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## Assessment Report of Master's Programme in Pharmaceutical Modelling (LMM) and Master's Programme in Drug Discovery and Development (LMU)

October 10, 2022

### Assessment Committee

- Eva Sjökvist Saers, MSc PhD Pharm., board member of life science companies, chairman of the strategic innovation program Swelife
- Fredrik Björkling, PhD in Organic chemistry, Professor Emeritus, Medicinal Chemistry, Dept. of Drug Design and Pharmacology, University of Copenhagen, Denmark
- Ran Friedman, PhD in Biochemistry, Professor in Chemistry with focus on Computational Chemistry and Biochemistry, Linnaeus University, Kalmar, Sweden
- Lisa Klasson, Ph.D. in Biology, Senior lecturer in microbial evolutionary genomics, Uppsala University, Sweden
- Jessica Rosenholm, D.Sc.(Tech.), Professor in pharmaceutical development, Åbo Akademi University, Finland
- Leo Svahn, Master's student at Uppsala University

### The mission and the process

The Assessment Committee has been asked to carry out an assessment of two Master's Programmes at the Faculty of Pharmacy at Uppsala University - Pharmaceutical Modelling (LMM) and Drug Discovery and Development (LMU). The assessment is based on Uppsala University's Model for Review of Study Programmes covering 11 Assessment Areas (sv. Riktlinjer för Uppsala universitets modell för utbildningsutvärdering UFV 2015/475).

The Assessment Report is based on the Self-assessment Report dated May 12, 2022, including 7 attachments and additional material provided during the site visit at the Faculty of Pharmacy performed September 1-2, 2022. The Self-assessment report presents and assesses the two programmes in one report. Therefore, the Assessment Committee presents the assessment of the two programmes in one report as it is not possible to make separate comments about the two programmes with respect to each assessment area.

During the site visit at the Faculty of Pharmacy the Assessment Committee had meetings with the vice dean, programme coordinators, course coordinators, study adviser, students, and alumni. At these meetings the overall organisation and education at the faculty was presented. The programme directors of LMM and LMU presented the respective Master's programmes; background, study plans, number of applicants and admitted students etc. The course coordinators presented their respective courses with emphasis on how the 11 aspects are met. Students and alumni were interviewed about their experiences, thoughts about the respective programmes and areas of improvement. All meetings and interactions were carried out in a very open and positive spirit and were well prepared by the participants. The staff from the faculty demonstrated enthusiasm and engagement, and deep



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knowledge in the field with pedagogical skills and ambitions. The students (LMU) and alumni (LMU and LMM) were engaged and had suggestions for the further development and improvements of the programmes.

The Assessment Committee had several digital meetings, corresponded via email and worked jointly on the report. The Assessment Committee found that the programmes are of high international class. In some parts the Assessment Committee has found it challenging to give clear opinions about the fulfilment of the 11 aspects for the two programmes, jointly and separately. This can be due to lack of relevant documentation and reports, but also due to some areas not being targeted, continuously evaluated and reported. The two programmes are not benchmarked against other programmes. The Assessment Committee has aimed at being constructive in order to support the further development of the programmes and presents strengths and suggestions for improvement.

We hereby present the report and would like to express our thanks for the honourable task to assess the Master's Programmes in Pharmaceutical Modelling and in Drug Discovery and Development.

On behalf of the Assessment Committee

Eva Sjökvist Saers, Chairman

### **Site visit – participants** (in order of appearance)

Anja Sandström	Vice dean, Professor
Per Larsson	Programme coordinator LMM
Luke Odell	Programme coordinator LMU
Michael Himmlegaard	Education Officer
Christina Ceder	Study Adviser
Maria Karlgren	Course Leader
Ulrika Simonsson	Course Leader
Ola Spjuth	Course Leader
Jonas Rydfjord	Course Leader
Anna Orlova	Course Leader
Maria Kjellsson	Course Leader
Jamie Morisson	Course Leader
Fredrik Jernerén	Degree Project Leader
Jessica Mahajan	Student LMU
Basmala Qaysson	Student LMU
Samia Mohammad	Alumni LMU
Sebastian Moes	Alumni LMM



