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

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

Graduates Biomedical Sciences (BMS) are able to:

1. Explain in detail the major underlying principles of biomedical sciences (knowledge).
2. Manage and interpret (big) data and demonstrate proficiency in computing technology for biomedical sciences (application).
3. Formulate solutions to biomedical issues both theoretical, technical and in a practical laboratory setting (knowledge and application).
4. Critically evaluate scientific biomedical data and offer sound arguments to justify a position (judgement and communication).
5. Effectively communicate scientific concepts to specialists as well as to a lay audience through oral and written presentations (communication).
6. Critically appraise the role of 'biomedical sciences' and/or in the dedicated specialisms 'Biology of Ageing' or 'Biology of Cancer and Immune System', 'Biology of Food and Nutrition' and 'Neuroscience' research aiming on supporting healthy ageing (knowledge and judgement).
7. Work independently as well as in a team to solve scientific and societal challenges related to biomedical sciences (communication and application).
8. Independently draw conclusion on ethical issues in biomedicine and apply this to scientific or public discussions about the impact of such science on society (judgement).
9. Evaluate and reflect on personal capabilities and motivation for a (international) scientific, policy or business career (lifelong learning skills).
10. Develop an international perspective on up-to-date scientific advances and on-going biological science-related issues (knowledge and lifelong learning skills).

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Appendix II Tracks/Specializations of the degree programme
(art. 3.5)

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 Biomedical Sciences, the general R-track **Biomedical Sciences Research** track, provides students training as a researcher in various fields of biomedical sciences.
3. Within the degree programme Biomedical Sciences, the R-track **Biology of Ageing**, provides students training as a researcher mainly in the field of ageing and age-related pathologies.
4. Within the degree programme Biomedical Sciences, the R-track **Biology of Cancer and Immune System**, provides students training as a researcher mainly in the field of fundamentals and mechanisms of immunology, oncology, cell biology and related pathologies. This track is not only focussed on disease but also on how immunity and mammalian cells behave in health.
5. Within the degree programme Biomedical Sciences, the R-track **Biology of Food and Nutrition**, provides students training as a researcher mainly in the importance of food for a healthy microbiota in relation to brain function, metabolism and immunity.
6. Within the degree programme Biomedical Sciences, the R-track **Neuroscience,** provides students training as a researcher mainly in the field of Neuroscience. The track focuses on the role of higher brain functions both in health and in disease.

Appendix III Content of the degree programme (art. 3.6)

The degree programme Biomedical Sciences offers the following Research tracks (R-track): Biomedical Sciences Research, Biology of Ageing, Biology of Cancer and Immune System, Biology of Food and Nutrition and Neuroscience as well as a Science, Business and Policy track (SBP-track).

General requirements for all BMS R-Track:

Course unit	ECTS	Assessment	Practical	Entry requirements
research project (RP)	40	technical and/or laboratory skills, written report, oral presentation	x	Safe Microbiological Technique certificate[#]
research project (RP)	30	technical and/or laboratory skills, written report, oral presentation	x	Safe Microbiological Technique certificate[#]
colloquium	5	oral presentation	x	RP
essay	5	written report	x	-
master courses	≥ 30	see appendix IV	see app. IV	see appendix IV
electives	≤ 10	see appendix IV	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	Assessment	Practical	Entry requirements
research project (RP)	40	technical and/or laboratory skills, written report, oral presentation	x	Safe Microbiological Technique certificate[#]
colloquium	5	oral presentation	x	RP
master courses	5	see appendix IV	see app. IV	see appendix IV
course units: Science & Business and Science & Policy	2x10 = 20	assignment, exam	x	-
Workplacement Business and Policy	40	performance, written report, reflection report	x	RP, course units S&B and S&P
electives	≤ 10	see appendix IV	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, unless the student will conduct a research project that does not involve any laboratory work.

