UPPSALA
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Report on Measures for Development

Educational Evaluation of the Master's Programme in Molecular Medicine at Uppsala University

Content

1. Introduction

This report concerns the planned measures for quality development of the Master's programme in Molecular Medicine, in response to the suggestions made by the Reviewer Board conducting the Educational evaluation during fall 2021. The quality assessment included as well the eight programme courses offered as free-standing. The evaluation also included the freestanding courses; 3MG049 *Innovation of molecular biosensors* (SensUs) 15 credits, 3MG018 *Immune, gene and cell therapy 7.5 credits*, 3MG009 *Basic medical genetics 4.5 credits (online in Swedish)*, offered at the Dept. of Immunology, Genetics and Pathology (IGP). Their assessment was based on the self-evaluation combined with provided documentations such as programme and course evaluations, examinations, information about the Master theses and alumni surveys. A site visit was performed in October 2021, during which additional information was provided by the programme director, and where teachers and students were interviewed separately. Similarly, the Master's Programme in Innovative Medicine was evaluated, being built in part from Molecular Medicine as well as IGPs' two other master's programme and free-standing courses.

Review Board

The members of the review panel were:

- **Göran Andersson**, Professor, Swedish University of Agricultural Sciences (Chairman).
- **Nicholas Foulkes**, Professor, University of Heidelberg/Institute of Biological and Chemical systems (IBCS), Karlsruhe Institute of Technology (KIT), Germany
- **Erik Fries**, Professor Emeritus, Uppsala University.
- **Margareta Krabbe**, Senior Lecturer, Biology Education Centre, Uppsala University.
- **Maria Lagerström-Fermér**, Associate Professor, Senior Director Clinical Innovation Early Clinical Development, Astra-Zeneca.
- **Anna Metreveli**, Stockholm University (Student representative).
- **Tejas Sawant**, Royal College of Surgeons, Dublin, Ireland (Student representative).

Interviewed by the Board during site visit

Degree project/PhD supervisors, teachers, course- and programme director (5 persons)

In a separate interview; four Molecular Medicine alumni and current PhD students (1 online).

2. Main conclusions from the Reviewer's Report

2.1 Strengths

- *"The review panel concluded that the Master´s programme in Molecular Medicine is a truly excellent Master's programme with high scientific level and of high international standard."*

- *"The courses included in the programme prepare the students for future careers in research both in academia and industry, and has a highly dedicated programme director and has an impressive list of excellent, associated lecturers and teachers, providing expertise in a wide spectra of research and development.*

- *The curriculum is well structured with good administrative support and provides in depth knowledge within the targeted areas of molecular medicine to give excellent basis for students to achieve the expected learning outcomes."*

- *"The examination process is also very flexible and ambitious with several different ways for examining the students. For e.g. research training and degree projects the student evaluations by supervisor are supported by rubrics and clearly defined criteria."*

- *"The teachers at both the programme-specific courses and the free-standing courses ensure that the course contents are regularly revised and updated to ensure that quality, intended learning outcomes and scientific-based teaching are maintained."*

2.2 Areas of Development

The low response rate of course evaluations was brought up by the Reviewers, which is a continuous concern of ours and several approaches has been attempted during the years to increase the engagement among the students.

The board commented on that the programme has a strong focus on cancer, which could prevent the coverage of other important diseases.

The Review board suggested to prioritise the integration of Biostatistics and Bioinformatics courses in the programme. A module of Bioinformatics has been part of the programme since its beginning and instead of having separate courses, it is integrated with data analysis during Genomics course and in research projects. Similarly, has Biostatistics been integrated in the same course and where it is applied in the research problems. Almost 50% of the degree projects also include analysis of large-scale data, and is covered by the students in these theses. However, it has been planned since long to expand on these subjects, which already has been implemented during spring 2022 and will further expand during fall and into 2023.

The committee requested also the programme to integrate more companies into the curriculum.

The Reviewers also pointed out the need of support for incoming international students such as in health care costs/insurance, visa matters, obtaining Swedish civil registration number.

3. Reflections on the Reviewer Report

The Reviewers have made an invaluable contribution to the quality development of our programme. The interactions and discussions with the Review Board during the site visit was in particular rewarding and effective, bringing together and allowing reflections among teachers and students.

The Reviewer's report covered all of the main aspects and constructively pointed out our aims, strengths and important suggestions for improvement, some of which we already have or will promptly address and some which mostly are out of our control, *i.e.* improving students' situation regarding problems with residence permits and bank accounts.

There were, however, a few points and questions raised in the report which could be due to lack of information or misunderstandings. Unfortunately, there was very little time to include provided clarifications and additional information.