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### High level observations

- The Assessment Committee was overall pleased with the academic level of the programmes and with the engagement of the staff at the Faculty of Pharmacy. The large number of applicants also attests to the programmes' appeal among prospective students.
- The Faculty of Pharmacy has appointed a Pharmaceutical council (Farmaceutiska rådet) with, to the Assessment Committee, not fully clear role and responsibility. The Assessment Committee strongly recommends the Faculty of Pharmacy to appoint a permanent council/board of knowledgeable individuals representing the pharmaceutical ecosystems, especially from the Pharma industry, and other stakeholders to support and give clear guidance in the development and follow-up of the educations at the undergraduate and postgraduate levels. This council should meet regularly and at least once a year for continuity.
- To continuously develop the Master's programmes LMM and LMU, it is suggested to appoint a Programme council, that operates as a board for each programme. The Programme council should consist of the Programme coordinator, teachers, students, representatives from Pharma industry and other possible stakeholders. To secure continuity, the council should meet regularly.
- There is a structure of fora on different levels and in different constellations where pedagogical developments and educational issues are discussed. There should be a more clear vision for what is to be achieved, with plans for the continuous and long-term development and improvement to make sure that continuous progress is achieved. It was a bit unclear how progress was monitored in the various fora.
- The progression should be continuously assured within an education programme and between education levels. The progression and "why the programme is built as it is" should be clear to the student. The programme should be structured so that the courses are built on each other in order to build a solid knowledge, within the area of each programme, that continuously develops during the programme. The self-assessment does not address how the progression is ensured in any depth. It is therefore hard to fully assess how the progression for each programme is ensured and how it is envisaged to the students.
- As some elective courses are part of other Swedish speaking programmes, a number of elective courses are currently given only in Swedish. This may place the international students in a compromised position, given that at least a couple of these courses were perceived to be of high relevance both from the students' side as well as the Assessment Committee's. We recommend the Faculty of Pharmacy to elucidate the possibilities to give critical courses in English for the benefit of the LMM and LMU students.
- According to information received during the Site visit, the timing of applications for the Master's projects is not optimal. The deadline for application for the Master's project is already in March, before the students have chosen their elective courses. It would be beneficial if the time for application could be delayed, or if not possible, the student's would receive more information about courses they have not yet attended before the deadline for application.



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- The challenge with group work came up from several participants at the Site visit. Group work is an integrated part of most of the courses as well as in real working life. To work in groups also provides good connections between students from different backgrounds. Early in the programme start, the students should be introduced to how to work in groups, as we believe there is a special need due to the diverse background of the students. Also, close supervision in the first group sessions would be valuable. Uppsala University has developed very good material on how to conduct group work, which is available on the website. This material should be more widely used and the progression in teamwork should be followed up over time during the programmes.
- Sustainability perspectives and aspects should be more integrated in the courses of the programmes. It is nowadays customary to justify which UN SDG's (United Nations Sustainable Development Goals) are relevant for projects, courses and articles produced at a university. Students should be more involved in discussing sustainability and how they can contribute more actively during their studies and in their future work life.

## Master's Programme in Pharmaceutical Modelling (LMM)

The Faculty of Pharmacy has strong research groups in areas such as computational chemistry, bioinformatics, pharmacometrics and pharmacokinetics. The international Master's Programme in Pharmaceutical Modelling was launched in 2016 and was the first international education programme at the Faculty of Pharmacy. The number of students that start the programme has increased over the years. In May 2022 there were 22 students in their second year and 29 students in their first year.

The international study plan is based on a fixed set of courses (75 credits) and either elective courses (15 credits) and Degree Project/Thesis (30 credits) or Degree Project/Thesis (45 credits).

The Master's students that graduate from the LMM programme are often recruited to postgraduate/research studies.

## Master's Programme in Drug Discovery and Development (LMU)

The Faculty of Pharmacy has a strong research and education expertise in the area of drug discovery and development. The international Master's Programme in Drug Discovery and Development was launched in the autumn of 2020. The programme is based on an earlier programme in Swedish given 2011-2019. Two cohorts of 30-40 students have entered the programme with a first cohort that graduated in June 2022. In May 2022 there were 26 students in their second year and 30 students in their first year.

The international study plan is based on a fixed set of courses in the first year (60 credits) with elective courses (15/30 credits) and Degree Project/Thesis (45/30 credits) in the second year.



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## **The 11 aspects - assessment areas of quality**

### **1. The Study Programmes Achieve the Objectives of the Higher Education Act and Higher Education Ordinance (Qualifications Ordinance) and Programme-Specific Objectives**

Both programmes use the final Master's project to ensure that all students reach the learning objectives of the higher education ordinance and of the programme. A mapping between the intended learning outcomes (ILOs) of the Master's project course with the objectives of the programme has been made and the examination criteria have been set to make sure the ILOs of the course are fulfilled.

