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Appendices for the Master's degree programme(s) in Medical Pharmaceutical Sciences

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Appendix I Learning outcomes of the degree programme (art. 3.1)

A graduate Medical Pharmaceutical Sciences (MPS) is able to:

1. Explain in detail the major underlying principles within the field of Medical and Pharmaceutical Sciences and integrate knowledge of etiology and pathophysiology of disease to design and develop more effective and safer drugs (knowledge).
2. Identify new developments within the field of Medical Pharmaceutical Sciences and can become familiar with these developments (Lifelong learning skills)
3. Critically appraise the results of research in 'medical pharmaceutical sciences' and/or in the dedicated specialisms 'drug toxicology and translational technology', 'pharmaceutical design and engineering' or 'pharmacoepidemiology and pharmacoeconomics' (knowledge and judgement).
4. Formulate hypotheses, design and conduct scientific research, manage and interpret data and demonstrate proficiency in statistical analyses for Medical Pharmaceutical Sciences (application).
5. Systematically organize his/her work in scientific research and formulate realistic and original solutions to complex problems (application).
6. Critically evaluate scientific data from experiments or literature, and offer sound arguments to justify a position (judgment and communication).
7. Work independently as well as in a team to solve scientific and societal challenges related to medical pharmaceutical sciences (application).
8. Effectively communicate scientific concepts to specialists as well as to a lay audience through oral and written presentations (communication).
9. Identify societal and ethical implications of Medical Pharmaceutical Research and acts according to the scientific code of conduct (judgement).
10. Evaluate and reflect on personal capabilities and motivation for a (international) scientific, policy or business career, and has knowledge and skills to develop their own career (lifelong learning skills).

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Appendix II Tracks of the degree programme (art. 3.6)

1. Within the degree programmes, the student chooses one of the Research-tracks written below (R-track), or one chooses the **Science, Business and Policy**-track ("SBP-track"), which prepares for professions in a societal, political and/or commercial context.

2. Within the degree programme Medical Pharmaceutical Sciences, the R-track **Drug Toxicology and Translational Technology**, provides students training as a researcher mainly in the field of adverse drug reactions.

3. Within the degree programme Medical Pharmaceutical Sciences, the R-track **Pharmacoepidemiology and Pharmacoeconomics**, provides students training as a researcher in the area of pharmacovigilance, database research, observational and trial intervention methodology and utilization studies with specific attention to the role of pharmaceuticals in healthy ageing.

4. Within the degree programme Medical Pharmaceutical Sciences, the R-track **Pharmaceutical Design and Engineering**, provides students training as a researcher in the areas of target identification, drug design, biologics, biotechnology, and innovative drug and dosage forms.

5. Within the degree programme Medical Pharmaceutical Sciences, students selected for the mobility programme Sustainable Drug Discovery are trained in inter-and trans-disciplinary skills in the different fields of drug discovery, with a focus on sustainability. For this mobility programme, specified Teaching and Examination Regulations and admission rules apply. Further information is available on: https://sustainabledrugdiscovery.eu/

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Appendix III. Content of the degree programme (art. 3.8)

The degree programme Medical Pharmaceutical Sciences offers the following Research tracks (R-track): Drug Toxicology and Translational Technology, Pharmacoepidemiology and Pharmacoeconomics and Pharmaceutical Design and Engineering as well as a Science, Business and Policy track (SBP-track).

General requirements for all MPS R-Tracks:

Course unit	ECTS	Course code	Practical	Entry requirements
research project (RP)	≥40	WMMP901-XX or WMMP902-XX	x	Safe Microbiological Technique certificate#
research project (RP)	≥30	WMMP901-XX or WMMP902-XX	x	Safe Microbiological Technique certificate#
colloquium	5	WMMP001-05	x	
essay	5	WMMP002-05	x	-
Drug Development: from Design to Evaluation	5	WMMP006-05		
Academic Skills	5	WMMP012-05	x	
track-specific mandatory courses	15-18*		see app. IV	see appendix IV
electives	12-15*		see app. IV	see appendix IV

Students who have not obtained a Safe Microbiological Technique certificate (VMT in Dutch) have to include the MBS course in the first year of their study programme.
* Depending on the chosen track.

