

Appendices to the Teaching and Examination Regulations 2023-2024

Appendix I. Learning outcomes of the degree programme Biology* (art. 1.3)

The graduate:

1. a) has acquired in depth knowledge on one or more scientific disciplines within the general field of Biology and can use this knowledge to explain in detail the relevant concepts, using the appropriate terminology
- b) has acquired cross disciplinary knowledge of issues across scientific disciplines within the field of Biology and can use this knowledge to explain current societal and scientific challenges;
2. can design, and conduct scientific research, and systematically organize his/her work in scientific research;
3. can independently investigate and critically evaluate scientific literature;
4. can identify new developments in the relevant disciplines, and can become familiar with these developments;
5. can formulate realistic, and original solutions to complex problems;
6. can participate in and contribute to a multidisciplinary team;
7. can effectively communicate acquired knowledge, insights and skills to others, both in writing and in oral presentation;
8. can identify societal and ethical implications of scientific research and is able to critically reflect on his/her actions in this context;
9. can independently acquire new knowledge and skills that are relevant for his/her professional career, in science, in policy & management or society.

* These are based on the taxonomy of Bloom

Appendix II. Tracks/Specializations of the degree programmes (art. 2.2)

1. Within the degree programme Biology, the student chooses one of the following tracks:
 - a. Integrative Biology track (IB-track), which provides training as a researcher within an inter- or multidisciplinary focus areas in integrative biology. The track offers the following profiles as specialisations:
 1. Human physiology, behaviour and health (PBH)
 2. Evolutionary medicine (EvM)
 3. Ecological sustainability (EcS)
 4. Biological data science (BDS)
 5. Modelling in the Life Sciences (MLS)
 - b. Research-track (R-track), which offers a customizable programme that provides training as a researcher.
 - c. Science, Business and Policy track, (SBP-track), which prepares for professions in a societal, political and/or commercial context.

Appendix III. Content of the degree programme (art. 2.3)

The degree programme consists of one of the following tracks:

Integrative Biology Track:

Study elements	Course code	ECTS	Entry requirements
Research project (RP)*	WMBY90x-xx	40 or ≥	see appendix V
Research project (RP)*	WMBY90x-xx	30 or ≥	see appendix V
Colloquium	WMBY020-05	5	RP
Essay	WMBY021-05	5	-
Compulsory MSc courses: - <i>Skills for Biology 1 : Professional Perspectives and Career Orientation</i> - <i>Skills for Biology 2 : Quantitative Research Methods^(§)</i> - <i>Profile-specific compulsory courses**</i>	WMBY029-05 WMBY028-05	5 5 10-18	see Ocasys
Electives***		≤20	see Ocasys

^(§) Can be substituted with *Data Science in Biomedicine (WMBM023-05)* by students in the specialisation *Biological Data Science*

Research Track:

Study elements	Course code	ECTS	Entry requirements
Research project (RP)*	WMBY90x-xx	40 or ≥	see appendix V
Research project (RP)*	WMBY90x-xx	30 or ≥	see appendix V
Colloquium	WMBY020-05	5	RP
Essay	WMBY021-05	5	-
Compulsory MSc courses**: - <i>Academic skills course</i> - <i>Quantitative skills course</i> - <i>Biology courses</i>	(see: category I, II, and III in table IV-1)	5 5 10	see Ocasys
Electives***		≤20	see Ocasys

Science Business and Policy-Track:

Study elements	Course code	ECTS	Entry requirements
Research project (RP)*	WMBY901-xx	30 or ≥	see appendix V
Work placement Business & Policy*	WMSE901-40	40 ^(@)	RP
Colloquium	WMBY020-05	5	RP
Compulsory MSc courses: - <i>Skills for Biology 1 : Professional Perspectives and Career Orientation</i> - <i>Skills for Biology 2 : Quantitative Research Methods</i> - <i>Introduction Science and Business</i> - <i>Introduction Science and Policy</i>	WMBY029-05 WMBY028-05 WMSE001-10 WMSE002-10	5 5 10 10	see Ocasys
Electives***		≤ 15	see Ocasys