When examining course syllabi from the programme outline, it is clear that objectives relating to knowledge are met. Several courses also have ILOs relating to skills and judgement. During discussions with the Programme coordinators, it was clear that the ILOs of the courses in the programme outline have not directly been analysed to see if they cover the programme objectives. It is therefore difficult to know whether all programme objectives are achieved for the courses in the outline and to what level. The fulfilment of objectives could be easily checked since most courses in the programmes are mandatory and thereby attended by all students. Such an analysis could provide insights into how well each objective is covered in each programme and if there are differences in fulfilment of the objectives between the programmes.

In the alumni survey one of the questions asked was "In your present employment situations, what use do you have of the following:". The general skills listed below this question got an average of 3,9 or higher on a scale from 1 to 5, suggesting that they have a lot of use for generic skills. However, it is hard to know if the alumni have gained these skills through their studies in the Master's programmes or if they are just answering how much they use them in their current work.

The students are informed about course ILOs at the start of each course, and these ILOs are examined either by a written exam at the end of the course, or via seminars, reports, labs etc.

The Assessment Committee found that it is not possible to make separate comments about the two programmes with regard to this assessment area.

### **Strengths**

- The Master's projects have written examination criteria for each ILO in the course syllabus. The ILOs for the degree project are mapped to the programme objectives to make sure that these are reached.
- Course ILOs are described to students at the start of a course so that it is clear what is expected, and they are examined in various ways in the courses.
- The students have a lot of use for their generic skills that are in agreement with the objectives of the Higher Education Ordinance.



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### Suggestions for improvements

- We recommend that the ILOs for the courses in the programme outline are analysed to see how well the objectives of the programme are met. This could be done by mapping each course ILO to the programme objectives.

## 2. The content and teaching activities are founded on a scientific basis and proven experience

Overall, both LMU and LMM have a strong foundation in the need for skilled, well-educated persons who will be able to take up positions in the pharmaceutical industry as well as continue their studies at PhD level.

The basis of the courses has previously been discussed with stakeholders in industry, academia and the authorities to ensure relevant scientific and practically useful content.

The specific courses are well aligned and connected to the scientific work and experience of the teachers and their ongoing research activities. Thus, the methods taught are similar or identical to the methods used in current active research. Most teachers are active researchers.

Guest lecturers are invited to several courses and provide an outside-university view on the subject of the course, e.g. from the pharmaceutical industry.

The more applied part of the studies is performed within the Master's project (30/45 credit points) where the acquired skills and competencies will be challenged in a research project. Students have found having the possibility to carry this out in industry to be of great benefit, and this is a recognized area of development and actively pursued also in the newer "sister" programme in Biopharmaceuticals: [https://www.linkedin.com/posts/master-s-programme-in-biopharmaceuticals\\_students-project-uppsalauniversity-activity-6976195727332904960-nyJ8](https://www.linkedin.com/posts/master-s-programme-in-biopharmaceuticals_students-project-uppsalauniversity-activity-6976195727332904960-nyJ8)

The Assessment Committee found that it is not possible to make separate comments about the two programmes regarding this assessment area.

### Strengths

- The course material is built around current research, in many cases performed by teachers themselves and/or their collaborators.
- The continuous course development adding state-of-the-art methods and technologies (e.g. deep learning) seems well in place through the close connection to the research environment.
- Teachers have relevant pedagogical education and most are experienced teachers. Junior teachers are supported by more senior colleagues to assure high quality.
- Guest lecturers/teachers from outside university are engaged to provide an understanding of the scientific needs in the pharmaceutical industry.



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### Suggestions for improvements

- We recommend, as a further teaching element, visits to and from industry, so that the students can see how their education might be used in the real world and what is expected of them.
- We recommend that an emphasis should be made to create more external Master's projects. The "visits to and from industry" would be a good platform for introducing students to the possibilities in the industry and for companies to introduce themselves to the students.
- We recommend that "PUFF-strimman", which under aspect #4 is suggested to be developed to include also the international programmes, could cater for introducing topics related to ethics and critical thinking.