General requirements for the SBP-track:

Course unit	ECTS	Course code	Practical	Entry requirements
research project (RP)	≥30	WMMP901-XX	x	Safe Microbiological Technique certificate#
colloquium	5	WMMP001-05	x	
Drug Development: from Design to Evaluation	5	WMMP006-05		
Academic Skills	5	WMMP012-05	x	
Introduction to Science & Business	10	WMSE001-10	x	-
Introduction to Science & Policy	10	WMSE002-10	x	-
work placement SBP	40	WMSE902-40	x	RP, course units S&B and S&P
electives	15		see app. IV	see appendix IV

Students who have not obtained a Safe Microbiological Technique certificate (VMT in Dutch) have to include the MBS course in the first year of their study programme.

The following rules apply to all tracks:

- The first research project must be performed at the Faculty of Science and Engineering (FSE) or the University Medical Center Groningen, under supervision of one of the appointed examiners. The grade of the first research project must be registered before a second research project or the SBP-internship can be started.
- It does not matter in which order a student does the ≥40 ECTS project and the ≥30 ECTS project. A student is allowed to do the ≥30 ECTS project in the first year and the ≥40 ECTs project in the second year.
- The student chooses or is assigned a study mentor from the list to advise and discuss the contents of the individual degree programme, before sending a signed programme proposal for approval to the Board of Examiners.
- The tracks Drug Toxicology and Translational Technology, Pharmacoepidemiology and Pharmacoeconomics, Pharmaceutical Design and Engineering and Sustainable Drug Discovery have designated mentors, as mentioned on the student portal.
- All elements of the individual programme must be approved by the Board of Examiners before their start.
- The research projects, colloquium and essay must deal with different research subjects, and must be supervised by different examiners appointed for MPS. The subject of the SBP-track internship must be clearly related to the scientific domain of MPS (see Appendix I). To conduct an SBP-internship, you will need 1. an SBP-examiner, and 2. a 'non-SBP MPS examiner'. The colloquium cannot be done in the Science & Society group or under supervision of an SBP-examiner in case you follow the SBP-variant.
- Electives can be:
    - an extension of a research project. The research project can be registered as 30, 35, 40, 45 or 50 ECTS project. Propositions for extensions of 10-15 ECTS must be requested before the start of the research project. Arrangements for extensions of 5-10 ECTS may also be made during the midterm evaluation. The research project cannot exceed 50 ECTS.
    - extra course units (see appendix IV).
    - a research assignment of 5 or 10 ECTS.

Track-specific requirements for Medical Pharmaceutical Sciences:

The course units Drug Development: from Design to Evaluation and Academic Skills are mandatory for all MPS students except students in the Sustainable Drug Discovery track.

Additional requirements for the research track Drug Toxicology and Translational Technology:

- the subject of one research project (≥40 ECTS) and the subject of either the essay or the colloquium is chosen in the field of Toxicology and/or advanced translational models for drug testing.
- 15 ECTS track-specific courses are filled with the following courses:
-

a. Track-specific mandatory courses (10 ECTS):

Course unit	Course code	ECTS
Molecular Toxicology	WMMP007-05	5
Advanced Pharmacokinetics	WMMP005-05	5

b. A minimum of 5 ECTS from the following list:

Course unit	Course code	ECTS
Pharmacovigilance (biennial, runs in 2022/2023)	WMMP011-05	5
Laboratory Animal Science	WMBY026-05	5
Reproductive Toxicology and Epidemiology	WMMP010-05	5
Nanomedicine and Advanced Pharmaceutics	WMMP018-05	5
Clinical Toxicology	WMFA042-05	5

- 15 ECTS of electives chosen from the elective courses as listed in appendix IV.

Additional requirements for the research track Pharmacoepidemiology and Pharmacoeconomics:

- the subject of one research project (≥40 ECTS) and the subject of either the essay or the colloquium is chosen in the field of Pharmacoepidemiology and/or Pharmacoeconomics.
- 18 ECTS track-specific courses are filled with the following courses:

Course unit	Course code	ECTS
Basics in Medicine	GKCPE001	8
Clinical Pharmacoepidemiology*	WMMP015-05	5
Pharmaco-epidemiology in Practice OR Pharmacoeconomics **	WMFA041-05 OR WMFA040-05	5

* students who accomplished the equivalent course phar-epi (= pharmacoepidemiology (EN)/ farmacoepidemiologie (NL)) in their bachelor programme will be exempted from this requirement. The remaining 5 ECTS should be considered as 5 ECTS extra electives in their master programme.
** Students who did Introduction to Pharmacoeconomics in their Bachelor could also only take Advanced PharmacoEconomics.