^(@) Part of the skills work placement SBP is taught at the UG

In addition to the above scheme, the following rules apply:

- *Study Mentor* The student chooses a mentor from the list of Biology to get advice on and discuss the contents of the individual degree programme before requesting approval from the Board of Examiners.
- *RP and Work Placement (*)*

The first research project (preferably the one ≥40 EC) must be an internal project. Internal projects must be performed at the FSE (within Life Sciences-oriented research groups), the University Medical Centre Groningen or the Netherlands Institute for Sea Research, under supervision of one of the examiners of the degree programme.

The subject of the SBP work placement must be clearly related to the scientific domain of the chosen master programme (see Appendix I, 1). Therefore, two examiners must be involved in the assessment of the internship: one SBP-examiner and one appointed examiner of the master programme

- *Compulsory MSc courses (**)* Courses in the category compulsory MSc courses differ between tracks and specialisations within the Integrative Biology track (see appendix IV). Compulsory courses can be replaced by substitute options available at other departments, other universities in the Netherlands or even abroad, under the provision that the learning outcomes of the degree programme continue to be met (Appendix I). Any such deviations from the specified programme of compulsory courses require prior consultation with the study mentor and are subject to approval by the Board of Examiners (use BoE form on student portal).
- *Electives (***)* The student may choose from the onset to use 5, 10, 15 or 20 ECTS to extend a research project, attend master courses (appendix IV), or perform a research assignment of 5, 10, 15 or 20 ECTS. Electives may include a maximum of 10 ECTS of courses from other relevant Life Sciences programmes, and/or courses that repair specific deficiencies. A research project can be

extended at the time of the mid-term assessment with 5 or 10 ECTS only. Research assignments that are dedicated to the preparation of a manuscript related to a master research project are limited to 10 ECTS (assessment of such an assignment will be Pass or Fail).

- *Individual study components* Research projects, colloquium and essay must deal with different subjects, and be approved of by the Board of Examiners. Research projects 1 and 2 must be supervised by a different first examiner. In addition, it is advisable that research projects, colloquium and essay all are supervised by different examiners.
- *Animal experiments* Students planning to participate in an "animal experiment" as defined by law (directive 2010/63/EU) during their research project work must complete the course unit Laboratory Animal Science before starting their project.

Appendix IV. Courses (art. 2.4)

1. Compulsory Master courses and electives

Table IV-1 specifies the programme of 'compulsory MSc courses' for each of the different tracks and specialisation within the track Integrative Biology. Tracks are abbreviated as IB (integrative Biology), R (research track / flexible programme) and SBP (Science, Business and Policy); specializations within the IB-track are: Human physiology, behaviour and health (PBH), Evolutionary medicine (EvM), Ecological sustainability (EcS), Biological data-science (BDS) and Modelling in the life sciences (MLS).

An 'x' in table IV-1 indicates that a course unit is compulsory for a given track or specialization; Roman numbers ('I, II, III,...'; applicable only to students in the R-track/flexible programme) indicate sets of course units from which students must select a specified minimum number of ECTS:

I : students must select at least 5 ECTS from these 'academic skills' courses

II : students must select at least 5 ECTS from these 'quantitative skills' courses

III : students must select at least 10 ECTS from these 'biology' courses.

Course units from the table can also be chosen as an elective. Recommended electives for each specialisation in IB are indicated with an asterisk '*'. Access to courses may be restricted by entry requirements or additional regulations (see Ocasys and table notes).

