two new biochemistry courses, *MBV1050: Biokjemi I - Biomolekylers struktur og funksjon* and *MBV2050: Biochemistry II - Metabolism and Bioenergetics*. The former (*MBV1050: Biokjemi I*) is be similar to MOL100, and is offered to bachelor students the 3rd semester (held for the first time fall semester 2011). IMBV students then take *MBV2010: Molecular Biology* and *MBV2020: Laboratory Course in Biochemistry and Molecular Biology* (similar to MOL202) the 4th semester, and *MBV2050: Biochemistry II - Metabolism and Bioenergetics* (similar to MOL200) the 5th semester (to be held for the first time in fall semester 2012).

As mentioned above, the IMBV course *MBV1050: Biochemistry I - Biomolekylers struktur og funksjon* corresponds to MOL100. The course was held for the first time this fall semester (2011) with 60 lecture hours. About 85 students were enrolled in the course and they were divided into 3 non-compulsory study groups; 2 hours per week for each group over about 12 weeks. The aim of the study groups was to help students that had difficulties with the problem sets (see attachment 3) that were handed out each week. About half the students attended the study groups – the number of students that attended a group thus varied between 5 and 20 – and each group had 2-3 teachers (at least one PhD fellow and one master student) to help students individually to solve problems. The students seemed overall to be satisfied with the course. The course had two 4-hour exams (see attachment 2a-d): 21% of the students scored 91% or better on the two exams, 40% scored between 80 and 90%, 17% scored between 70 and 79%, and 7% failed. Enclosed are the detailed learning plan for the course (attachment 1), the two 4-hour course exams (attachments 2a, 2b, 2c, 2d), and the problem sets that were given to the students (attachment 3).

The MBI course in experimental molecular biology (**MOL202**) seems to have an appropriate work load for a 10 stp course The students that were interviewed also felt that the work load is appropriate and seemed to be quite satisfied with the course. Indeed, many students said that they would have liked to have had even more laboratory work incorporated in their Bachelor courses. As to the introductory course in bioinformatics, **MOL204**, I agree with MBI's decision to make the course compulsory.

Master program and more advanced courses

The Master Program provides advanced research-training in the molecular biosciences and altogether appears to give students the core competencies and skills needed to compete and succeed in a variety of science-related careers.

In the advanced graduate laboratory courses **MOL300**, students become experienced with a broad range of biochemical and molecular biological techniques that they need in their Master degree research project and in relevant science-related careers. The students that were interviewed thought that the work load was quite heavy, but they were very satisfied with the course and said that the learning outcome was high. As was the case with MOL202, many students said that they would have liked to have had even more laboratory work incorporated in their courses.

The students seemed to give the graduate course in structural molecular biology, **MOL310**, a fair rating. As I mentioned in an earlier report, the subject area covered in the course is fundamental and MBI should consider having this as a compulsory Bachelor course. Many of the topics covered in the course deal with properties of macromolecules that all students that have completed their Bachelor studies should be well acquainted with. As mentioned for MOL201 and MOL203, I think the number of lecture-hours is low (about 30 hours (2x15) lectures and twelve hours (2x6) colloquia/study groups, including PC/data-lab).

The more specialized and/or advanced courses, such as **MOL211** (Virology), **MOL212** (Immunology), **MOL213** (Developmental Genetics), **MOL215** (Tumor Biology), and **MOL217** (Applied Bioinformatics), are all relevant and appropriate for Bachelor and Master studies in molecular biology. As I have mentioned in an earlier annual rapport, MOL211-Virology is one of few - possibly the only - course(s) given in virology to bioscience students in Norway. Virology is an important bioscience subject, and one might consider transforming MOL211 into an intensive 2-3 week course that graduate students from other universities also could take as part of their graduate (Master/PhD) studies.

IV. Optimizing use of teaching resources

I was asked to comment on the use of teaching resources and suggest ways of optimizing their use. It is difficult to come with specific recommendations, as that would require a more detailed insight into MBI's teaching activities and resources. In more general terms, I can however recommend that MBI consider the following points: (i) Identify and eliminate unnecessary overlap in the curriculum between courses, (ii) Optimize the use of Master students, PhD-fellows and post docs as teaching assistants, (iii) Collaborate with other departments, (iv) Recruit externally funded Proffesor-II, (v) Use National PhD-school courses, and (vi) Obtain funds from the National PhD School program to arrange MBI National PhD school courses. I will in the following illustrate some of these points with examples from IMBV, UiO.

