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9 Description of the education (the units of study)

This chapter describes the education provided in your degree course in the form of a curriculum overview and description of the units of study, starting with the units of study in the propaedeutic phase, then those of the post-propaedeutic phase, the minors and tracks with a special feature.

Name degree program: Biologie en Medisch Laboratoriumonderzoek		
CROHO-number: 34397		
Degree format	Full-time	
Language	Dutch	English
Variants and tracks	Abridged English variant (Life Sciences)	

Below is a schematic overview that gives you an overall impression of the degree program. It also gives the units of study in the degree program.

Curriculum table propaedeutical phase

A: Overview of Biologie en Medisch Laboratoriumonderzoek (Dutch) Foundation Year

Term 1	Term 2	Term 3	Term 4
BMC1A, 4 credits	BMC2A, 4 credits	BM3K, BM3P, BM3T or BM4K, BM4P, BM4T 3 x 5 credits	BM3K, BM3P, BM3T or BM4K, BM4P, BM4T 3 x 5 credits
BMC1B, 5 credits	BMC2B, 5 credits		
BMC1C, 6 credits	BMC2C, 6 credits		

B: Overview of Life Sciences Foundation Year

Term 1	Term 2	Term 3	Term 4
CHLS1A, 4 credits	CHLS2A, 4 credits	LS3K, LS3P, LS3T of LS4K, LS4P, LS4T 3x5 credits	LS3K, LS3P, LS3T of LS4K, LS4P, LS4T 3x5 credits
CHLS1B, 5 credits	CHLS2B, 5 credits		
CHLS1C, 6 credits	CHLS2C, 6 credits		

Curriculum table postpaedeutical phase

A: Overview of Main Phase full-time Biologie en Medisch Laboratoriumonderzoek (Dutch)

	Graduation subject:	Term 1	Term 2	Term 3	Term 4
2nd year		BM5A1, BM5B, BM5C or BM6A1, BM6B, BM6C 3 x 10 credits		BM5A2, BM5B, BM5C or BM6A2, BM6B, BM6C 3 x 10 credits	
	Biotechnology.	BMLS8*, 30 credits		Minor* or internship (B11) 30 credits	
3rd year	Molecular Plant biology	BMLS9*, 30 credits			

	Biomedical research	BMLS10*, 30 credits	
4th year		Minor, internship (BM11, M11Mm, M11Kc) or graduation project (BM12) 30 credits	Minor or graduation-Assignment (BM12) 30 credits

* Due to mirroring of the study programme, it is is also possible to do a minor in the first semester and BMLS8, BMLS9 or BMLS10 in the second semester.

B: Overview of Life Sciences Main Phase

	Graduation subject:	Term 1	Term 2	Term 3	Term 4
2nd year		LS5A1, LS5B, LS5C or LS6A1, LS6B, LS6C 3 x 10 credits		LS5A1, LS5B, LS5C or LS6A1, LS6B, LS6C 3 x 10 credits	
3rd year	Biotechnology.	BMLS8 30 credits		Minor or internship (LS11) 30 credits	
	Molecular Plant biology	BMLS9 30 credits			
	Biomedical research	BMLS10 30 credits			
4th year		Minor, internship (LS11) or graduation project (LS12) 30 credits		Minor or graduation-Assignment (LS12) 30 credits	

Safety

If students by exemptions or other measures enter the degree program in the main phase, they are required to take the workshop 'Safety in the laboratory' or take notice of the safetyprotocol to ensure that students can work safely in the laboratories at Laan van Scheut 2.

9.1 Units of study of the propaedeutic phase

The foundation year of the study degree program includes the following eductional units with the associated studyload.

A. Full-time biology and medical laboratory research (Dutch)
   a. Course unit 1A: BMC1A (4 credits)
   b. Course unit 1B: BMC1B (5 credits)
   c. Course unit 1C: BMC1C (6 credits)
   d. Course unit 2A: BMC2A (4 credits)
   e. Course unit 2B: BMC2B (5 credits)
   f. Course unit 2C: BMC2C (6 credits)
   g. Course unit 3K: BM3K (5 credits)
   h. Course unit 3P: BM3P (5 credits)
   i. Course unit 3T: BM3T (5 credits)

j. Course unit 4K: BM4K (5 credits)
k. Course unit 4P: BM4P (5 credits)
l. Course unit 4T: BM4T (5 credits)

B. Full-time Life Sciences (English variant)
a. Course unit 1A: CHLS1A (4 credits)
b. Course unit 1B: CHLS1B (5 credits)
c. Course unit 1C: CHLS1C (6 credits)
d. Course unit 2A: CHLS2A (4 credits)
e. Course unit 2B: CHLS2B (5 credits)
f. Course unit 2C: CHLS2C (6 credits)
g. Course unit 3K: LS3K (5 credits)
h. Course unit 3P: LS3P (5 credits)
i. Course unit 3T: LS3T (5 credits)
j. Course unit 4K: LS4K (5 credits)
k. Course unit 4P: LS4P (5 credits)
l. Course unit 4T: LS4T (5 credits)

This section only contains the Course unit descriptions of the English variant of the study program. The Dutch Course unit descriptions can be found in the Onderwijs en Examenregeling of the study program Biologie en Medisch Laboratoriumonderzoek.

Course unit 1A: CHLS1A (4 credits)

	CHLS1A
General information	
Target group	Full-time foundation year students Life Science, BML and Chemistry
Name of course unit	CHLS1A: Basic Skills
Study unit code	CHLS1A
Teaching term	1
ECTS credits	4 ECTS
Study load in hours	112 SBU
Study hours (contact hours)	Programmed contact time: average of 7.5 lessons periods per week, 53 lessons per term= 39.75 hours Scheduled time for exams: 3 hours Planned time for self-study: 69.25 hours Total: 112 hours
Unit of study entry requirements	HAVO /VWO diploma with the Nature and Technology or Nature and Health profile, MBO diploma level 4.
Content and organization	
General description	In CHLS1A, subjects introduced are essential to the degree programme. The basic knowledge on lab calculations, mathematics and safety is the central focus of this course unit. Workshops also focus on basic skills that are important when working together at HBO level.
Exit qualifications	- Quality control - Teamwork

	- Professional development
Professional tasks and products	Carrying out scientific research.
Professional products	
Cohesion	CHLS1A is the first course of the degree programme. In this course, basic knowledge is learned or brought to the required level.
Mandatory participation	Participation in the Professional Skills 1 workshop is mandatory
Maximum number of participants	
Compensation possibilities	
Activities and/or teaching methods	**Support subject: Laboratory calculations** - Concentrations - Dilutions - Average, range, standard deviation, coefficient of variation - Mol and molar mass - Molecular and empirical formulas Teaching methods: Combined lectures/tutorials **Supporting subject: Mathematics** Basic calculation rules (including formulae) Isolate various functions, including equations and variables: - Linear - Quadratic functions - Broken functions Teaching methods: Combined lectures/tutorials **Supporting subject: Safety** - Laboratory Rules - Safe handling of materials - Waste categories - Practical rules/accident or incident Teaching methods: Lectures and work discussion in the lab **Supporting subject: PDL Professional Skills 1:** - Exercising basic skills for working together, giving feedback, active listening, summarising, asking questions - Gaining insight into different ways of feedback in an intercultural setting - Gaining insight into one's own strengths and learning points with regard to cooperation and feedback Teaching methods: Workshop
Required literature	The latest edition of: - Heron-reeks Managing safety, health and environmental risks in laboratories V € 37,41 Leven, Iris van 't | Syntax Media bv | Druk: 2 |

	The following e-books: - Mathematics Fundamentals (https://bookboon.com/en/mathematics-fundamentals-ebook) - Precalculus (https://openstax.org/subjects/math)
Required software/materials	
Recommended literature	Verkerk G. et al. BINAS book VWO HAVO Groningen: Noordhoff Uitgeverij.
Examination	
	CHLS1A-Lab
Name of examination or modular examination	Lab calculations
Examination or modular examination code	CHLS1A-Lab
Assessment types(s):	Individual written open questions
Result	Grade
Passing grade	5.5
Weight factor of modular exams	2
Exam opportunities	In case of physical lessons: Modular exams during term 1. Resit end of term 1 and 3 In case of online lessons: CHLS1A-Lab: Term 1, term 3. Resit mid-term 2.
Permitted resources	Non-graphic calculator, periodic table
Method of enrolment for exam/enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the assessment period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is held during a lesson of Lab calculations BMC2A. The discussion of exams taken in a resit period is scheduled at the end of the education period. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	2 examiners for the construction and the evaluation. Assessment by one examiner based on the answer key (theory lecturer).