Table IV-1 Compulsory MSc courses per track/specialization and electives

Course unit	Track/specialisation		IB					R	SBP	
	Course code	ECTS	PBH	EvM	EcS	BDS ^(a)	MLS			
<i>Academic skills and professionalisation</i>										
Skills for Biology 1: Professional Perspectives and Career Orientation	WMBY029-05	5	x	x	x	x	x	x	I	x
Orientation on Non- academic Careers	WMBY032-05	5							I	
Scientific Writing	WMBM013-05	5							I	
Research proposal Ecology and Evolution ⁽¹⁾	WMEV012-05	5							I	
Laboratory Animal Science ^(b)	WMBY026-05	2/5	*						I	
Microbiological Safety	WMMP004-01	1							I	
<i>Quantitative biology</i>										
Skills for Biology 2: Quantitative Research Methods	WMBY028-05	5	x	x	x	x		x	II	x
Mathematical Models in Biology	WMBY031-05	5						x	II	
Programming in C++ for Biologists ^(c)	WMBY010-10	5/10				*	*	x	II	
Modelling Complex Biological Systems	WMBY027-05	5						x		
Practical Computing for Biologists	WMBY008-05	5				x	*	*	II	
Practical Modelling for Biologists	WMBY009-05	5						*	II	
Advanced Statistics	WMBY018-06	6				x			II	
Meta-analyses in Ecology ^(e)	WMBY013-05	5							II	

Track/specialisation			IB						R	SBP
Course unit	Course code	ECTS	PBH	EvM	EcS	BDS ^(a)	MLS			
Mathematical Models in Ecology and Evolution	WMEV013-06	6					*	II		
Genomics in Ecology and Evolution	WMEV011-05	5		*		*				
Statistical Genomics ^(e)	WMMA008-05	5				*	*			
Tools and Approaches of Systems Biology ^(l)	WMBS005-05	5				*	*	*	II	
Next-generation sequencing methods and data analysis ^(l)	WMBS023-05	5				*	*		II	
Data Science in Biomedicine	WMBM023-05	5					x		II	
Big Data & Applications in Biomedicine	WMBM025-05	5		*		*	x			
Applied Statistics and Modeling	WMBM024-05	5					x			
Applied Statistics and Machine Learning	WMBM024-05	5				*	*		II	
From Big Data to Personalised Medicine	WMBM008-05	5					*			
<i>Biochemistry and biomolecular sciences</i>										
Radioisotopes in experimental biology	WMBY011-05	5								
Biocatalysis & Green chemistry	WMCH027-05	5								
Bioinspired Designer Materials	WMCH009-05	5								
Synthetic Biology and Systems Chemistry	WMCH021-05	5								
Biocatalysis for Engineers	WMCE015-05	5								
Advanced light microscopy	WMBY016-05	5	*						III	
Advanced Membrane Biology ^(l)	WMBS007-05	5							III	
Advanced genetic engineering and complex gene regulatory circuitries ^(l)	WMBS006-05	5							III	
Advanced Mammalian Cell Biology ^(l)	WMBS022-05	5	*						III	
Electron Microscopy of Biological Macromolecules	WMBS011-05	5							III	
Molecular Modeling and Analysis in Structural Biology	WMBS021-05	5								
Molecular Dynamics ^(l)	WMBS003-05	5						*		
Organelle and membrane biogenesis	WMBS012-05	5							III	