(i) Identify and eliminate overlap in the curriculum

A clear message we obtained when interviewing Master students about our Bachelor courses was that there was too much overlap in the curriculum; especially the good students found the repetition frustrating – a waste of time for both students and teachers and an inefficient use of the department's recourses. To remove some of the overlap, the biochemistry/molecular biology courses at IMBV have been re-organized and -structured (as referred to above). With this restructuring, the curriculum in three previous biochemistry courses (MBV1030: General Biochemistry, MBV3030-The Biochemistry of Proteins and MBV3040-The Biochemistry of Nucleic Acids) is now included in the two new courses (*MBV1050: Biochemistry I - Biomolekylers struktur og funksjon* and *MBV2050: Biochemistry II-Metabolism*). This restructuring has also made room for a new and more advanced research and literature based course the 6th semester; a course where the

students have to participate in the teaching by presenting recent and important research publications to the other students. Our student reference group and other master students that have been interviewed recommended that such a course be included in the last semester of the Bachelor program.

(ii) Optimize the use Master students, PhD-fellows and post docs as teaching assistants

Twenty-five percent of the ordinary work-load of 4-year PhD-fellows should involve teaching, and this amounts to about 400 hours of teaching each year. At IMBV, PhD-fellows are automatically credited with 100 hours per year because they assist in the supervision of Master students. The PhD-fellows are consequently expected to do about 300 hours of course-teaching per year. I suspect that many PhD fellows, both at IMBV and other institutions, do less than this – perhaps only 200-250 hours per year. This may in part be due to (i) the lack of a rigorous and efficient accounting system for registering teaching hours, (ii) the inability to efficiently implement and coordinate the use of PhD fellows in different teaching activities, and/or (iii) the inability to make use of all fellows in teaching due to for instance language problems (i.e. inability to speak Norwegian and/or English fluently). It is important that MBI has a simple and rapid and (preferably) net-based system for registering all teaching activities. Such an accounting system makes it easier to implement and coordinate the use of PhD fellows in various teaching activities, and to ensure that all fellows fulfil their teaching obligations. Fellows that cannot be used in teaching due to language problems should be assigned other duties, such as to help prepare (laboratory) courses. Moreover, when employing PhD fellows and post docs with teaching duties, MBI should ensure that employed candidates can in fact carry out the expected teaching obligations. It should also be noted that the use of Master students as teaching-assistants may be an efficient use of the department's resources; it is not expensive and gives the students an important teaching experience.

(iii) Collaboration with other departments

When possible, collaborate with other departments in giving courses. IMBV has made use of such of collaboration to establishing several courses, such as:

MBV1020: Physiology, collaboration with the Department of Biology
MBV-KKM1030: Biological Chemistry, collaboration with the Department of Chemistry
MBV-INF4410/9410: Bioinformatics for Molecular Biology, collaboration with the Department of Informatics
MBV4330/9330: Experimental Animal Studies

(iv) Recruit externally funded Proffesor-II positions

Obtain funding from external institutions for Proffesor-II positions that may contribute to teaching will of course increase MBI's teaching resources. Many of the graduate IMBV courses, such as *MBV4240: Biochemical Mechanism in Intracellular Transport* and *MBV4160: Advanced Cancer Biology*, are partly or completely taught by externally funded personnel.

(v) Use courses arranged by the National PhD Schools

Make sure MBI graduate students make efficient use of the many relevant *National PhD School* courses held at other institutions.

(vi) Obtain funds from the National PhD School program to arrange MBI courses

Funds may be obtained from the National PhD School program to arrange national graduate courses at MBI. IMBV has made use of such "external funding" to establishing several new graduate courses, such as:

MBV4270/9270-BIOSTRUCT: Advanced Glycobiology
MBV9220-BIOSTRUCT: Protein Crystal Spectroscopy
MBV9300BTS-BIOSTRUCT: Membrane Proteins: from isolation to crystals
MBV9510-BIOSTRUCT: Biomolecular NMR Spectroscopy
MBV9520-BIOSTRUCT-Advanced Biomolecular NMR Spectroscopy

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