### 3. The teaching focuses on the learning of students/doctoral students

From talking to the students, and from course evaluations, it is also clear that most of the teaching on the programmes, as well as the teachers, are highly appreciated by the students. The start of the programmes was for some international students perceived as quite overwhelming since everything was very new and information dense. A thorough introduction and a forum for a continuous dialogue with the students could assist the students in their introductions but also present areas for continuous improvement of the programmes to the staff.

The students are informed about their rights and responsibilities at the start of the programme. Uppsala University's rules and guidelines and information about student working conditions are also put on Studium. According to the self-assessment, extra emphasis is put on making sure that international students understand the study culture in Sweden and that students have to take responsibility for their own learning at the start of the programme.

The courses in both programmes use varied and student-activating teaching methods, such as group work, projects, labs (theoretical or practical), seminars, workshops and presentations. During our discussions with teachers on the programmes, we also felt that there is a lot of engagement in developing the teaching in the courses and using up-to-date teaching methods, including for example flipped classroom, case methodology and peer-review.

The Assessment Committee found that it is not possible to make separate comments about the two programmes regarding this assessment area.

### Strengths

- Students are informed about the Swedish study system and rules at Uppsala University
- The faculty has engaged teachers that use modern and student-activating teaching methods

### Suggestions for improvement

- We recommend investigating if there are student groups within the programmes that have a low finishing rate (for example comparing Swedish vs. international, fee paying vs non-fee paying or students with different basic educational backgrounds etc.), that would mandate





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further action in this area.

- We recommend and encourage to continue to evaluate and implement modern teaching methods in addition to traditional ones.
- We recommend that the students should be introduced in how to work in groups early in the programme, as we believe there is a special need due to the diverse background of the students. Also, close supervision in the first group sessions would be valuable.

### **4. The achievement of intended learning outcomes is assessed using appropriate methods and in compliance with the legislation, and that progression is ensured**

Teaching and examination is based on the objectives of the courses. A variety of different examination forms are used to ensure examination of the intended learning objectives. Exam questions and assignments are said to cover all course objectives. Some of the courses include joint group exercises where the students submit a project together. However, each student is examined individually which reinforces that the examination is appropriate. Programme objectives focus on the progress of the student, starting with testing of knowledge and understanding and finishing with presentation, synthesis and applying the knowledge to real world problems through the final project.

All submitted texts undergo automatic plagiarism review in a program.

The self-assessment presents the challenges during the covid-19 with regard to assuring the identity of the students during examination at home exams. The teachers have used a number of methods to ensure correct examination (randomised questions, essay-type questions, plagiarism checks).

The progression of educational elements seems not to be well covered, i.e. do the students systematically get more advanced exercises in respect to e.g. writing, oral presentations and group work and is this progression described for the student.

The self-assessment does not address how the progression is ensured in the programmes. It is therefore hard to fully assess how the progression for each programme is ensured, especially when it comes to general skills, and how it is perceived by the students. Progression in both skills and knowledge should be assured within an education programme and can be done by making sure that the content of the courses build on each other, so that students gain both a deeper knowledge and more advanced skills throughout their studies. Each teacher thus needs to be aware of what has been taught in earlier courses and should assure that the students acquire competence that is relevant for the courses to come. Clear communication of such progression from teachers and program coordinators might also help the student to understand “why the programme is built as it is”.

The balance between compulsory and elective courses is not optimal, as many courses are compulsory in both programmes, in particular in LMM where the course set seems to be fixed when doing a 45-credit diploma work.

An assessment of the programmes with the aim to remove overlapping courses from the obligatory course set in favour of courses in pharmacology, formulation and regulatory affairs could be made. There is e.g. a course “Regulatory Requirements and Quality Assurance” although this is only given in





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Swedish at the moment. This could be quite relevant especially for the LMU students alongside with "Drug Safety and Pharmacovigilance". Which courses are the most critical/decisive for future employment should be assessed.

The students also pointed out that the selection process of elective courses should be parallel to choosing the Master's project so the students are aware of which group he/she will do their degree project in, so they can choose the elective courses based on this to support their Master's project in the best way possible.

The Assessment Committee found that it is not possible to make separate comments about the two programmes regarding this assessment area.

### Strengths

- The courses use a variety of different examination forms.
- Coupling between the course ILOs and the examination exists.
- Individual examination even when the students are working in groups
- Students are well informed about ethics and the importance of avoiding plagiarism.