Possibilities for compensation	
Assessment dimensions	Knowledge of lab calculations: Systematically work out problems in lab work using elementary calculation rules and the several core relationships.
Assessment criteria	The student is able to: Calculate volume and mass using density of a solution; Perform calculations with percentages and fractions; Apply descriptive statistics and display answers in scientific notation and correct significance; Calculate atomic mass, molecular mass and formula mass of a substance; Calculate with mole and molar mass; Calculate molecular and empirical formulas of a substance; Calculate the concentration of a substance after dilution.
Exam matrix	Modular exams: 1. Concentrations 1 + Dilutions 1 30% 2. Average & dispersion + Mol & Molar mass 30% 3. Molecular and empirical formulas + Concentrations & Dilutions 2 40%
	CHLS1A-Wis
Name of examination or modular examination	Mathematics
Examination or modular examination code	CHLS1A-Wis
Assessment types(s):	Individual, written, open questions
Result	Grade
Passing grade	5.5
Weight factor of modular exams	2
Exam opportunities	CHLS1A-Wis: term 1, term 3. Resits during term 2.
Permitted resources	Non-graphic calculator
Method of enrolment for exam/enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the assessment period or the resits. The period is published in the SABC annual schedule on Insite-Timetables
Discussion and review	• The SABC annual schedule indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is held during a Mathematics lesson of BMC2A.The discussion of exams taken in a resit period is scheduled at the end of the education period. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not

	take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	2 examiners for the construction and the evaluation. Assessment by one examiner based on the answer key (theory lecturer).
Possibilities for compensation	
Assessment dimensions	Knowledge of mathematics
Assessment criteria	The student masters the following basic math skills: Calculation sequence and calculations with fractions Manipulating formulas with powers (with whole, negative and broken exponents), scientific notation Factor analysis and removing brackets; Defining fraction formulas and solving equations with fractions, isolating variables, inverse functions Finding a straight line, solving first-degree equations Solve equations of quadratic functions and broken functions, power functions Isolate variables at linear, quadratic functions and broken functions
Exam matrix	1 question covering each of the following subjects: where each of the 10 questions is worth 10% of the CHLS1A-Wis grade. Addition/subtraction + simplification of fraction formulas Multiplying/dividing fractional formulas + simplifying power formula simplify (writing without fractional and/or negative exponent) Removal of parentheses Isolation of fraction equations Equation through two points or by drawing a graph Determination of the intersection between 2 functions or solving systems of equations Solving second degree equations by factorizing or abc formula Solve broken equation Asymptote broken function
	CHLS1A-Kvei
Name of examination or modular examination	Theory exam: Safety
Examination or modular examination code	CHLS1A-Kvei
Assessment types(s):	Individual, Written, Multiple choice questions
Result	Grade

Passing grade	5.5
Weight factor of modular exams	1
Exam opportunities	Term 1, resit end term 1. Term 3, resit end term 3
Permitted resources	
Method of enrolment for exam/enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the assessment period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam will be scheduled before the resit. The discussion of the resit is scheduled in the following teaching period. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	2 examiners for the construction and the evaluation. 1 Examiner for the assessment (Safety lecturer).
Possibilities for compensation	
Assessment dimensions	Knowledge of safety in the lab.
Assessment criteria	The student: Can apply general and specific laboratory rules; Is familiar with safety equipment available and how they should be used; Recognize the safety symbols, GHS pictograms dangerous substances and knows how to act appropriately; Know the short- and long-term effects of harmful substances on the human body and the environment; Knows and can apply the definitions of the safety concepts: limit value, LD50 value, H and P statements; Can estimate fire and explosion risk based on physical fire related concepts; Can look up safety information on substances in MSDS sheets and chemistry charts; Knows and recognises the biological agents Knows the rules on “safe microbiological techniques”; Knows the rules on processing lab waste (chemicals and biological agents); Can indicate how first aid should be applied in lab situations;
Exam matrix	10% Laboratory rules 50% Safe handling of materials 15% Categories of waste 25% Practical rules/accident or incident
	CHLS1A-PS1

Name of examination or modular examination	Professional Skills 1
Examination or modular examination code	CHLS1A-PS1
Assessment types(s):	Oral, Individual
Result	Satisfactory / Not Satisfactory
Passing grade	Satisfactory
Weight factor of modular exams	0
Exam opportunities	There is only one opportunity for the workshop (EER 8.5) See the class roster.
Permitted resources	
Method of enrolment for exam/enrolment period	Participation in CHLS1A counts as registration for CHLS1A-PS1.
Discussion and review	For questions about the assessment, please contact the examiner.
Number of examiners	One examiner for the assessment (workshop lecturer).
Possibilities for compensation	
Assessment dimensions	Competence 8: Cooperation / communication / internationalization 8.1.1. Adheres to rules. 8.1.2. Makes a valuable contribution to the group. 8.1.6. Maintains eye contact with conversation partner 8.1.7. Gives others opportunity to speak. 8.1.8. Verbally expresses their opinion/message. 8.1.9. Is active in conflict resolution. 8.1.12. Is aware of the international character of the professional community. Competence 11: Professional development 11.1.3. Reflects critically on their actions and learning process; learns from mistakes.
Assessment criteria	An active participation in the Professional Skills 1 workshop is required for a satisfactory assessment. At the end of the academic year a team discussion takes place in which the student has to demonstrate their professional skills.

Course unit 1B: CHLS1B (5 credits)

	CHLS1B
General information	
Target group	Full-time students Common Foundation Year - Life Sciences, Biology and Medical Laboratory Research, Chemistry
Name of course unit	CHLS1B: Basic practical skills Chemistry, Biology & Medical (Basispraktijkvaardigheden Chemie, Biologie & Medisch CHLS1B)
Study unit code	CHLS1B

Teaching term	1
ECTS credits	5 study credits
Study load in hours	140 SBU
Study hours (contact hours)	Biology and Medical Practical/ Chemistry Practical/ Tutorial/ Workshops Programmed contact hours: Avg. 11.7 periods (lesson periods) per week= 82 periods in term 2 = 61.5 clock hours per term Planned time for self-study: 78.5 hours per term Total: 140 hours
Unit of study entry requirements	HAVO (higher general continued education)/VWO (pre-university) diploma with the Nature and Technology or Nature and Health profile, MBO diploma level 4.
Content and organisation	
General description	Based on the themes of basic techniques, spectrophotometry and separation techniques, both the biological and chemical aspects are highlighted. In addition, professional attitude is developed in the tutorial through development assignments.
Exit qualifications	Design of experimental plan Experimenting Results Analysis Quality control Management and administration Reporting and presenting Methodology Professional development
Professional tasks and products	Carrying out scientific research.
Professional products	Lab journal, IPS
Cohesion	CHLS1B is related to CHLS1A and CHLS1C.
Mandatory participation	CHLS1B-P: In case of unsatisfactory attendance of practice and workshops (knockout) practical assessment is 0.0 (assessment form will not be filled in further). CHLS1B-IPV: In case of unsatisfactory participation, IPS assessment is unsatisfactory.
Maximum number of participants	
Compensation possibilities	
Activities and/or teaching methods	**Practical Biology & Medical:** Histology staining, Cytology, Microbiology, Molecular techniques, Microscopy, Biochemical techniques. *Teaching methods: Lab practicals*