Planned measures

3.1 Programme content

Apart from the already existing module of Bioinformatics during the first semester, which will be expanded with additional Biostatistics in fall-22, we have integrated an updated the epigenome analysis during February 2022, with extension of the genomic and epigenomic computer data analysis with data mining and introducing command lines as well as incorporated biostatistics lecture. A large number of Molecular Medicine degree projects every year already involve large-scale sequencing and analysis.

An objective of the programme is to also be relevant for the current Life Science industry and prepare students for careers in the private sector. A number of companies have been engaged in lectures, seminars, career days as well as site visits since the initiation of the programme. Moreover, as documented in the self-evaluation, every year, some students undertake their degree project in Life Science companies.

A large number of research scientists from other universities, departments or companies are invited guest lecturers on our courses. As mentioned by the Reviewers, many of these are not aware of the learning outcomes of the course and efforts will be made to better inform guest lecturers of these.

As suggested by the Reviewers, more companies will be integrated in the programme curriculum. New companies, with activities directly in the scope of the programme, have recruited several of our graduates and/or have already contacted us for recruiting students. There are now plans to integrate these on course lectures providing

applications of what the students already are trained in during the practical laboratory work on the programme.

We also intend to take better advantage of our alumni, who many are working in Life Science companies and some are engaged during career activities.

Information on course content

We have always made schedules from previous courses on the programme publicly available on the Student Portal. This, in order for prospective students and for current students to view upcoming courses later in the programme.

Since a transfer to the new platform Studium was done last fall, not all information has yet been organised for all courses. It is expected that there will be a learning period for both teachers and students to navigate in the platform.

It is important that information on courses and course content are easily accessible for prospective students, and it is disconcerting that these are not always appearing in searches on UU website.

Molecular Medicine programme content

Although the programme starts with courses with focus on genetic diseases and cancer, different aspects of cancer research lead also to immunology and vascular biology, in which cellular and molecular mechanisms of angiogenesis, immune therapy and autoimmune diseases form a substantial part of the curriculum as well. Genetic diseases encompass, for example, also neurodevelopmental and neurodegenerative disorders.

In the course schedules, the content of the programme is shown which covers research into neurodegenerative diseases, as well as mechanisms for development of lymphatic vessels, cardiovascular and metabolic disorders using Zebrafish model.

The genomic and epigenetic research integrated into the programme, stretches out into various diseases as well as describing general molecular mechanisms similar to the method development aimed at a number of medical applications.

All through the programme, the lecturers are asked to first give an overview of the field and thereafter bring forward the medical and scientific problems and how these are addressed in their own research, which would also include method application.

During the Molecular Tools and Biomarkers course, different disease markers and diagnostics are discussed. The Molecular Tools section includes lectures giving introduction to infectious diagnostics by Qlinea and student research assignments which are presented at a Mini-symposium giving State-of-the-art diagnostics review of diseases such as rheumatoid arthritis, diabetes, tuberculosis, Parkinson's disease, ALS and SLE.

This shows that *medical issues, treatment strategies and several diseases other than cancer, are covered during the programme*.

While there is a limit to the number of subjects which can be included in programme courses spanning, for most students 1 1/2 year, it is also a strength of a programme being both interdisciplinary and having a specific profile.

To address additional comments from the Reviewers regarding execution of the courses.

Exams

Example of previous exam questions are available on the course teaching platform. However, the students are notified on that the course content is updated annually according to recent research findings and other answers to exam questions can be expected. It is therefore important to assimilate the current course material.

Plagiarism Check

All written assignments by the students are checked for plagiarism using URKUND/Ouriginal.

Plagiarism control of master theses and research project articles which include unpublished research, as well as those under patent application or from companies, are done in part manually.

3.2 Progression

There is a challenge to achieve subject progression on an interdisciplinary programme in less than 1 ½ year, before most of the students starting their degree project during which the main in-depth learning occurs.

Although one of the strengths of the programme lies in its interdisciplinary structure, all subjects are taught at the current research level. The possibilities with research projects will provide the students will excellent opportunities to further develop their own research interest.

The progression in the programme will be made more visible, where the training of the competences and skills of the students will be emphasised. We plan to establish rubrics for progression in generic skills and research training abilities.

As suggested by the Reviewers, the expected progression of different abilities, competences and skills can be outlined in the Study handbook. Goal attainment matrix has been made for the MolMed/IMIM courses and can also be included in the handbook.