### Suggestions for improvement

- We recommend that the programme and course ILOs should be monitored continuously, since the development of the field is rapid.
- We recommend that the students are more clearly guided through the programme via course prerequisites rather than specifying mandatory courses. Course prerequisites can be used to clarify what knowledge is needed to follow a course and ensure progression between courses.
- We recommend that the progression of a compound through the drug discovery and development process is used as it is well introduced in the introductory course. It is not clear if this is followed up in the following courses, such that the students do not lose track. There is seemingly a lack of some elements in the series of courses, such as pharmacology/toxicology, pre-formulation and formulation, quality assurance and regulatory affairs. The need may differ between LMM and LMU.
- We recommend that the sequential course series covering from discovery to clinical development should be used as this was pointed out from the students we interviewed. For example, there seems to be some overlap between the clinical courses within the LMU programme.
- We recommend that the "PUFF-strimman", which promotes the development of translatable skills, could be developed to include also the international programmes as it seems to work very well for the Swedish-speaking programmes.



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### **5. The staff involved in the study programme possess current subject area and teaching and learning in higher education/discipline-based skills, and that there is sufficient teaching capacity**

The Assessment Committee has met with multiple teachers from the Faculty of Pharmacy at Uppsala University, which demonstrated enthusiasm, knowledge in the field and high pedagogical skills. There also is an ambition of continuous development of the courses with the introduction of modern teaching/learning techniques. The teachers involved have relevant higher educational pedagogical education and/or work in teams with senior teachers with higher educational pedagogical education, which means that more experienced teachers support more junior teachers.

Undergraduate teaching workshops are arranged (three full days/year) where participation is expected. The Faculty's Directors of Studies meet once a month to discuss ongoing educational issues. The Study Directors within each department also meet once a month together with the Deputy Head of Department. Each Director of Studies has regular meetings with their own group of teachers. Thus, there seems to be a well-established organisation of fora to discuss educational issues on various levels at the Faculty. The Assessment Committee were not presented with plans, evaluations/follow up and action plans from these fora but got the impression that this structure works well and is under continuous development.

There is a Pedagogical Council (PRåM) with the role to be a subject didactic node for pedagogical development and to promote high quality education according to Uppsala university's goals and strategies. PRåM provides support to education committees and individual teachers and disseminates information within pedagogical development in science.

The teachers are active scientists and the strong research environment means that courses can be updated based on state-of-the-art and frontline research.

At the site visit the Assessment Committee did not get any signals on either understaffing or overstaffing in the various courses of the programmes.

The Assessment Committee found that it is not possible to make separate comments about the two programmes regarding this assessment area.

### **Strengths**

- The faculty has many knowledgeable and motivated teachers that are experts in their field, and teaching follows the expertise of each lecturer.
- A well functioning structure of fora on different levels where pedagogical developments and educational issues are discussed.
- External experts, especially from the industry, are involved in the teaching.

### **Suggestions for improvement**

- We recommend to continue to develop the structure of fora on different levels and in different constellations where pedagogical developments and educational issues are discussed. Make sure that there is a clear vision for what is to be achieved, make plans for the continuous



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development and improvement and make sure that continuous progress is achieved.

- We recommend to strengthen and broaden the collaboration with Pharma industry and stakeholders from other parts of the life science eco system for teaching, study visits, internships for students, Master's projects etc.

### **6. Internationalization, International Perspectives and Sustainability are Promoted**

A majority of the students in both LMU (60%) and LMM (80%) are international and come from many different countries worldwide. Thus, some international perspectives will be provided by the students themselves to enrich the experience of all involved students. This should be seen and used as a strength and an opportunity to learn more about intercultural opportunities and challenges in a global world.

Group work is an integrated part of most of the courses as well as in real working life. This also provides good connections between students from different backgrounds. Uppsala University has developed very good material on how to conduct group work (e.g. <https://www.medfarm.uu.se/admissions/puff/group-work/>).

The students we interviewed stated that they did not get in contact with any current students in the programme (e.g. in the form of mentoring) prior to coming to Sweden, but that they had now themselves been contacted by new students via the LinkedIn page that was recently set up as an alumni network. Some kind of study orientation and/or mentoring/tutoring by students already in the programme may prove beneficial for the integration process of new students, especially given they come from different countries and backgrounds. Here it is important that Swedish students also involve themselves and take active part and use the benefits of being part of an international programme.

International students have not chosen to be very active in the student union activities, possibly due to language barriers, since much of the activities are in Swedish. A suggestion could be that the international students have a section within the student union, if this is seen as beneficial. Alternatively, and as a complement, many more student activities may be carried out in English.