	Practical Chemistry: Weighing, Pipetting, Titration, Dilution, Spectrophotometry, Synthesis, Refractive index, IR spectrometry, TLC *Teaching methods: Lab practicals* **Tutorial** What are tutorials? Cell structure Spectro techniques Basic Excel *Teaching methods: project group meetings* **Workshops** Scientific writing: Lab journal Excel: data analysis in Excel *Teaching methods: interactive workshops*
Required literature	The latest version of: Campbell N, Reece J, *Biology*, Pearson Education Inc Nivaldo J Tro; *Principles of chemistry,* Pearson Dean, J.R. *et al*.: *Practical skills in Chemistry/Biomolecular sciences*, Prentice Hall, Harlow
Required software/materials	LabArchives, Microsoft Office
Recommended literature	
Examination	
	CHLS1B-P
Name of examination or modular examination	Practical
Examination or modular examination code	CHLS1B-P
Assessment types(s):	Individual, Practice, Written
Result	Grade
Passing grade	5.5
Weight factor of modular exams	1
Exam opportunities	Term 1: There is only one opportunity per year for the modular exam CHLS1B-P (EER art. 8.5)
Permitted resources	

Method of enrolment for exam/enrolment period	Participation in CHLS1B is considered as registration for CHLS1B-P.
Discussion and review	The filled-in assessment form with any feedback is considered the discussion and review of this modular assessment.
Number of examiners	Assessment by one examiner on the basis of assessment forms (practical lecturer).
Possibilities for compensation	
Assessment dimensions	Competence 1: Design 1.1.4. Forms a hypothesis based on the research question. Competence 2: Experimenting 2.1.1. Reads and understand the practical guide; understands the theoretical background of the main steps of the methods. 2.1.2. Performs calculations prior to beginning lab work. 2.1.3. Ensures that all requirements are present before beginning the experiment. 2.1.4. Carries out experiments accurately according to the protocol. 2.1.5 Carries out the experiment within the given time frame. Competence 3: Results Analysis 3.1.1. Carries out results analysis according to the prescribed methods; performs error analysis in the correct manner (if applicable). 3.1.2. Evaluates the obtained results based on their accuracy and reliability. 3.1.3. Makes conclusions relating to the initial research question (if possible). 3.1.4. Discusses the execution of the experiment and results. Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules. 4.1.2. Uses materials and equipment correctly. Competence 5: Management and administration 5.1.1. Encodes chemicals and samples; stores these in the prescribed manner. 5.1.2. Leaves the workplace tidy and clean. 5.1.3. Manages and archives data in lab journal (aim, experiment description, alterations, results, conclusion) and if relevant, other ways of storing data. Competence 6: Reporting and presenting 6.1.1. Reports their research according to the product criteria for lab journal and reports; Level 1: 6.1.3 Is familiar with the international conventions of scientific and academic writing.

	Competence 7: Methodology 7.1.3. Works according to the previously described plan. Competence 11: Professional development 11.1.5. Has study skills required by higher professional education; is motivated and determined.
Assessment criteria	See assessment form on #OnderwijsOnline under General Information. Practical assessment: Lab journals and the practical impression throughout the course will be assessed as a whole using the assessment form.
Exam matrix	See assessment form on #OnderwijsOnline under General Information. Practical assessment: 12.5% Lab journal: General 25% Preparation 40% Practical Performance 22.5% Analysis
	CHLS1B-IPV
Name of examination or modular examination	IPS
Examination or modular examination code	CHLS1B-IPV
Assessment types(s):	Individual, Oral, Written
Result	Satisfactory/ Unsatisfactory
Passing grade	Satisfactory
Weight factor of modular exams	1
Exam opportunities	Term 1: There is only one opportunity per academic year for the modular exam CHLS1B-IPV (EER art. 8.5)
Permitted resources	
Method of enrolment for exam/enrolment period	Participation in CHLS1B is considered as registration for CHLS1B-IPV.
Discussion and review	For questions about assessment, contact the examiner.
Number of examiners	One examiner (tutor) for the assessment based on participation and effort.
Possibilities for compensation	
Assessment dimensions	Competence 7: Planning and project-based working Works according to the previously described plan.

	Competence 8: Team work 8.1.1. Adheres to rules. 8.1.2. Makes a valuable contribution to the group. Communicates his task to fellow students and lecturer according to the basic rules of communication; if needed, supervised by the lecturer. 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.1.8. Verbally expresses their opinion/message. Competence 11: Professional development 11.1.5. Has study skills required by higher professional education; is motivated and determined.
Assessment criteria	The student: - Has prepared for the meeting by completing the assignment to be discussed, and also completed the required reading for the following assignment to be discussed; - Is able to show weekly assignments to the tutor (according to agreement, in writing or as a presentation); all required aspects are complete in all assignments; - Adheres to the rules agreed upon; - Asks questions and shares knowledge regarding the assignment during tutorials; verbalizes these clearly and audibly, maintains eye contact; - Gives others opportunity to speak; - The student offers feedback to group and class members and is open to receiving feedback; - Is satisfactorily present during the tutor lessons (missed a maximum of 1 lesson for a good reason); - Submits a reflection report on the professional attitude to the tutor.

Course unit 1C: CHLS1C (6 credits)

	CHLS1C
General information	
Target group	Full-time students common foundation year - Life Sciences, Biology and Medical Laboratory Research, Chemistry
Name of course unit	CHLS1C: Basic theory Biology&Medical and Chemistry 1 (Basistheorie Biologie&Medisch en Chemie 1 CHLS1C)
Study unit code	CHLS1C
Teaching term	1
ECTS credits	6 study credits
Study load in hours	168 SBU
Study hours (contact hours)	Programmed contact hours: 6 lesson periods/week, 42 lesson periods/term = 31.5 hours Scheduled time for exams: 4 lesson periods per term =3 hours Planned time for self-study: 133.5 hours

	Total: 168 hours
Unit of study entry requirements	HAVO (higher general continued education)/VWO (pre-university) diploma with the Nature and Technology or Nature and Health profile, MBO diploma level 4.
Content and organisation	
General description	Students work from different angles on basic biological, medical and chemical knowledge.
Exit qualifications	Design Experimenting Results Analysis Quality control
Professional tasks and products	Carrying out scientific research.
Professional products	
Cohesion	CHLS1C is related to CHLS1A and CHLS1B
Mandatory participation	
Maximum number of participants	
Compensation possibilities	Final grade CHLS1C = (CHLS1C-Tbm + CHLS1C-Tc) /2 ≥ 5.5 CHLS1C-Tbm en CHLS1C-Tc may be compensated from ≥ 4.5.
Activities and/or teaching methods	**Support subject: Biology&Medical:** Biological macromolecules Cell structure and function Prokaryotic versus eukaryotic Cell respiration Mitosis *Teaching methods: Combined lectures/tutorials* **Supporting subjects: *Theory of the Life Science/ Biology & Medical lab practicals*** Theoretical background to lab practical *Teaching methods: Combined lectures/tutorials* **Supporting subjects: Chemistry** Atoms and elements Nomenclature of molecules and salts Spectrophotometry Redox reaction *Teaching methods: Combined lectures/tutorials* **Supporting subjects: Theory of the chemistry practicals** Theoretical background to lab practical *Teaching methods: Combined lectures/tutorials*

Required literature	Latest version of Campbell and Reece, Biology, a Global Approach, Pearson Education Latest version of Nivaldo J Tro, Chemistry, A Molecular Approach, Pearson Education
Required software/required materials	LabArchives
Recommended literature	Life Science: Latest version of Reed and Weyers, Practical Skills in Biomolecular Science, Pearson Education. Chemistry Students: Latest version of Reed and Weyers, Practical skills in Chemistry, Pearson Education.
Examination	
	CHLS1C-Tbm
Name of examination or modular examination	Basic Theory Biology & Medical
Examination or modular examination code	CHLS1C-Tbm
Assessment types(s):	Individual written open questions and/or multiple choice questions
Result	Grade
Passing grade	4.5
Weight factor of modular exams	1
Exam opportunities	Term 1, resit Term 2 Participation in CHLS1C-Tbm is only possible twice per academic year.
Permitted resources	Ordinary calculator
Method of enrolment for exam/enrolment period	Registration for the modular exam via Alluris. The registration term is several weeks prior to the exam period or the resit period. The period is stated in the SABC annual schedule on Insite - Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is scheduled in the following teaching period. The discussion of exams taken in a resit period is scheduled at the end of the education period. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	2 Examiners for construction and evaluation. Assessment by one examiner based on the answer key.
Possibilities for compensation	CHLS1C-Tbm may be compensated from ≥ 4.5.