To address challenges with having the highly diverse international student cohort of heterogenous educational backgrounds and at the same time take advantage of the students' own knowledge, the Advanced Techniques in Molecular Medicine course starts with some weeks of seminars in which a large number of methods are surveyed and where the students are trained in experimental designs and critical analyses of results. The students identify their own knowledge gaps and the need of learning. The course includes an intense research communication training, both oral and in writing. Evaluation of others' research and work is part of the training.

On the first course, students assess their team work abilities and following courses include both training in self-assessment and peer assessment, also in the format of being peer reviewers and opponents.

Tools such as portfolios could be provided, in order to aid the students to themselves build on and monitor their personal academic development and progression.

Feed-back and constructive criticism are important means for the student to both monitor and achieve progression.

As described in the self-evaluation, the Molecular Medicine students receive feed-back and training during different activities and assignments. During the first course, they are assessing their ability in Team work and they are presenting and defending Research plans, providing another opportunity to receive and give constructive criticism.

During the second course, Advanced Techniques in Molecular Medicine, the students are video recorded during project presentation and receive direct feed-back from teachers and fellow students as well as addition direct feed-back on presentations. On the third course, the students are instructed in written Self-assessment and Peer-assessment of oral presentations, with criteria agreed on by former students. These are tools meant to continuously aid the individual student in further monitor and developing their skills.

All Literature seminars or Journal clubs on the programme courses, where the students are presenting recent research findings are also opportunities during which competences and skills are trained. The students' abilities to give and receive constructive criticism are further trained and assessed during programme courses when acting as opponents on research project seminars as well as opponent and peer-reviewers of master thesis and presentations. The students are also peer- reviewing written reports of experimental results during a programme course.

To better illustrate for the students this continuous competence training, the activities will be summarised in the Study handbook and in potential portfolio.

3.3 Study Handbook

A comprehensive study handbook is being generated, including such as programme and course contents, learning outcomes, grading scales and career development. In spite of that several information seminars are given throughout the programme and access to platform/websites on which similar information is posted, questions arise. A single site, where all information is gathered would provide a better overview of the programme and courses. For example, it would visualise several subjects, which are not given as separate courses, but are integrated in the courses and applied in different aspects and areas of research.

The Reviewers commented on that several of the described learning outcomes in course syllabi were too general. In a programme heavily integrated with current research, it is not practical to in detail describe subject-related learning outcomes as course content is continuously updated with on-going research and novel findings. A more detailed description of the course can instead be given in the Study handbook, which provides a flexible tool to better illustrate the programme content.

The study handbook would resemble partly IMIM's STER- (The Study-, teaching- and exam regulations), but would also include career development.

3.4 Course Evaluations

Of concern, similarly to many educations worldwide, is the frequent low response rates from students in on-line course surveys and evaluations. Research done shows that transfer from paper to online surveys did cause a drastic reduction in responses (1), questioning how representative such as course evaluations would be. A challenge with master's educations is also the short time during which students are studying on the programme, and might therefore not recognise the benefit and use of the outcome of course evaluations.

Measures currently in place

A large effort is made to engage the students in the development of the programme.

At both course introductions and at the course conclusion, the importance and use of course evaluations as well as who are benefitting are conveyed to the students, exemplified with changes made based on previous students' suggestions. Or, explained why it has not been feasible or practical to implement other suggestions from course evaluations.

It is a strong aim to directly create a climate of open communication and discussion on the programme and courses, in which up-coming issues can directly be resolved during on-going courses. The students are encouraged to promptly contact course director, administrators or programme director regarding issues or problems. On an international programme, this requires immediate implementation of our flat and collegial educational structure. In addition, information on contact routes is described and posted on Studium.

During the courses, the course directors are keeping a very frequent contact with the students in seminars, lectures and other activities. On several courses, introduction of guest lecturer by the course director allows almost daily contact in which student have immediate access to communicate any issues.

Furthermore, upon initiation from the students, a scheduled "mid-course evalution" has been implemented on programme courses to make additional opportunities for bringing up issues and to follow-up changes made. This is a brief in-class discussion together with the course director, directly following a lecture not to result in any extra efforts in students' busy schedules.

From the beginning of the programme, as well as on those of its courses offered since 25+ years ago, students have in a regular written survey evaluated each course on its content, structure and organisation as an assessment of the learning experience and contribution to further development of the course.