The overall theme of both Master's programmes, i.e. drug discovery and development, is in itself international, and most, if not all, procedures and methodologies are internationally accepted. However, there are some differences in regulatory requirements which are recognised. As the self-assessment document outlines, the regulatory requirements for drug approval from different international agencies (FDA and EMA) are covered especially in the courses "Clinical Pharmacokinetics and Pharmacodynamics" and "Drug Discovery and Development".

The sustainability perspective is part of several courses, e.g. using *in silico* techniques. However, it seems this could be more systematically communicated to the students. It is nowadays quite customary to be required to justify which UN SDG's (United Nations Sustainable Development Goals) are relevant for projects, courses and articles produced at a university. This aspect could also be highlighted for LMM and LMU.

The Assessment Committee found that it is not possible to make separate comments about the two programmes regarding this assessment area.



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### Strengths

- Group work is more or less inevitable in the working life, so getting familiarised with this type of working method during the studies is of huge benefit. This provides an especially useful means of dealing with people from different backgrounds, which is more or less inevitable in working life within this field.

### Suggestions for improvement

- We recommend that the graduation symposium is held in English.
- We recommend the implementation of a mentoring system for the new students. There is no systematic study orientation offered for new international students, which may make it difficult for them to integrate and get to know the new studying environment and culture.
- As the students suggested, we recommend that a get-together is arranged for graduate students, second year students, and new students at least in the beginning of each semester so everyone would share the experience so far and the students can increase their network.
- We recommend a workshop on 'cultural intelligence' for both teachers and students, which should minimise the risk of culture clashes.
- We recommend that the guide on group work from Uppsala university is actively presented to the students and the progression in teamwork should be followed up over time during the programmes.
- We recommend an improvement of the interaction between the student union "Farmaceutiska studentkåren" and international students in order to better integrate new international students into the student culture.
- We recommend that sustainability perspective is more clearly presented to the students throughout the studies.

## 7. A Gender Equality Perspective is integrated into the Study Programme

The title suggests that this aspect entails only gender aspects, but here all aspects of equal opportunity are considered.

According to the self-assessment, all courses in the programmes provide information about Uppsala Universities' policies regarding equal opportunities in their introductory lectures. Additionally, the faculty course template in Studium provides a link to departmental information about equal opportunities. The department is also currently working on clarifying its routines for when issues relating to equal opportunities arise. Seminars about equal opportunities are also offered to teachers occasionally.

From discussions with students, course evaluations and the alumni survey, we did not identify general problems related to discrimination on any grounds. However, in one of the course evaluations, a student comments that there is a lot of racism between students and that some students are unwilling to



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work with particular students. In several of our discussions with teachers, issues with group work were mentioned. There was no mention of issues relating to racism, but sometimes students with different educational backgrounds were found to not work well together (for example Apotekare and Master's students). Although this can be just due to different knowledge, it might also be due to differences in study techniques and study culture between Swedish and international students, which can potentially be perceived as racism.

One weak point, mentioned also in the self-assessment, is that some elective courses are only offered in Swedish and some documents and activities are only provided in Swedish. This will of course exclude most international students from such courses and create fewer opportunities for taking part in activities related to their studies.

The Assessment Committee found that it is not possible to make separate comments about the two programmes regarding this assessment area.

### Strengths

- Information about equal opportunity policies is communicated to students in each course to make sure every student knows that there is a zero tolerance policy regarding discrimination.

### Suggestions for improvement

- We recommend that the programme ensures that all courses, documents and activities communicated or advertised as part of the programmes should be available in English.
- We recommend that active measures are proactively taken to certify that no discrimination is taking place between students or student groups, both during group work and in other study related situations. This could be performed e.g., by the tutors being aware that discrimination might also occur between students in groups; and by following on students comments on the issue in course evaluations and also in informal contacts with the teachers.

## 8. The Study Programme Meets Individuals' and Society's Needs for Learning and Professional Knowledge and Prepares The Students for Future Careers

Based on the materials we were given, the employment data is a bit unclear. It is stated that 19 out of 28 have a job after 6 months, and the employment rate is 85% after one year. It is unclear if all students answer this questionnaire. During the discussions we were informed that almost 50% go on to PhD studies. Is this realistic/according to demand - are they educated for the working life or for the university? It may be that in order to get to work with any kind of R&D in Pharma industry, a doctoral degree would be required. In light of this, it may be important to learn what especially LMU graduates can work with after graduation if moving directly to industry.