The following rules apply to all programmes:

- 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 for the respective master programme. The grade of the first research project must be registered before a second research project or the SBP-internship can be started.
- the student chooses or is awarded a study mentor from the list of the master programme 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 Biology of Ageing, Biology of Cancer and Immune system, Biology of Food and Nutrition and Neuroscience 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 BMS. The subject of the SBP-track internship must be clearly related to the scientific domain of the chosen master programme (see Appendix I). To conduct an SBP-internship, you will need 1. an SBP-examiner, and 2. a 'non-SBP BMS 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 master course units, including course units that are especially assigned as possible elective course units (see appendix IV).
  - a research assignment of 5, 10, 15 or 20 ECTS.

Additional requirements for Biomedical Sciences

Additional requirements for the general research track Biomedical Sciences Research

- 30 ECTS master courses are filled with the following courses:
  a. Courses (10 ECTS)

Course unit	ECTS
Biomedical Sciences: Professional Perspectives	5
Data Science in Biomedicine	5

  b. 20 ECTS of other master courses chosen from the BMS master courses as listed in appendix IV.

Additional requirements for the research track Biology of Ageing:

- topics of both research projects, essay, and colloquium are chosen within the biology of ageing research area.
- 30 ECTS master courses are filled with the following courses:
  a. Courses (20 ECTS)

Course unit	ECTS
Biomedical Sciences: Professional Perspectives	5
Data Science in Biomedicine	5
Current Themes in Healthy Ageing	5
Molecular Biology of Ageing and Age-related Diseases	5

  b. 5 ECTS from the following list of courses:

Course unit	ECTS
Advanced Metabolism & Nutrition	5
Immunology: from Bedside to Bench and Back	5

Neurodegenerative Diseases	5
Stem Cells & Regenerative Medicine	5
Microbiome and Health	5

c. 5 ECTS from the following list of courses:

Course unit	ECTS
Advanced Light Microscopy	5
Advanced Imaging Techniques	5
Practical Bioinformatics for Biologists	5
Scientific Writing	5
From Big Data to Personalised Medicine	5
Editing, Regulating and Targeting Genomes with CRISPR-Cas9	5

Additional requirements for the research track Biology of Cancer and Immune System:

- the subject of one research project (≥40 ECTS) and the subject of either the essay or the colloquium is chosen in the field of cancer and immune system research area.
- 30 ECTS master courses are filled with the following courses:

a. Courses (15 ECTS)

Course unit	ECTS
Biomedical Sciences: Professional Perspectives	5
Data Science in Biomedicine	5
Immunology: from Bedside to Bench and Back	5

b. 15 ECTS from the following list of courses:

Course unit	ECTS
Current Themes in Oncology#	5
Cancer Research#	5
Stem Cells & Regenerative Medicine	5
Microbiome and Health	5
Editing, Regulating and Targeting Genomes with CRISPR-Cas9	5
From Big Data to Personalised Medicine	5
Translational Research in Respiratory Disease	5

choose at least one of these 2 course units

Additional requirements for the research track Biology of Food and Nutrition:

- topics of both research projects, essay, and colloquium are chosen within the food and nutritional life sciences research area.
- 30 ECTS master courses are filled with the following courses:

a. Courses (15 ECTS)

Course unit	ECTS
Biomedical Sciences: Professional Perspectives	5
Data Science in Biomedicine	5
Advanced Metabolism & Nutrition	5

b: 15 ECTS from the following list of courses:

Course unit	ECTS

Nutrition in Medicine	5
Neurobiology of Nutrition	5
Microbiome and Health	5
Nutrition, Brain Development and Cognition	5
From Big Data to Personalised Medicine	5

Additional requirements for the research track Neuroscience:

- topics of both research projects, essay, and colloquium are chosen within the neuroscience research area.
- 30 ECTS master courses are filled with the following courses:
  a. Courses (25 ECTS)

Course unit	ECTS
Biomedical Sciences: Professional Perspectives	5
Data Science in Biomedicine	5
Neurodegenerative Diseases	5
Behavioral Pharmacology	5
Neurobiology of Psychiatric Disorders	5

b. 5 ECTS from the following list of courses:

Course unit	ECTS
Advanced Imaging Techniques	5
Nutrition, Brain Development and Cognition	5
Molecular Biology of Ageing and Age-related Diseases	5

Appendix IV Electives

(art. 3.7.1)

Table 1-3 below list study elements that can be chosen as 'master courses' or 'electives' in BMS. 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.
Table 4 and 5 list courses that can only be chosen as 'electives' in BMS. 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: Master courses available for BMS

Course	ECTS
Advanced Metabolism & Nutrition	5
Big Data & Applications in biomedicine	5
Applied statistics and modelling	5
Current Themes in Healthy Ageing	5
Current Themes in Oncology	5
Immunology: from Bedside to Bench and Back	5
Molecular Biology of Ageing and Age-related Diseases	5
Neurodegenerative Diseases	5
Scientific Writing	5
Stem Cells & Regenerative Medicine	5
Cancer Research	5
Nutrition in Medicine	5
Neurobiology of Nutrition	5
Microbiome and Health	5
Nutrition, Brain Development and Cognition	5
Editing, Regulating and Targeting Genomes with CRISPR-Cas9	5
Biomedical Sciences: Professional Perspectives^	5
Data Science in Biomedicine	5
From Big Data to Personalised Medicine	5
Translational Research in Respiratory Disease	5
Neurobiology of Psychiatric Disorders	5

^Students who follow the SBP-track cannot choose this course unit as part of the (elective) master courses.

Table 2: Medical Pharmaceutical Sciences and Pharmacy Master courses

Course	ECTS
Drug Development: from Design to Evaluation	5
Pharmacovigilance (biannual 21-22)	5
Nanomedicine and Nanosafety	5
Microbiological Safety	1*

***** Entry requirement for research

Table 3: General Life Sciences master courses

Course	ECTS
Advanced Light Microscopy	5
Advanced Imaging Techniques	5

Advanced Statistics	6
Animal Experimentation ^	5
Behavioural Pharmacology	5
Evolutionary Medicine Diseases of Affluence	5
Evolutionary Medicine Infectious diseases	5
Introduction to the Behavioural and Cognitive Neurosciences	4
Science & Business#	10
Science & Policy#	10
Orientation on International Scientific Careers	5
Programming in C^{++} for Biologists	5/10
Radioisotopes in Experimental Biology	5
Practical Bioinformatics for Biologists	5
Tools and approaches of systems biology	5

^ You could also follow the course 'handling laboratory animals' for 4 ECTS extracurricular. You will receive a certificate (ex. Art.9 Experiments on Animals Act). However, this will cost a fee and PhD students have priority to enrolment.

Students who follow a R-track/track may only choose one of these courses as part of the 'electives' and not as part of the 'master courses'.

Table 4: Elective master courses organized by other Master Programmes

Course	**ECTS**
DNA Micro-array Analysis	5
Skills in Science Communication (2a)	5
iGEM (International Genetically Engineered Machine competition)*	20
Basiscursus Master Lerarenopleiding^	5
Masterstage 1^	5

* 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.

Table 5: Elective master courses organised by The Donald Smits Center for Information Technology:

Course (max 2 ects per individual programme^)	**Half day unit^**
Access basic	5
Excel basic	5
Excel module draaitabellen	1

^ A minimum of 5 half day units is required for a study load of 1 ECTS, for 2 ECTS 11 units are needed. These courses have additional costs (low student tariff), which are at the student's own expenses. These courses are not available in Ocasys. Please consult the Center for Information Technology for further information, time schedules, language of instruction and enrolment details.