In addition, prior to the conclusion of the programme courses and as a scheduled event, an *open in-class discussion* between students and directors takes place during which the different course activities and outcome are reviewed. This open discussion serves several purposes, amongst others it;

i) aims to create a direct and straight-forward communication between students and directors and to achieve a collegial mindset of working together during the studies

ii) shares the views and opinions of all students, which often can be opposite what is deduced from written course evaluations

iii) conveys an effort to engage students, again including reminders on the importance of course evaluations and its use.

iv) aims to refresh the memories from course introduction of aims and learning outcomes of the course (sometimes students' expectations of the course have been collected and reviewed) as well as changes made to the course in response to previous students' course evaluations, discuss the outcomes of these or discuss new suggestions of changes

v) allows a discussion in real-time among all students during which ideas are given immediate feed-back by other students

Minutes from these discussions will be summarised for the students and included in evaluation reports.

Another important assessment of the education is the programme evaluation which is done at the conclusion, *i.e.* after the final degree project presentations, providing opinions on all programme courses and whether its content and activities have been of use during the individual research degree projects. Here, the graduating students are sharing their retrospective perspectives of the master's training and whether they have gained abilities and skills to fulfil the learning outcomes for a master's degree.

As described in the self-evaluation, written, anonymous course evaluations are routinely processed for each course via UUs software KURT since several years. To facilitate a good response rate, these evaluations are often opened very early on during the courses for the students to directly assess lectures and seminars while the memory is fresh. The course evaluations are kept open often two weeks into the following course, and a couple of reminder emails are sent. A course report is summarised by the course directors.

All course evaluations and reports are made available on the teaching platform, for in-coming student cohorts as well as previous students. (A login function in Studium could allow access also for alumni).

Attempts to increase the response rate have been made by shorten the course evaluations and time is scheduled for in-class discussion and on-line evaluation.

Clearly, there is a risk for assessment "fatigue" among students, which also has been demonstrated in multiple research studies (1-3). In spite of low response rate on student surveys, research shows that opinions not necessarily differ to those in course evaluations with high response rate (1), although research on higher educational programmes suggests that student evaluation surveys should not be the only method use measure (2)

The most successful response rates are obtained when students are informed about the importance and use of evaluations, and where there is a mutual respect between students and their tutors (1-3).

Measures for development

We will continue with all the measures already in place as described above. From the mentioned research studies, it is obvious that we use and aim for similar strategies to what have been found to be successful in increasing the response rates of course evaluations. However, we could achieve a better balance between the different modes of course evaluations by taking minutes from the open discussions and make them available to the students as well. Most often these are already included in the course reports.

In addition, a discussion about how to improve the course evaluations will be initiated with the students.

We have a great engagement from our graduates and alumni, for many years after completing the programme. They volunteer to participate in career activities, notify us on open PhD positions or job, or in other ways offer to support and aid younger students. We need to better make use of this engagements and find venues to convey these directly to the current students. Summaries of the programme evaluations will alos be made available to students.

References

1. *Strategies for Increasing Response Rates for Online End-of-Course Evaluations. Chapman D.D and Joines J.A.* 2017. *Int. J. of Teaching and Learning in Higher Education*, 29(1), 47.

2. *Student evaluation of teaching and the development of a comprehensive measure of teaching effectiveness for medical schools. Constantinou C, Wijnen-Meijer M. 2022. BMC Med Educ., 22(1):113.*

3. *Surveying international university students: The case of the 5% response rate. Steinmetz C., Thompson S. and Marshall, N. 2020. Issues in Educational Research, 30(3), 1105*

3.5 Grading scales

Information on the different grading scales used are always conveyed to the students on the first day at course introduction and also available on the teaching platform.

The information on the grades, assessments and modules is given on all courses at course introduction.
The students are informed on the problem with the international acceptance of Swedish grading scales at some of the career-development discussions between the programme director and the students during the programme. Later, during the

master's degree project and after graduation, when required in applications for PhD positions or registration, a more detailed assessment is estimated.

Additional Molecular Medicine students at LMU required detailed translation of the grades and achievements in order to be registered as a PhD student. MolMed students were denied PhD registrations in UK due to the Swedish grades and lack of classified degree, in spite of PhD positions offered. However, these problems are not general as many other MolMed students are in PhD programmes at several research institutes and universities in both Germany and UK.

As part of the UU committee overseeing the grading systems a few years back, I promoted a change to more differentiated grading scales. The committee finally proposed that each programme should have the possibility to choose grading scale from among the existing scales, which was also approved later by UU and the faculty. However, none of the five different existing scale is optimal, but the Molecular Medicine programme have the aims to establish the 6 (or7)-scale grade system to move towards the Netherland's assessment scale and better harmonise with international grading scales. When presented at Teacher's meeting, a majority was positive, providing that rubrics with defined criteria are available.