Assessment dimensions	Competence 1: Design 1.1.4. Forms a hypothesis based on the research question. 1.1.5. Integrates information into a simple research plan. 1.1.6. Understands and applies simple English literature relevant to the given context. Competence 2: Experimenting 2.1.1. Reads and understand the practical guide; understands the theoretical background of the main steps of the methods. 2.1.2. Performs calculations prior to beginning lab work. Competence 3: Results Analysis 3.1.1. Carries out results analysis according to the prescribed methods; performs error analysis in the correct manner (if applicable). 3.1.3. Makes conclusions relating to the initial research question (if possible). Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules.
Assessment criteria	The student has knowledge of the following subjects and is able to apply them: Biology & Medical Theory - The structure and function of different parts of the animal and plant cells; - The differences between the prokaryotic and eukaryotic cell; - The structure and function of biological macromolecules; - Cellular respiration - Mitosis Background theory of experiments and analysis: - Microscope use; - Mitosis - diluting, plating and reading; - Spectrophotometry - isolation of DNA; - agarose gel electrophoresis; - Lab safety
Exam matrix	65 (±5)% Biology & Medical theory 35 (± 5)% Lab Practical theory and analysis
	CHLS1C-Tc
Name of examination or modular examination	Chemistry Theory
Examination or modular examination code	CHLS1C-Tc
Assessment types(s):	Individual, Written Open Questions

Result	Grade
Passing grade	4.5
Weight factor of modular exams	1
Exam opportunities	Term 1, resit Term 2 Participation in CHLS1C-Tc is only possible twice per academic year.
Permitted resources	Ordinary calculator
Method of enrolment for exam/enrolment period	Registration for the modular exam via Alluris. The registration term is several weeks prior to the exam period or the resit period. The period is stated in the SABC annual schedule on Insite - Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is scheduled in the following teaching period. The discussion of exams taken in a resit period is scheduled at the end of the education period. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	2 Examiners for construction and evaluation. Assessment by one examiner based on the answer key (theory lecturer).
Possibilities for compensation	CHLS1C-Tc may be compensated from ≥ 4.5.
Assessment dimensions	Competence 1: Design 1.1.4. Forms a hypothesis based on the research question. 1.1.5. Integrates information into a simple research plan. 1.1.6. Understands and applies simple English literature relevant to the given context. Competence 2: Experimenting 2.1.1. Reads and understand the practical guide; understands the theoretical background of the main steps of the methods. 2.1.2. Performs calculations prior to beginning lab work. Competence 3: Results Analysis 3.1.1. Carries out results analysis according to the prescribed methods; performs error analysis in the correct manner (if applicable). 3.1.3. Makes conclusions relating to the initial research question (if possible). Competence 4: Quality control

	4.1.1. Is aware of the health and safety rules and works according to these rules.
Assessment criteria	The student has knowledge of the following subjects and can apply this knowledge: Chemistry Basic Theory: *Basic chemistry:* - Describe how an atom or simple ion is structured; - Draw ratio formulas of ion and molecule formulas of molecules; - Name cations, anions, ion compounds and Inorganic compounds or vice versa; - Calculate using the formulas c= n/V and m=n*Mm - Predict the possible reaction between 2 substances and balance the reaction equation; - Calculating and working with precipitation reactions (balancing equations, calculate hvh, predict precipitate) *Redox:* - Identifying an oxidizer and a reducing agent of the oxidation and reduction reaction by the determination of the oxidation numbers of the elements in a compound; - Make balanced redox reactions on the basis of half-reactions. *Spectrophotometry:* - Knows the relationship between wavelength and energy; - Calculate using the Lambert-Beer Law; - Convert extinction to transmission and vice versa. - Calculating with the relation between the energy of light/photon and the frequency of light Background theory of experiments and analysis: - Quantitative transfer - Dilution - Titration - Spectrophotometry - TLC analysis - Lab safety
Exam matrix	65 (±5) % Chemistry theory 35 (± 5)% Lab Practical theory and analysis

Course unit 2A: CHLS2A (4 credits)

	CHLS2A
General information	
Target group	Full-time foundation year students Life Science, BML and Chemistry
Name of course unit	CHLS2A General Skills / CHLS2A Basic Skills
Study unit code	CHLS2A
Teaching term	Term 2
ECTS credits	4 ECTS
Study load in hours	112 SBU

Study hours (contact hours)	Programmed contact time: average of 7 lessons per week, 51 lessons periods per term = 38.25 hours Scheduled time for exams: 2 hours Planned time for self-study: 71.75 hours Total: 112 hours
Unit of study entry requirements	HAVO (higher general continued education)/VWO (pre-university) diploma with the Nature and Technology or Nature and Health profile, MBO diploma level 4. Course unit CHLS1A must be followed.
Content and organisation	
General description	In CHLS2A, subjects introduced are essential to the degree programme. The basic knowledge on lab calculations and mathematics are the central focus of this course unit. Workshops also focus on conflict management.
Exit qualifications	- Quality control - Teamwork - Professional development
Professional tasks and products	Carrying out life science research
Professional products	
Cohesion	CHLS2A follows on from CHLS1A.
Mandatory participation	Participation in the Professional Skills 2 workshops is mandatory.
Maximum number of participants	
Compensation possibilities	
Activities and/or teaching methods	**Support subject: Laboratory calculations** - Dilutions - Stoichiometry - Gases and the ideal gas law - Calculations with reactions - Mixing Teaching methods: Combined lectures/tutorials Supporting subject: Mathematics - Power functions - Logarithmic and exponential functions - Trigonometry - Differentiation Teaching methods: Combined lectures/tutorials **Supporting subject:** PDL Professional Skills 2 - Recognize your own style of conflict behavior - Practicing escalating and de-escalating behavior - Gaining insight into Hofstede's intercultural dimensions of cooperation

	- Gaining insight into one's own strengths and learning points with regard to conflict management *Method: Workshop*
Required literature	The latest edition of: - Leven, I. van 't Veiligheid en milieu in laboratoria. Utrecht: Syntax Media. The following e-books: - Mathematics Fundamentals (https://bookboon.com/en/mathematics-fundamentals-ebook), - Precalculus (https://openstax.org/subjects/math) - Calculus Volume 1 (https://openstax.org/subjects/math)
Required software/materials	
Recommended literature	Verkerk G. et al. BINAS book VWO HAVO Groningen: Noordhoff Uitgeverij.
Examination	
	CHLS2A-Lab
Name of examination or modular examination	Lab calculations
Examination or modular examination code	CHLS2A-Lab
Assessment types(s):	Individual written open questions
Result	Grade
Passing grade	5.5
Weight factor of modular exams	2
Exam opportunities	In case of physical lessons: Modular exams during term 2. Resit end of term 2 and 4 In case of online lessons: CHLS2A-Lab: Term 2, term 4. Resit in Term 3.
Permitted resources	Non-graphic calculator, periodic table
Method of enrolment for exam/enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the assessment period or the resits. The period is published in the SABC academic calendar on Insite-Timetables
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is scheduled in the following teaching period. The discussion of exams taken in a resit period is scheduled at the end of the education period. At the end of term 4, the discussion will be held before the start of the resit period of term 4.