Several lectures are given by external lecturers, which give a good view of the tasks and working environment the students might end up in after graduation.

There are ample local industries in Uppsala/Mälardalen area and the connections to alumni seems to be good. In addition, companies usually want to advertise themselves, so it should be a win-win



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situation to keep companies involved in the continuous development and teaching activities of both programmes.

The Master's project is the key component of hands-on practical work within the education. However, most practical work is expensive and resources are required that should be guaranteed by the university to ensure a sufficient knowledge base and infrastructure in this respect. The students themselves put forward that the objective of the programmes would be giving the students the opportunity to graduate with laboratory skills, some software skills, and be aware of the opportunities in industry, academia and authorities.

The faculty's good connections to society e.g. via their alumni association "Alumniföreningen Farmis" and external representatives in "Farmaceutiska rådet" could be utilised more in the follow-up and continuous development of the international Master's programmes. These have been widely used to evaluate relevance to the field for the Swedish Receptarie/Apotekar programmes, but not so much for the international programmes to date. Members from these could function e.g. as an external advisory board, and an obvious place to start could be the guest lecturers that are already actively taking part in teaching and that have positions outside Uppsala University.

In the course Clinical Pharmacokinetics and Pharmacodynamics (common to both programmes) the students come into contact with students from other educational programmes with both pharmacy and engineering backgrounds, which is also of benefit for future working life besides interacting with other students from different international backgrounds. Also in the course Drug Discovery & Development, there are biomedical students that provide their perspectives and views on DDD.

The Assessment Committee found that it is not possible to make separate comments about the two programmes regarding this assessment area.

### Strengths

- Importantly, the students feel they left the programmes well equipped for a future career as noted in the student alumni survey. However, the first students from the LMU programme graduated as late as June 2022.
- Uppsala University and the faculty have many very good connections to society e.g. via their alumni association "Alumniföreningen Farmis" and external representatives in "Farmaceutiska rådet" as well as industry representatives acting as guest lecturers in courses. SweDeliver was perceived as a driver from the student's side.
- The Master's projects can be carried out in industry and thus provide a smooth transition and very good preparation for future industrial work.

### Suggestions for improvement

- We recommend an improved survey and better follow-up in respect to what kind of job the students get and if they stay in Sweden or go back to their home country or elsewhere after graduation.



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- We recommend that efforts are made to provide students with an industrial Master's project. This may lead to future employment and even if not, this is undoubtedly an important knowledge to have for future career selection.
- We recommend the introduction of an elective individual course in research training to secure a good preparation of the students for the Master's project. The students put forward that they wished for more proper preparation ("**videos cannot replace hands-on work**") for the Master's project, e.g. in the form of lab orientation.
- We recommend a systematic follow-up system to ensure continuous industrial relevance. Thus, an external advisory board could be helpful in this respect. This course of action would also add to the LMM/LMU programmes being more widely known within the field/industry, which is currently allegedly not the case.
- We recommend that the students get opportunities to attend conferences or participate in competitions organised by the programme committee or external opportunities of this type.

## 9. Students/Doctoral students have Influence on the Planning, Implementation and Follow Up of the Study Programme

The LMM and LMU programmes use course evaluations that are standardized by the faculty, but with the option to add additional questions. In the self-assessment, the programmes report that course coordinators and course representatives meet and write a course report based on the evaluation. The report is then discussed in GRUFF. However, the programmes also indicate that it is sometimes difficult to find student representatives that are willing to take part in the course report work.

Additionally, most of the courses are taken by multiple educational programmes, and it is not stated if the course evaluations or other comments are discussed on the programme level or only on a course level. If the courses are not discussed on a programme level (i.e., with students from each programme taking the course), they could be developed to fit programmes with higher student numbers rather than programmes with fewer students. Hence, it is unclear to what extent the students of LMM and LMU programmes are involved in the planning of future improvements to the courses in reality and if the planned changes are according to the experience of these student groups. For instance, the students that the Assessment Committee interviewed were of the opinion that the courses "Molecular imaging" and "Clinical trial methodology" could be introduced as elective courses, and that the Molecular imaging in the first semester would be replaced with a statistical analysis course, and Clinical trial methodology course with an internship. They were of the opinion that the concepts and updates concerning molecular imaging could be included as an overview in the first course. The students also wished for introducing more R so they can graduate with both analytical and laboratory skills.