- ≤ 12 ECTS of electives chosen from the elective courses as listed in appendix IV. Recommended courses in this elective space are:

Course unit	Course code	ECTS
Advanced Pharmacoeconomics	WMFA001-05	5
Pharmacovigilance (biennial, does not run in 2023/2024)	WMMP011-05	5
Reproductive Toxicology and Epidemiology	WMMP010-05	5

Additional requirements for the research track Pharmaceutical Design and Engineering:

- the subject of one research project (≥40 ECTS) and the subject of either the essay or the colloquium is chosen in the field of target identification, drug design, biologics, biotechnology, or innovative drug and dosage forms.
- 15 ECTS master courses are filled with the following courses:
  a. Track-specific mandatory courses (10 ECTS):

Course unit	Course code	ECTS
Green Chemistry	WMMP017-05	5
Sustainable Drug Design and Engineering	WMMP016-05	5

b. A minimum of 5 ECTS from the following list:

Course unit	Course code	ECTS
Molecular Toxicology	WMMP007-05	5
Translational Research in Respiratory Disease	WMBM015-05	5

- 15 ECTS of electives chosen from the elective courses as listed in appendix IV. Recommended courses in this elective space are

Course unit	Course code	ECTS
Nanomedicine and Advanced Pharmaceutics	WMMP018-05	5
Medicinal Natural Products	WMFA051-05	10

Additional requirements for the mobility programme Sustainable Drug Discovery. Students selected for this mobility programme follow this set of courses while at the University of Groningen. For this mobility programme, specified Teaching and Examination Regulations and admission rules apply. Further information is available on: https://sustainabledrugdiscovery.eu/

Course unit	Course code	ECTS
Drug Development: from Design to Evaluation	WMMP006-05	5
Sustainable Drug Design and Engineering	WMMP016-05	5
Advanced Pharmacokinetics	WMMP005-05	5
Green Chemistry	WMMP017-05	5
Nanomedicine and Advanced Pharmaceutics	WMMP018-05	5
Essay or Colloquium	WMMP002-05 or WMMP001-05	5

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Appendix IV Electives (art. 3.9.1)

Table 1 lists study elements that can be chosen as electives in MPS.

Additional knowledge may be required in specific course units. These requirements will be published on Ocasys. For up to date information regarding the courses, such as assessment, entry requirements and learning objectives, Ocasys is leading.

After consultation with the study mentor and approval of the Board of Examiners, students may also choose from options available from other departments, other universities in the Netherlands or even abroad.

Table 1: Elective courses organised by Medical Pharmaceutical Sciences or other master programmes

Course	Course code	ECTS
Advanced Light Microscopy	WMBY016-05	5
Advanced Pharmacoeconomics	WMFA001-05	5
Advanced Pharmacokinetics	WMMP005-05	5
Advanced Statistics	WMBY018-06	6
Applied statistics and modeling	WMBM028-05	5
Behavioural Pharmacology	WMBC003-05	5
Big Data & Applications in biomedicine	WMBM025-05	5
Clinical Pharmacoepidemiology *	WMMP015-05	5
Clinical Toxicology	WMFA042-05	5
From Big Data to Personalised Medicine	WMBM008-05	5
Green Chemistry	WMMP017-05	5
iGEM (International Genetically Engineered Machine competition) **	Varies	20
Introduction to Science & Business	WMSE001-10	10
Introduction to Science & Policy	WMSE002-10	10
Laboratory Animal Science	WMBY026-05	5
Lerarenopleiding: Basiscursus ^	TEM0105	5
Lerarenopleiding: Masterstage 1^	TEM0205	5
Medicinal Natural Products	WMFA041-10	10
Microbiological Safety	WMMP004-01	1
Molecular Toxicology	WMMP007-05	5
Nanomedicine and Advanced Pharmaceutics	WMMP018-05	5
Neurobiology of Psychiatric Disorders	WMBM018-05	5
Orientation on International Scientific Careers	WMBY014-05	5
Pharmacoeconomics	WMFA040-05	5
Pharmaco-epidemiology in Practice	WMFA041-05	5

Pharmacovigilance (biennial, does not run in 2023/2024	WMMP011-05	5
Programming C++ for Biologists	WMBY010-05	5
Quantitative Bioanalysis	WMFA049-05	5
Radioisotopes in Experimental Biology	WMBY011-05	5
Reproductive Toxicology and Epidemiology	WMMP010-05	5
Skills in Science Communication (2a)	WMEC006-05	5
Sustainable Drug Design and Engineering	WMMP016-05	5
Tools and Approaches of Systems Biology	WMBS005-05	5
Translational Research in Respiratory Disease	WMBM015-05	5

* students who accomplished the equivalent course phar-epi (= pharmacoepidemiology (EN)/ farmacoepidemiologie (NL)) in their bachelor programme are not allowed to take this course.