Track/specialisation			IB					R	SBP
Course unit	Course code	ECTS	PBH	EvM	EcS	BDS ^(a)	MLS		
iGEM (International Genetically Engineered Machine competition) ^(f)	WMBS013-xx	≤20							
Molecular Methods in Ecology and Evolution	WMEV007-10	5/10				*		III	
<i>Biomedical and neuro-sciences</i>									
Evolutionary Medicine: Diseases of Affluence	WMBY025-05	5	x	x				III	
Evolutionary Medicine: Infectious Diseases	WMBY024-05	5	*	x				III	
Nutrition, Brain Development and Cognition ⁽¹⁾	WMBM020-05	5	x					III	
Microbiome & Health ⁽¹⁾	WMBM01005	5	*	*				III	
Molecular Biology of Ageing and Age-related Diseases ⁽¹⁾	WMBM017-05	5	*	*				III	
Neurobiology of nutrition ⁽¹⁾	WMBM011-05	5	*					III	
Neurodegenerative diseases ⁽¹⁾	WMBM012-05	5	*					III	
Neurobiology of Psychiatric Disorders ⁽¹⁾	WMBM018-05	5	*					III	
<i>Ecology & Evolution and Marine Biology</i>									
Evolutionary Theory ⁽¹⁾	WMEV006-07	7	*	x				*	
Conservation Ecology Practices ⁽¹⁾	WMEV004-05	5			x			III	
Ecology of Sustainable Farming ^(d)	WMEV009-05	5			*			III	
Flyway Ecology ^(d)	WMEV010-05	5			*			III	
Island Biology	WMEV016-05	5						III	
Marine Conservation ⁽¹⁾	WMMB011-05	5			*				
Marine Ecosystem Service and Global Change ⁽¹⁾	WMMB008-05	5			*			III	
Polar Ecosystems ⁽¹⁾	WMMB009-05	5			*			III	
Principles of Population Genetics in Natural Populations	WMMB005-05	5				*	*	*	
NIOZ Marine Masters' Summer Course		4							
<i>Energy and environmental sciences</i>									
Sustainable Use of Ecosystems ⁽¹⁾	WMEE003-05	5			x				
Impact of Energy and Material Systems ⁽¹⁾	WMEE002-05	5			*				
Sustainability & Society ⁽¹⁾	WMEE005-05	5			*				
Systems Integration and Sustainability ⁽¹⁾	WMEE006-05	5			*				
<i>Interdisciplinary</i>									
Language, Brain and Cognition ⁽¹⁾	LTR022M10	10	*						
Anthropocene ⁽¹⁾	LPR002M10	10			*				

Track/specialisation			IB					R	SBP
Course unit	Course code	ECTS	PBH	EvM	EcS	BDS ^(a)	MLS		
Neural Networks and Computational Intelligence	WMCS010-05	5				*	*		
<i>Science, business & policy</i>									
Introduction to Science & Business	WMSE001-10	10							x
Introduction to Science & Policy	WMSE002-10	10							x
<i>Science education and communication</i>									
Research Methods in Science Education and Communication ^(l)	WMEC005-05	5							
Skills in Science Communication ^(l)	WMEC006-05 (2a only)	5							
<i>Teacher's education^(g)</i>									
Basiscursus Master Lerarenopleiding	TEM0105	5							
Masterstage 1 Lerarenopleiding	TEM0205	5							
<i>Computer skills^(h)</i> ½ day unit									
Access basic		5							
Excel basic		3							
Excel advanced		5							

Table notes:

- (a) This specialisation has two variants, one focusing on data science in biomedicine; the other with a broader biological focus.
- (b) Only in combination with an MSc research project involving animals.
- (c) This course is suitable for students irrespective of their prior programming experience. Students who have already completed a BSc-level C++ programming course will be able to learn advanced programming techniques tailored to their individual background knowledge and skills.
- (d) Biennial, runs in 2022/2023
- (e) Biennial, does not run in 2022/2023
- (f) Selection for this course takes place in wintertime, an advertisement about application details is announced via Brightspace and other means during the academic year.
- (g) For Dutch-speaking students only.
- (h) These elective master courses are organised by The Donald Smits Center for Information Technology. Please consult their website for further information, time schedules and enrolment details (courses are not listed in Ocasys). Participants in these courses have to pay a course fee (reduced rate for students; at the student's own cost). A minimum of 5 half day units is required for a study load of 1 ECTS, for 2 ECTS 11 units are needed. No more than 2 ECTS can be allocated to computer skills courses from this category.
- (l) Students from another MSc programme have priority in enrolment for this course (except for students in the track Integrative Biology, when the course unit is a compulsory course in their specialisation).