	• Indicate for an exam made in a resit period to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	2 examiners for the construction and the evaluation. Assessment by one examiner based on the answer key (theory lecturer).
Possibilities for compensation	
Assessment dimensions	Knowledge of lab calculations: Systematically work out problems in lab work using elementary calculation rules and the several core relationships. Systematically work out problems with chemical reactions using several core relationships.
Assessment criteria	The student is able to: Reverse calculation of concentrations after dilution; Calculate the concentration of a substance after mixing; Calculate with reactions and apply stoichiometry on reactions; Apply the ideal gas law.
Exam matrix	Modular exams: 1. 30% Dilutions recalculation + stoichiometry 2. 30% Gases and the ideal gas law + calculate with reactions 3. 40% Mixing 1 + Mixing 2
	CHLS2A-Wis
Name of examination or modular examination	Mathematics
Examination or modular examination code	CHLS2A-Wis
Assessment types(s):	Individual, written, open questions
Result	Grade
Passing grade	5.5
Weight factor of modular exams	2
Exam opportunities	CHLS2A-Wis: Term 2, term 4. Resit in term 3
Permitted resources	Non-graphic calculator
Method of enrolment for exam/enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the assessment period or the resits. The period is published in the SABC academic calendar on Insite-Timetables

Discussion and review	- The exam and resit periods, and review of exam results are indicated in the SABC academic calendar. Review takes place in the presence of a supervisor. - The discussion of the exam is scheduled in the following teaching period. The discussion of exams taken in a resit period is scheduled at the end of the education period. At the end of term 4, the post-exam discussion will be held before the start of the resit period of term 4. - Contact the examiner/course coordinator (for exams taken during a resit period) if you would like to discuss the exam. Upon request, the post-exam discussion will be scheduled. - Participation in the post-exam discussion is only allowed if you have taken the exam.
Number of examiners	2 examiners for the construction and the evaluation. Assessment by one examiner based on the answer key (theory lecturer).
Possibilities for compensation	
Assessment dimensions	Knowledge of mathematics
Assessment criteria	Masters the following basic math skills: Solving equations with power functions, logarithms and exponential functions Isolate variables in power functions, logarithms and exponential functions Trigonometry in right angled triangles Converting degrees to radians and vice versa Knowing the relationship between graphical waveform and trigonometric function Apply sine rule and cosine rule in arbitrary triangles Differentiation with standard rules, sum rule, product rule, chain rule
Exam matrix	10 questions covering each of the following subjects: where each of the 1 questions is worth 10% of the CHLS2A-Wis grade. Solving equations with roots Isolation with different types of equations Solving equations with exponential functions Solving equations with logarithms or applying logarithmic calculation rules Applying trigonometry in a right angle triangle and/or calculations with radials Applying sine and cosine rules Determination of amplitude, period, equilibrium position and phase shift in trigonometric function Differentiation with standard rules Differentiation with product rules Differentiation with chain rules
	CHLS2A-PS2
Name of examination or modular examination	Professional Skills 2
Examination or modular examination code	CHLS2A-PS2

Assessment types(s):	Oral, Individual
Result	Satisfactory / Not Satisfactory
Passing grade	Satisfactory
Weight factor of modular exams	0
Exam opportunities	There is only one opportunity for the workshop (EER 8.5) See the class roster.
Permitted resources	
Method of enrolment for exam/enrolment period	Participation in CHLS2A is considered as registration for CHLS2A-PS2.
Discussion and review	For questions about the assessment, please contact the examiner.
Number of examiners	One examiner for the assessment (workshop lecturer).
Possibilities for compensation	
Assessment dimensions	Competence 8: Cooperation / communication / internationalization 8.1.1. Adheres to rules. 8.1.2. Makes a valuable contribution to the group. 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.1.8. Verbally expresses their opinion/message. 8.1.9. Is active in conflict resolution. 8.1.12. Is aware of the international character of the professional community. Competence 11: Professional development 11.1.3. Reflects critically on their actions and learning process; learns from mistakes.
Assessment criteria	An active participation in the Professional Skills 2 workshop is necessary for a satisfactory assessment. At the end of the academic year a team discussion takes place in which the student has to demonstrate their professional skills.

Course unit 2B: CHLS2B (5 credits)

	CHLS2B
General information	
Target group	Full-time students common Foundation Year - Life Sciences, Biology and Medical Laboratory Research, Chemistry
Name of course unit	CHLS2B: Basic practical skills Chemistry, Biology & Medical (Basispraktijkvaardigheden Chemie, Biologie & Medisch / CHLS2B)
Study unit code	CHLS2B
Teaching term	Term 2
ECTS credits	5 study credits
Study load in hours	140 SBU
Study hours (contact hours)	Biology and Medical Practical/ Chemistry Practical/ Tutorial/ Workshops

	Programmed contact hours: Avg. 11.7 lesson periods per week= 82 lesson periods per term = 61.5 hours per term Planned time for self-study: 78.5 hours per term Total 140 hours
Unit of study entry requirements	HAVO (higher general continued education)/VWO (pre-university) diploma with the Nature and Technology or Nature and Health profile, MBO diploma level 4. CHLS1A, CHLS1B and CHLS1C must be followed.
Content and organisation	
General description	Based on the themes of benzoic acid and nutrition, the basic techniques of Chemistry and Life Science research are applied. At the end, a personal research project will be carried out within a chosen theme in which the design, execution and presentation of research and results will be discussed. In addition, professional attitude is developed in the tutorial through development assignments.
Exit qualifications	Design of experimental plan Experimenting Results Analysis Quality control Management and administration Reporting and presenting Methodology Professional development
Professional tasks and products	Carrying out life science research
Professional products	Lab journals, measurement reports, IPS and final presentation
Cohesion	CHLS2B is related to CHLS2A and CHLS2C.
Mandatory participation	CHLS2B-P: In case of insatisfactory attendance of practice and workshops (knockout) practical assessment is 0.0 (assessment form will not be filled in further). CHLS2B-IPV: In case of insatisfactory participation, IPS assessment is not satisfactory
Maximum number of participants	
Compensation possibilities	
Activities and/or teaching methods	**Practical Biology & Medical:** Histology staining, Cytology, Microbiology, Molecular techniques, Microscopy, Biochemical techniques. *Teaching methods: Lab practicals* **Practical Chemistry:**

	Weighing, Pipetting, Titration, Dilution, Spectrophotometry, Synthesis, Melting point determination, Refractive index, IR spectrometry, TLC *Teaching methods: Lab practicals* **Tutor:** Calculation and error analysis Benzoic acid background Lab materials and safety Biobased economy Field of work and internationalization *Teaching methods: project group meetings* **Workshops** Scientific writing: Lab journal and data report: discussion and conclusion. *Teaching methods: interactive workshops*
Required literature	The latest version of: Campbell N, Reece J, *Biology*, Pearson Education Inc Nivaldo J Tro; *Principles of chemistry,* Pearson Dean, J.R. *et al*.: *Practical skills in Chemistry/Biomolecular sciences*, Prentice Hall, Harlow
Required software/materials	LabArchives, Microsoft Office
Recommended literature	
Examination	
	CHLS2B-P
Name of examination or modular examination	Practical
Examination or modular examination code	CHLS2B-P
Assessment types(s):	Individual, Practice, Written
Result	Grade
Passing grade	5.5
Weight factor of modular exams	1
Exam opportunities	Term 2. There is only one opportunity per year for the modular exam CHLS2B-P (EER art. 8.5)