** Selection for this competition takes place in winter time, an advertisement about application details will be announced via the student portal during the academic year. Maximum of 10 ECTS of the available 20 ECTS can be registered within elective space, the rest will be extracurricular credits.

^ Course unit offered in Dutch only.

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Appendix V Entry requirements and compulsory order of examinations (art. 4.4)

Course unit	Entry requirement
Research project 1	Safe Microbiological Technique certificate
Research project 2	Research project 1 + Academic Skills
Work placement Science Business & Policy	Research project 1 + courses Science & Business and Science & Policy

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Appendix VI Admission to the degree programme

(art. 2.1A.1 + 2.1B.1)

1. Requirements for admission to the master degree in Medical Pharmaceutical Sciences

Holders of the following Bachelor's degrees from the University of Groningen are considered to have sufficient knowledge and skills and will be admitted to the Master's degree programme in Medical Pharmaceutical Sciences on that basis:

- a Bachelor's degree in Pharmacy.

- a Bachelor's degree in Biology OR Life Science & Technology (old curriculum, prior to 2020/2021) with one of the following majors:
  - Biomedical Sciences with the following course units from Pharmacy:
    - Medicine Groups: Endocrine System and Digestive and Respiratory Tract
    - Medicinal Chemistry & Biophysics
    - Organic & Biosynthesis OR Bio-organic Chemistry (WBBY050-05)
    - Pharmacokinetics
    - Metabolism & Toxicology.

  - Molecular Life Sciences with the following course units from Pharmacy:
    - Medicine Groups: Endocrine System and Digestive and Respiratory Tract
    - Medicinal Chemistry & Biophysics
    - Organic & Biosynthesis OR Bio-organic Chemistry (WBBY050-05)
    - Pharmacokinetics
    - Metabolism & Toxicology.

- A Bachelor's degree in Life Science & Technology (new curriculum from 2020/2021 onwards) with the following courses:
  - Pharmacokinetics
  - Metabolism and Toxicology
  - Biostatistics
  - Pharmacoepidemiology
  - One from:
    - MG: Endocrine System and Digestive and Respiratory Tract
    - MG: Circulatory Tract
    - MG: Infectious Diseases and Oncology
    - Collected Medicine Groups
    - Drugs for the Central Nervous System
  - A Bachelorproject in a field suitable for MPS – Course code WBFA903-15

- A Bachelor's degree in Chemistry with:
  - Chemistry of Life track
  - The following courses in their minor:
    - Medicinal Chemistry 1
    - Pharmacokinetics
    - Metabolism & Toxicology

Students lacking one or two of the above mentioned courses, may sometimes be admitted on the condition of including these courses within the electives of the master programme.

Students with a Bachelor's degree in a discipline closely related to pharmacy from another Dutch or foreign university may also qualify for admission. The respective bachelor program will be evaluated for relevant courses in molecular and cellular biology, biochemistry/organic chemistry, pharmaceutical sciences, chemical analysis, statistics. practical lab skills in medical pharmaceutical sciences and proof of academic scientific writing skills . The completeness and compatibility of the individual admission files is independently evaluated by two members of the Admission Board upon which a common decision for admission or rejection is reached. Both admission and rejection decisions have as a primary aim to warrant the interest of the student.

It is possible to appeal to the decision of the admission board via standardized procedures at the University of Groningen.

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Appendix VII Transitional provisions (art. 7.1)

Changes 2023-2024 MPS

Major and minor changes that take effect in the Medical Pharmaceutical Sciences programme as per 2023/2024 are listed below.

Tracks/track requirements:
The general Research track has been discontinued as of 2023/2024. Students from earlier cohorts in that track will still be able to graduate in it until 31st of August 2025. After that, the decision is up to the Board of Examiners.

Entry requirements
No changes

Courses
- Pharmacovigilance runs biennially. It will run again in 2024/2025.
- Pharmaceutical Design and Engineering (WMMP008-05) will change its name to Sustainable Drug Design and Engineering (WMMP016-05)
- Pharmaceutical Biotechnology (WMFA043-05) will change its name to Green Chemistry (WMMP017-05)
- Nanomedicine and Nanosafety (WMFA047-05) will change its name to Nanomedicine and Advanced Pharmaceutics (WMMP018-05)

Schedule
- Nanomedicine and Advanced Pharmaceutics will move from 1B3 to 1B2.

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Appendix VIII Additional Requirements Open degree Programmes (Art. 3.10)

Students wishing to pursue an open degree programme should file a request with the Board of Examiners.