The assessment of master's degree project and thesis by supervisor, examiner and reviewers, was further differentiated into a 10-point scale (from 5) during spring semester 2021. This scale is better fitted to international gradings, provides a

IMIM – For the IMIM students, we have estimated an approximate conversion table of the national grading scales for the three partner universities. This table is presented in STER- (The Study-, teaching- and exam regulations), which now is under revision March-April 2022.

3.6 Gender balance

The Review Board commented on the gender imbalance among students in the programme and whether any measures are taken to counteract this.

Similarly, to many other master's programme within Life Sciences, the fraction of female students is high as up to 80-85%. This imbalance can be caused by the generally higher qualifications of female students, who also are clustering to educations in these subjects. However, we have not done any detailed statistics of all applicants' gender, but there are also a lower number of applications to the programme from male students. Among the applications this year, approximately 35 % are from male students.

It is important to admit the most merited students, who are highly motivated for studies on the programme regardless of gender. However, during assessment of the applications, extra attention could be made to the selection process in cases where applicants of different gender have equal merits and whether the criteria used are giving rise to any gender bias.

Plans are on-going to better convey information about the career opportunities provided through the programme, as well as the results of the quality assessment and alumni surveys, showing that practically all graduates proceed to PhD studies or relevant jobs in the industry. This information might further attract applicants of different gender.

In spite of the large number of female students in secondary cycle higher education which has been the situation for long time in many European countries and US, the fraction of high-ranking female researchers and professors still increases slowly (4), at Uppsala University by only 1% per year and has now reached 33% (www.uu.se). A persisting and structural gender bias is suggested to still give raise to these discrepancies (4), while number of female PhD students is more than 50% (in medicine and biology about 60%).

The lectures and seminars on *Equality* as well as *Master suppression techniques* and counter strategies during our joint seminar series for master's programmes, "Professional Training", is the more important today as both female and male students appear to unintentionally support and foment the gender bias within academia (1,4).

4. Does Gender Bias Still Affect Women in Science?
Roper, R.L. 2019. Microbiology and Molecular Biology Reviews 83(3)

3.7 Free-standing courses

The IGP free-standing Basic course in Medical Genetics (*Grundläggande medicinsk genetik* 3MG009) is not part of or intended to be a complement to the programme. However, it is a basic online course that is used as a refresher course or a competence-building course (life-long learning) and could make students interested in the subject.

It can be used as a preparatory course for prospective programme students. Indeed, we can also see that some of our programme students previously has taken this course.

The programme course, *Medical genetics and cancer; molecular mechanisms* (3MG022) is also offered as two free-standing courses, *Medical Genetics* (3MG011) and *Molecular mechanisms of cancer* (3PA013). These are exactly overlapping except for the *Professional Training* seminar series which is optional for free-standing students. The two separate free-standing modules provides flexibility for students interested in one or the other subject. These, together with other programme courses, are also used as competence-building courses for applicants from industry or other professions.

5. Actions and Time plan

Measures

The self-evaluation of the programme had already revealed areas in need of development and summarised in a list, out of which several have already been started to be addressed:

• *continuous planning and course development, integrating novel aspects and methods to maintain at the frontier of international research in the field*

• *improve information and interactions with teachers*

• *further review of course syllabi and learning outcomes.*

• *improve feed-back processes to students*

• *convey better to students the purpose, goal and opportunities with different activities and assignments - further expanding into a study handbook with detailed goals and course contents*

• *continue attempts to improve the study situation for international students and others*

• *take better advantage of the cultural diversity during the education*

• *with aims to increase the response frequency of online course evaluations, try to establish simplified course evaluations together with students*

• *make better use of the alumni promoting the programme in career events and help establish additional interactive events*

• *increase inclusion of Life Sciences companies in the curriculum*

• *improve information and interactions to supervisors*

Time plan

2022

Continuous work to facilitate the permit process and mobility.

Implement already planned as well as suggested measures to improve programme content

Integrate more companies in the programme curriculum

Complete information package from the Quality Assessment

Establish effective course evaluations together with students

2023

further review of course syllabi and learning outcomes

Progression- visualisation and establish rubrics

Complete study handbook

improve feed-back processes to students

Integrate more companies in the programme curriculum

Grading scales- establish rubrics for a more differentiated grading

Integration of novel research findings and methods

Establish effective course evaluations together with students

2024

Integrate more companies in the programme curriculum

Grading scales – pilot test of parallel grading scale and evaluation

Integration of novel research findings and methods

Further international collaborations

Inventory of student portfolio tools for personal development

2025

Grading scales – implementing of new scale

Integration of novel research findings and methods

Implementation of student portfolio tools for personal development

Further international collaborations

2026

Integration of novel research findings and methods

Grading scales- follow up