Permitted resources	
Method of enrolment for exam/enrolment period	Participation in CHLS2B is considered as registration for CHLS2B-P.
Discussion and review	The filled-in assessment form with any remarks is considered the discussion and review of this modular assessment.
Number of examiners	Assessment by one examiner on the basis of assessment forms (practical lecturer).
Possibilities for compensation	
Assessment dimensions	Competence 1: Design 1.1.4. Forms a hypothesis based on the research question. Competence 2: Experimenting 2.1.1. Reads and understand the practical guide; understands the theoretical background of the main steps of the methods. 2.1.2. Performs calculations prior to beginning lab work. 2.1.3. Ensures that all requirements are present before beginning the experiment. 2.1.4. Carries out experiments accurately according to the protocol. 2.1.5 Carries out the experiment within the given time frame. Competence 3: Results Analysis 3.1.1. Carries out results analysis according to the prescribed methods; performs error analysis in the correct manner (if applicable). 3.1.2. Evaluates the obtained results based on their accuracy and reliability. 3.1.3. Makes conclusions relating to the initial research question (if possible). 3.1.4. Discusses the execution of the experiment and results. Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules. 4.1.2. Uses materials and equipment correctly. Competence 5: Management and administration 5.1.1. Encodes chemicals and samples; stores these in the prescribed manner. 5.1.2. Leaves the workplace tidy and clean. 5.1.3. Manages and archives data in lab journal (aim, experiment description, alterations, results, conclusion) and if relevant, other ways of storing data. Competence 6: Reporting and presenting 6.1.1. Reports their research according to the product criteria for lab journal and reports; Level 1:

	6.1.3 Is familiar with the international conventions of scientific and academic writing. Competence 7: Methodology 7.1.3. Works according to the previously described plan. Competence 11: Professional development 11.1.5. Has study skills required by higher professional education; is motivated and determined.
Assessment criteria	See assessment form on #OnderwijsOnline under General Information. Practical assessment: Lab journals and the practical impression throughout the course will be assessed as a whole using the assessment form.
Exam matrix	See assessment form on #OnderwijsOnline under General Information. Practical assessment: 12.5% Lab journal: General 25% Preparation 40% Practical Performance 22.5% Analysis
	CHLS2B-IPV:
Name of examination or modular examination	IPS
Examination or modular examination code	CHLS2B-IPV:
Assessment types(s):	Individual, oral, written
Result	Satisfactory/ Unsatisfactory
Passing grade	Satisfactory
Weight factor of modular exams	1
Exam opportunities	Term 2. There is only one opportunity per academic year for the modular exam CHLS2B-IPV (EER art. 8.5)
Permitted resources	
Method of enrolment for exam/enrolment period	Participation in CHLS2B is considered as registration for CHLS2B-IPV.
Discussion and review	For questions about assessment, contact the examiner.
Number of examiners	Assessment by one examiner (tutor) for the assessment based on participation and effort.
Possibilities for compensation	

Assessment dimensions	Competence 7: Planning and project-based working Works according to the previously described plan. Competence 8: Teamwork Functioning in a group 8.1.1. Adheres to rules. 8.1.2. Makes a valuable contribution to the group. Communication Is able to communicate about their assignment with peers and lecturers applying basic rules of communication, if necessary under supervision of the lecturer: 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.1.8. Verbally expresses their opinion/message. Competence 11: Professional development 11.1.5. Has study skills required by higher professional education; is motivated and determined.
Assessment criteria	The student: - Has prepared for the meeting by completing the assignment to be discussed, and also completed the required reading for the following assignment to be discussed; - Is able to show weekly assignments to the tutor (according to agreement, in writing or as a presentation); all required aspects are complete in all assignments; - Adheres to the rules agreed upon; - Asks questions and shares knowledge regarding the assignment during tutor meetings; verbalizes these clearly and audibly, maintains eye contact; - Gives others opportunity to speak; - The student offers feedback to group and class members and is open to receiving feedback; - Is satisfactoryly present during the tutor lessons (missed a maximum of 1 lesson for a good reason); - Submits a reflection report on the professional attitude to the tutor.
	CHLS2B-Pr
Name of examination or modular examination	Presentation
Examination or modular examination code	CHLS2B-Pr
Assessment types(s):	Oral, in pairs
Result	Individual grade
Passing grade	5.5
Weight factor of modular exams	1

Exam opportunities	Term 2, resit in consultation with lecturer.
Permitted resources	
Method of enrolment for exam/enrolment period	Participation in CHLS2B is considered as registration for CHLS2B-Pr
Discussion and review	The filled-in assessment form with any remarks is considered the discussion and review of this modular assessment.
Number of examiners	Two examiners for the assessment based on the assessment form (subject expert)
Possibilities for compensation	
Assessment dimensions	Competence 1: Design 1.1.1. Independently identifies relevant background information required to answer the research question. 1.1.2. Knows the criteria defining reliable sources of information in scientific research. 1.1.5. Integrates information into a simple research plan. Competence 3: Results Analysis 3.1.3. Makes conclusions relating to the initial research question (if possible). 3.1.4. Discusses the execution of the experiment and results. Competence 6: Reporting and presenting 6.1.3. Is familiar with the international conventions of scientific and academic writing. 6.1.5. Presents research to a target audience with similar knowledge background, applies general presentation techniques and answers questions: uses correct spelling and grammar; Describes results so the reader can understand; Uses clearly labelled figures and tables; there is structure in the presentation (introduction-body-conclusion); speaks clearly and coherently; has upright posture and hands are freely used; makes eye contact with the audience; makes organised and clear slides or other visual products. Competence 8: Teamwork Is able to communicate about their assignment with peers and lecturers applying basic rules of communication, if necessary under supervision of the lecturer: 8.1.2. Makes a valuable contribution to the group. 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.1.8. Verbally expresses their opinion/message.
Assessment criteria	*See assessment form "Presentation Course 2 CHLS2B" on OnderwijsOnline under General Information.*
Exam matrix	Content: 30%

	Presentation: 45% Questions: 25%

Course unit 2C: CHLS2C (6 credits)

	CHLS2C
General information	
Target group	Full-time students common foundation year - Life Sciences, Biology and Medical Laboratory Research, Chemistry
Name of course unit	CHLS2C: Basic Theory Biology & Medical and Chemistry 2 / ECU CHLS2C: Basic theory Life Science, Biology, Medical and Chemistry 2
Study unit code	CHLS2C
Teaching term	Term 2
ECTS credits	6 study credits
Study load in hours	168 SBU
Study hours (contact hours)	Programmed contact hours: 6 lesson periods/week, 42 lesson periods/term = 5.75 hours Scheduled time for exams: 4 lesson periods per term =3 hours Planned time for self-study: 133.5 hours Total: 168 hours
Unit of study entry requirements	HAVO (higher general continued education)/VWO (pre-university) diploma with the Nature and Technology or Nature and Health profile, MBO diploma level 4. CHLS1C must be followed
Content and organisation	
General description	Students work from different angles on basic biological, medical and chemical knowledge.
Exit qualifications	Design Experimenting Results Analysis Quality control
Professional tasks and products	Carrying out life science research
Professional products	
Cohesion	CHLS2C is related to CHLS1A, CHLS1B, CHLS1C, CHLS2A and CHLS2B
Mandatory participation	
Maximum number of participants	
Compensation possibilities	Final grade CHLS2C = (CHLS2C-Tbm + CHLS2C-Tc) /2 ≥ 5.5