There are currently no regular meetings between student representatives and programme coordinators (or other programme representatives) to discuss the courses in the programme outlines from a programme perspective or the programme content and structure. Importantly though, the alumni survey suggests that the students think the teachers are open to their opinions, which indicates that the students still feel that they can influence their education. During discussions with current students, it also seemed like the programme coordinators were easily approached and listened to suggestions.





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When interpreting the answers in the alumni survey it is important to consider that the large majority of students who filled out the survey are from the LMM programme (22 out of 28) and the remaining students from the LMU programme did not attend the international Master's programme, but the prior national version of the programme. Hence, the responses might not reflect the opinions of students from both programmes nor the current international students in the LMU programme.

The Assessment Committee found that it is impossible to make separate comments about the two programmes regarding this assessment area.

### Strengths

- Course evaluations are done for all courses and are followed up by teacher, students and GRUFF.
- Several good channels for communication between teachers and students are available, with both open or anonymous options; where students can pose questions to increase their understanding of the course in general or specific tasks. The students we met seemed satisfied with the contact opportunities between everyone involved in the program; students and teachers/staff.
- Alumni expressed that teachers listened to their opinions during their Master's studies.

### Suggestions for improvement

- We recommend regular formalized meetings between the programme coordinators (and possibly other programme representatives) and students to ensure that programme-specific issues can be detected and considered in both course and programme development.
- We suggest setting up programme committees (one per programme) that include student representatives, where the quality and development of the programme can be discussed and decided upon.

## 10. An Appropriate Study Environment is Available to all Students/Doctoral students

Overall, the study environment seems very good. The students are well informed about courses and options on how to plan their studies. There are updated room for modern interactive teaching available, that we visited during the Site visit. The students also have various channels to get in contact with teachers, the study adviser or programme coordinators in case of any questions they may have. This contact can also take place anonymously in some cases.

In case of more general problems with several students not able to successfully follow the courses an assessment and determination of the reason for this might be warranted. Moreover, a system for following up on any measures taken needs to be in place.

Students that miss compulsory course components are afforded the opportunity to complete these components the next time the course is given. Most courses are given twice per year so there are multiple occasions for a student to complete these. There are 2-4 formal examinations for each course



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per year with no limit to the number of re-examinations. There is no additional payment required for re-examination.

The Assessment Committee found that it is not possible to make separate comments about the two programmes regarding this assessment area.

### Strengths

- There is an experienced study adviser available to discuss options with the students.
- The programme coordinators are very engaged and close to the students, continuously answering any questions the students may have.
- Several digital platforms for communication with the teachers and fellow students are available and seem to work very well.
- The teachers we met seemed very qualified in their subject and engaged in their course, thus providing different teaching modalities and options for learning, e.g. lectures, seminars, laboratory work, flipped classroom, role play, speed dating, different types of project tasks and essay work.

### Suggestions for improvement

- We recommend a systematic assessment of more general problems which may cause difficulties for the students and a follow up of measures taken.
- We recommend increased time is set aside for the Programme coordinators (today 10%). We got the impression their work load is larger than that.

## 11. Continuous Follow-up and Development of the Study Programme is carried out

The two programmes are currently followed up officially according to the Uppsala University guidelines, and this review is part of the process. Programme coordinators carry out discussions with the course coordinators and lecturers to ensure that the programmes are up-to-date. Follow up on the student satisfaction is carried out through evaluations following each course. Follow up on student employment has started using a dedicated LinkedIn group.

The yearly action plan for continuous improvement of the programmes is developed according to guidelines from the Disciplinary Domain of Medicine and Pharmacy. The action highlights various parts of the programmes that need to be improved.

The Assessment Committee found that it is not possible to make separate comments about the two programmes regarding this assessment area.

### Strengths

- The faculty of pharmacy at Uppsala University has a streamlined routine for follow up on programs that involve self-assessment and reviews by external referees on a regular basis.



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- The programme coordinators are active scientists and the strong research environment means that courses can be updated based on state-of-the-art research.
- The programme coordinators have initiated a follow-up on students' employment after graduation through LinkedIn.

### Suggestions for improvement

- We recommend to form a programme council that includes representatives from the industry and other stakeholders in the life science ecosystem and that meets regularly to follow up on all aspects of the programmes, and in particular on the courses that are offered at each stage.