Appendix V. Compulsory order of examinations (art 3.4)

Course unit	Entry requirement
Colloquium	Research project 1
Research project 2	Research project 1
Work placement Business & Policy	Research project, Introduction Science & Policy, Introduction Science & Business
Modelling Complex Biological Systems	Mathematical Models in Biology or equivalent

Appendix VI. Admission to the degree programmes 2022/2023 (art. 2.1A.1 + 2.1B.1)

1. Requirements for admission to the master's degree in Biology

Holders of the following Bachelor's degrees are considered to have sufficient knowledge and skills and will be admitted to the Master's degree programme in Biology on that basis:

- Holders of a Bachelor's degree in Biology from the University of Groningen or other Dutch research universities;
- Holders of a Bachelor's degree in Life Science & Technology (old curriculum, prior to 2020/2021) from the University of Groningen with the majors *Biomedical Sciences*, *Behaviour and Neurosciences* or *Molecular Life Sciences* will be admitted to the Master's degree programme in Biology on the basis of a Research project (10 EC) and Bachelor thesis (5 EC) in the discipline of interest.
- Holders of a Bachelor's degree in Life Science & Technology (new curriculum from 2020/2021 onwards) from the University of Groningen on the basis of a Research project (10 EC) and Bachelor thesis (5 EC) in the discipline of interest (major Ecology and Evolution, major Molecular Life Sciences) combined with at least 15 EC from below mentioned course list. Students need to contact admissionsupport.fse@rug.nl to have the content requirement checked by the Board of Admissions and to finalize the enrollment in Studielink:
 - Systems Ecology & Ecological Interactions 1 *
 - Systems Ecology & Ecological Interactions 2 *
 - Integrative Neuroscience
 - Molecular Genetics
 - Bioinformatics ***
 - Chronobiology
 - Modelling Life ***
 - Behavioural Biology *
 - C++ for Biologists ***
 - Genes & Behaviour *
 - Conservation Biology *
 - Host-microbe Interactions
 - Immunology
 - Biostatistics II (obligatory for Research project in EE) * / ***
 - Big Data Management in Ecology and Evolution ***
 - Bioanalytical and Omics Techniques **
 - Evolutionary Processes ***
 - Evolution and Development
 - Evolutionary Medicine
 - Biology of Human Behaviour
 - Marine Biology
 - Cell Migration and Communication **
 - Practical Carrousel **
 - Evolutionary and Ecological Genomics *
 - Integrative Biology
 - Microbiome * / **
 - Self-organization * / ***

* - Suggested for students who wish to focus on ecology and behavior in the Integrative Biology-, Research-track or SBP-track.

** - Suggested for students who wish to focus on molecular biology in the Integrative Biology-, Research-track or SBP-track.

*** - Suggested for students who wish to focus on theoretical modelling and/or data science in the Integrative Biology-, Research-track or SBP-track.

For holders of another relevant academic Bachelor's degree in life sciences there is an individual admission procedure based on the content of the bachelor's programme and language skills, see <https://www.rug.nl/fse/programme/admissions/msc/language-requirements>. It is possible to appeal to the decision of the admission board via standardized procedures at the University of Groningen.

Appendix VII Transitional provisions (art. 7.1)

The following courses will no longer be offered; the new curriculum contains alternative courses for each one of them, or an alternative combination of courses with equivalent learning outcomes, so that the transition between old and new curriculum is smooth:

Course unit(s) in old curriculum	Course code	Replaced by:
Skills and Scopes in Biology (WMBY007-05)	WMBY029-05	Skills for Biology 1: Professional Perspectives and Career Orientation
<ul style="list-style-type: none"> ● Mathematics in the Life Sciences (WMBY006-05) ● Biological Modelling and Model Analysis (WMBY005-10) 	<ul style="list-style-type: none"> WMBY031-05 WMBY028-05 WMBY027-05 	<ul style="list-style-type: none"> ● Mathematical Models in Biology ● Skills for Biology 2: Quantitative Research Methods ● Modelling Complex Biological Systems

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

In exceptional circumstances students wishing to pursue an open degree programme may file a request with the Board of Examiners. The Board of Examiners will evaluate whether the proposed curriculum meets the learning outcomes of the degree programme and can determine further conditions in their rules and regulations.

Appendix IX Application and decision deadlines for admission

See art. 2.6.1 and 2.6.2 of basic TER