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

Course unit	Entry requirement
Research project	Safe Microbiological Technique certificate
Colloquium	Research project
Research project 2	Research project
Internship Science Business & Policy	Research project + 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 Biomedical Sciences[1]

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

- a Bachelor's degree in Biology with one of the following majors:
  - Biomedical Sciences.
  - Behavioural & Neurosciences including the course Immunology and a minimum of 20 ECTS of the following courses: Food and Metabolism, Evolutionary Medicine, Neurobiology of Ageing, Endocrinology, Epigenetics and Gene-editing, Big Data in Human Disease, Microbes and Infection, Medical Physiology.
  - Molecular Life Sciences including the courses Immunology, Bio-organic chemistry and a total of 20 ECTS chosen from BMS electives taught in semester 2 of year two.
- a Bachelor's degree in Life Science & Technology with one of the following majors:
  - Biomedical Sciences.
  - Behavioural & Neurosciences including the course Immunology and a minimum of 20 ECTS of the following courses: Food and Metabolism, Evolutionary Medicine, Neurobiology of Ageing, Endocrinology, Epigenetics and Gene-editing, Big Data in Human Disease, Microbes and Infection, Medical Physiology.
  - Molecular Life Sciences including the courses Immunology, Bio-organic chemistry and a total of 20 ECTS chosen from BMS electives taught in semester 2 of year two.

- a Bachelor's degree in Pharmacy with the following major:
  - Medical Pharmaceutical Sciences plus the courses (pharmaceutical/medical) microbiology and neurobiology.

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 comparable Bachelor's degree from another Dutch or foreign university, focusing on knowledge and skills at the interface of molecular and cellular biology, organic chemistry and biochemistry, integrative physiology and behaviour, and medical sciences, may also qualify for admission. However, admission is then granted on an individual basis by the Admission Board.

[1] As of the academic year 2022-2023 the master degree in Biomedical Sciences will be a selective programme with a capacity limit. De selection criteria and procedure will be made available before October first 2021.

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Appendix VII Transitional provisions (art. 7.1)

N.a.

Appendix VIII Additional Requirements Open degree Programmes (Art. 5.6)

N.a.

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Appendix IX

Application and decision deadlines for admission (art. 2.6.1 and 2.6.3)

Programmes starting on 1 September 2021

Programme	Deadline of Application	Deadline of decision
Behavioural and Cognitive Neurosciences	1 May 2021	1 June 2021
Biology	1 May 2021	1 June 2021
Biomedical Engineering	1 May 2021	1 June 2021
Biomedical Sciences	1 May 2021	1 June 2021
Biomolecular Sciences	1 May 2021	1 June 2021
Ecology and Evolution	1 May 2021	1 June 2021
Energy and Environmental Sciences	1 May 2021	1 June 2021
Human-Machine Communication	1 May 2021	1 June 2021
Marine Biology	1 May 2021	1 June 2021
Mechanical Engineering	1 May 2021	1 June 2021
Medical Pharmaceutical Sciences	1 May 2021	1 June 2021
Nanoscience: for non-EU/EEA students	1 February 2021	1 June 2021
Nanoscience: for EU/EEA students	1 May 2021	1 June 2021
Science Education and Communication	1 May 2021	1 June 2021

Programmes starting on 1 September 2021 and 1 February 2022

Programme	Deadline of Application for 1 September	Deadline of decision for 1 September	Deadline of Application for 1 February	Deadline of decision for 1 February
Applied Mathematics	1 May 2021	1 June 2021	15 October 2021	15 November 2021
Applied Physics	1 May 2021	1 June 2021	15 October 2021	15 November 2021
Artificial Intelligence	1 May 2021	1 June 2021	15 October 2021	15 November 2021
Astronomy	1 May 2021	1 June 2021	15 October 2021	15 November 2021
Chemical Engineering	1 May 2021	1 June 2021	15 October 2021	15 November 2021
Chemistry	1 May 2021	1 June 2021	15 October 2021	15 November 2021
Computing Science	1 May 2021	1 June 2021	15 October 2021	15 November 2021
Farmacie	1 May 2021	1 June 2021	15 October 2021	15 November 2021
Industrial Engineering and Management	1 May 2021	1 June 2021	15 October 2021	15 November 2021
Mathematics	1 May 2021	1 June 2021	15 October 2021	15 November 2021
Physics	1 May 2021	1 June 2021	15 October 2021	15 November 2021