	Compensation is possible for CHLS2C-Tbm and CHLS2C-Tc from 4.5.
Activities and/or teaching methods	**Supporting subjects: Biology & Medical** Form and function of plant and animal tissues Photosynthesis Digestion *Teaching methods: Combined lectures/tutorials* **Supporting subjects: Life Science/Biology & Medical Lab practicals theory** Theoretical background to lab practical *Teaching methods: Combined lectures/tutorials* **Supporting subjects: Chemistry** Acids and bases Buffers Organic Chemistry Macromolecules *Teaching methods: Combined lectures/tutorials* Supporting subjects: *Theory of the chemistry practicals* Theoretical background to lab practical *Teaching methods: Combined lectures/tutorials*
Required literature	Latest version of Campbell and Reece, Biology, a Global Approach, Pearson Education Latest version of Nivaldo J Tro, Chemistry, A Molecular Approach, Pearson Education
Required software/required materials	LabArchives
Recommended literature	Life Science: Latest version of Reed and Weyers, Practical Skills in Biomolecular Science, Pearson Education. Chemistry Students: Latest version of Reed and Weyers, Practical skills in Chemistry, Pearson Education.
Examination	
	CHLS2C-Tbm
Name of examination or modular examination	Basic Theory Biology & Medical
Examination or modular examination code	CHLS2C-Tbm
Assessment types(s):	Individual written open questions and/or multiple choice questions
Result	Grade
Passing grade	4.5

Weight factor of modular exams	1
Exam opportunities	Term 2, resit term 3 Participation in CHLS2C-Tbm is only possible twice per academic year.
Permitted resources	Ordinary calculator
Method of enrolment for exam/enrolment period	Registration for the modular exam via Alluris. The registration term is several weeks prior to the exam period or the resit period. The period is stated in the SABC annual schedule on Insite - Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is scheduled in the following teaching period. The discussion of exams taken in a resit period is scheduled at the end of the education period. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	2 Examiners for construction and evaluation. Assessment by one examiner based on the answer key.
Possibilities for compensation	CHLS2C-Tbm may be compensated from ≥ 4.5.
Assessment dimensions	Competence 1: Design 1.1.4. Forms a hypothesis based on the research question. 1.1.5. Integrates information into a simple research plan. 1.1.6. Understands and applies simple English literature relevant to the given context. Competence 2: Experimenting 2.1.1. Reads and understand the practical guide; understands the theoretical background of the main steps of the methods. 2.1.2. Performs calculations prior to beginning lab work. Competence 3: Results Analysis 3.1.1. Carries out results analysis according to the prescribed methods; performs error analysis in the correct manner (if applicable). 3.1.3. Makes conclusions relating to the initial research question (if possible). Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules.
Assessment criteria	The student has knowledge of the following subjects and is able to apply them: Biology & Medical Theory

	- The form and function of plant tissues - Structure and function of animal tissues - Photosynthesis - Digestion Background theory of experiments and analysis: - Inoculation and reading plates - Gram staining - Staining of digestive tract tissue - Yeast staining and counting chamber - Plant stem and microscope - Lab safety
Exam matrix	65 (±5)% Biology & Medical theory 35 (± 5)% Lab Practical theory and analysis
	CHLS2c-Tc
Name of examination or modular examination	Chemistry Theory
Examination or modular examination code	CHLS2c-Tc
Assessment types(s):	Individual, Written Open Questions
Result	Grade
Passing grade	4.5
Weight factor of modular exams	1
Exam opportunities	Term 1, resit Term 2 Participation in CHLS2C-Tc is only possible twice per academic year.
Permitted resources	Ordinary calculator
Method of enrolment for exam/enrolment period	Registration for the modular exam via Alluris. The registration term is several weeks prior to the exam period or the resit period. The period is stated in the SABC annual schedule on Insite - Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is scheduled in the following teaching period. The discussion of exams taken in a resit period is scheduled at the end of the education period. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	2 Examiners for construction and evaluation. Assessment by one examiner based on the answer key (theory lecturer).

Possibilities for compensation	CHLS2C-Tc may be compensated from ≥ 4.5.
Assessment dimensions	Competence 1: Design 1.1.4. Forms a hypothesis based on the research question. 1.1.5. Integrates information into a simple research plan. 1.1.6. Understands and applies simple English literature relevant to the given context. Competence 2: Experimenting 2.1.1. Reads and understand the practical guide; understands the theoretical background of the main steps of the methods. 2.1.2. Performs calculations prior to beginning lab work. Competence 3: Results Analysis 3.1.1. Carries out results analysis according to the prescribed methods; performs error analysis in the correct manner (if applicable). 3.1.3. Makes conclusions relating to the initial research question (if possible). Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules.
Assessment criteria	The student has knowledge of the following subjects and can apply this knowledge: Chemistry Basic Theory: *Acids and bases:* - Balance acid-base reactions and identify acids and bases; calculate the pH and pOH of a solution of strong and weak acids and strong bases; - Calculate the concentration H3O+ and OH- from the pH and Kw; - Calculation of pH at every point in a titration of a strong acid with a strong base; - Calculation of pH at every point in a titration of a weak acid with a strong base; - Calculation of pH at every point in a titration of a strong acid with a weak base; - Calculate the volume of titrant at the end point of the titration. - Calculation of the pH of a buffer, buffer range and buffer capacity Organic Chemistry - Identify two molecules as structural isomers or stereoisomers; - Draw hydrocarbons with and without functional groups based on the name and determine whether the name is correct; - Nomenclature of hydrocarbons with and without functional groups; - Recognize and name functional groups (haloalkane, alcohol, ether, phenol, aldehyde, ketone, carboxylic acid, amine, amide or ester); predict the influence of hydrogen bonds on the physical properties of organic compounds;

	Macromolecules – Recognition of building blocks of macromolecules (lipids, carbohydrates, proteins, plastics) – Reactions between different building blocks of lipids, carbohydrates, proteins and plastics – Protein structures Background theory of experiments and analysis: - Benzoic acid synthesis - Infrared spectrometry - Spectrophotometry - TLC - Titration - Molecular cooking - Lab safety
Exam matrix	65 (±5) % Chemistry theory 35 (± 5)% Lab Practical theory and analysis

Course unit 3K: LS3K (5 credits)

	LS3K
General information	
Target group/groups	Full-time Students Main phase - Biology and Medical Laboratory Research, Life Science level 1 MLO transfer students
Name of unit of study	ECU 3K: Knowledge of molecular biology and biochemical research of DNA and protein
Code of unit of study	LS3K
Lecture period	Term 3
ECTS credits	5 stp
Study load in hours	140 SBU
Study hours (contact hours)	Lesson/contact hours: Avg. 8 lesson hours per week, 6 clock hours per week Total 56 lesson hours (periods) /week= 42 hours per term Planned time for self-study: 98 clock hours Total: 140 hours
Entry requirements for unit of study	HAVO (higher general continued education)/VWO (pre-university) diploma with the profile Nature and Technology or Nature and Health, and course units CHLS1A/B/C and CHLS2A/B/C. Participants MLO-flow-through program or shortened route for secondary school students or MLO'ers.
Inhoud en organsatie	
General description	In this course unit, students learn about the molecular and biochemical properties of the biomolecules RNA, DNA and protein, and about the processes that are involved in the production of these biomolecules. Students learn to use databases and IT tools to analyse DNA, RNA and proteins. The theory behind important methods are discussed that are integral to the research of biomolecules.
Exit qualifications	Design
Professional task	Carrying out life science research.
Beroepsproducten	

Cohesion	LS3 builds on CHLS1A/B/C and CHLS2A/B/C and prepares for the main phase of Life Science. LS3 is divided into three course units, each worth 5 study credits. LS3K (Knowledge), LS3P (practical), LS3T (theme, project).
Mandatory participation	-
Maximum number of participants	**-**
Compensation options	**-**
Activities and/or instructional formats	Supporting subject Molecular Biology Structure of the cell Properties of DNA, RNA, proteins, lipids and carbohydrates. Genetic code Replication, telomeres, packaging of DNA, transcription, translation Comparison of gene expression in prokaryotes and eukaryotes Mutations, protein folding, Post-Translational Modification (PTM), protein trafficking. *Working methods: combined lectures/response classes* Supporting subject Bioinformatics Biological database Bioinformatics web portals CLC Bio Genetic Code, determination of Open Reading Frames Restriction enzyme analysis Primer design and analysis Protein analyses *Working methods: response classes* Supporting subject Chemistry Chemical bonds Weak acids and bases Buffers Properties of proteins *Working methods: combined lectures/response classes* Supporting subject Physics Centrifugation Electrophoresis Fluorescence *Working methods: lecture* Workgroups Practical theory / expert Theoretical background and designing experiment plan for protein isolation, protein purification, protein concentration measurement, SDS PAGE Using and referencing sources of literature *Working methods: lecture*

Required literature	The latest edition of: - Reece, J.B. et al. Campbell Biology (latest edition).San Francisco: Pearson/Benjamin Cummings - Tro, N.J., Principles of chemistry, a molecular approach. Upper Saddle River, New Jersey: Prentice Hall/ Pearson. BINAS handbook for the natural sciences and mathematics (1st edition, English). Groningen: Noordhoff Uitgevers. - Honing, H. van der, Janse, H., Jagers, D., Thiele, A., (2013) Course guide 'Biomolecules in their environment", HAN HAN University of Applied Sciences, Faculty of Engineering, Applied Sciences. - Agostino, M., Practical Bioinformatics. New York: Garland Science.
Required software / required materials	
Recommended literature	The latest edition of: - Holmes, D.A., Reed, R., Jones, A.M., Dean, J. Practical Skills in Biomolecular Sciences, (4th revised ed.) New York NY: Pearson Education Ltd.
Examination	
	LS3K-Bi
Name [exams or modular exams]	Bioinformatics Assessment and Assignments
Code [exams or modular exams]	LS3K-Bi
Exam and modular exam format(s)	Individual, In writing, Open Questions
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 3, resit end of term 4
Permitted resources	Non-graphical calculator, internet, CLC-Bio
Method of enrolment for exam / enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the assessment period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is scheduled in the following teaching period. The discussion of exams taken in a resit period is scheduled at the end of the education period. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	Two examiners for construction and evaluation. Assessment by one examiner using the correction model (theoretical or practical lecturer).
Compensation possibility	-

Competences and indicators	Competence 1: Design 1.1.3. Consults simple and relevant sources of scientific information. These sources are presented in the assignment. In the context of: Biological databases and analysis tools for gene and protein sequences Restriction maps and in silico restriction analysis PCR primer analysis Protein analyses
Assessment criteria	The student: searches in biological databases e.g. for articles, gene and protein sequences; identifies gene sequences and performs a nucleotide blast to determine whether a nucleotide sequence comes from a specific organism and/or codes for a (part of) the gene. learns to work with analysis software to nucleotide sequences to import and editing; makes restriction maps and determines sizes of restriction fragments; can detect an ORF from nucleotide sequences using CLC bio and translate to the protein encoded; then study the molecular mass, isoelectric point and amino acid composition. develops primers for PCR; determine the molecular mass and isoelectric point of proteins; analyzes known protein sequences and can determine in which organisms that protein is found. The grade for the exam is only awarded if all self-study assignments have been satisfactory. That means that all self-study assignments are satisfactory and submitted before the deadline via email and/or OnderwijsOnline. The exam is a practical test, which is why extra exam time is not allowed. The search speed is part of the assessment.
Test matrix	1/3: General bio-informatics knowledge and finding information in bio-informatics databases 1/3: Sequence analysis 1/3: primer design and restriction enzyme analysis
	LS3K-K
Name [exams or modular exams]	Theory exam
Code [exams or modular exams]	LS3K-K
Exam and modular exam format(s)	Individual, In writing, Open Questions, Multiple choice
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	2
Exam opportunities	Term 3, resit end of term 4
Permitted resources	non-graphical calculator

Method of enrolment for exam / enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the assessment period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is scheduled in the following teaching period. The discussion of exams taken in a resit period is scheduled at the end of the education period. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	Two examiners for construction and evaluation. Assessment by one examiner using the correction model (theory lecturer).
Compensation possibility	-
Competences and indicators	Knowledge of molecular biology: - Biomolecules: DNA, RNA, proteins, lipids and carbohydrates - Replication, telomeres, packaging of DNA, transcription, RNA processing, translation - The genetic code, mutations, protein folding, Post-Translational Modification (PTM) and protein trafficking. Knowledge of chemistry: - Chemical binding - Weak acids, bases and buffers - Properties of proteins - Separation techniques Knowledge of physics / theory behind practice: - Centrifugation; - Electrophoresis; - Fluorescence; - DNA isolation and analysis: - Protein isolation, purification and determination
Assessment criteria	The student: Molecular Biology - names the structure and properties of the biomolecules DNA, RNA, protein, carbohydrates and lipids - makes statements about the percentage of adenine, cytosine, guanine or thymine in a double-stranded DNA molecule; -describes the structure of chromosomes from DNA and histon proteins; -has knowledge of the function of telomeres and telomerase in relation to cell division;

	- predicts, based on the properties of biomolecules their localization and possible function in the cell and vice versa - has knowledge and insight in replication, transcription, RNA processing, translation, protein folding, PTM and protein trafficking of prokaryotes and eukaryotes; - applies knowledge of the genetic code and gene expression in order to make statements about RNA and protein sequences based on DNA sequences and vice versa and on the consequences of changes in DNA, RNA or protein in cells; - names and describes different types of mutations and mutations in different DNA sequences and explains the possible consequences for a cell Chemistry - has knowledge of atomic composition and types of molecular bonds and can apply this to draw Lewis structures and determine dipolar moments: - describes the composition and properties of molecular bonds, ion bonds, covalent bonds can perform pH calculations for weak acids, weak bases and buffers - has knowledge of amino acids and protein and can calculate the load of proteins as a function of the pH has knowledge of separation techniques and can apply it to determine the elution order of a mixture or to determine a strategy to separate a mixture Centrifugation: - has understanding of the forces that work on a particle in a solution; - knows what influences the sedimentation speed; knows centrifugation - methods and understands the relationship between rpm, RCF and r (radius of the centrifuge) and can calculate these Electrophoresis: - understands movement of ions in an electrical field; - has knowledge and understanding of agarose and polyacrylamide gel electrophoresis;. - understands the aspects regarding heat development, endosmosis and use of buffers; - has knowledge and insight in the influence of load, size and shape of molecules (DNA, RNA and proteins) on the mobility Fluorescence: - knows the relationship between the wavelengths of light and the resolution; - knows the concept and the differences between excitation, fluorescence emission; - understands the aspects of a light source, RGB, monochromator, splitters, filters, and cross-talk with fluorescence Isolation and analysis of DNA and protein: - knows methods for the isolation and analysis of DNA and protein, and then apply this knowledge in practical questions.
Test matrix	60% of the test consists of multiple choice questions and 40% of the test consists of open questions. 45-55% cell biology (multiple choice); 5-15% physics/theory underlying practical work (multiple choice);

	35-45% Chemistry (open questions).

Course unit 3P: LS3P (5 credits)

	LS3P
General information	
Target group/groups	Full-time Students Main phase - Biology and Medical Laboratory Research, Life Science level 1 MLO transfer students
Name of unit of study	ECU 3P: Practical molecular biology and biochemical research of DNA and protein
Code of unit of study	LS3P
Lecture period	Term 3
ECTS credits	5 stp
Study load in hours	140 SBU
Study hours (contact hours)	Lesson/contact hours Avg. 11 lesson hours per week, 8.25 clock hours per week Total 140 lesson hours (periods) /week= 58 hours per term Planned time for self-study: 82 clock hours Total: 140 hours
Entry requirements for unit of study	HAVO (higher general continued education)/VWO (pre-university) diploma with the profile Nature and Technology or Nature and Health, and course units LS1A,B,C and LS2A,B,C. MLO transfer students, accelerated route for MLO or VWO students. Attendance at the practical lessons is a prerequisite for participation in the modular examination PL (Practical with lab journal).
Content and organisation	
General description	In this course unit, students learn about the molecular and biochemical properties of the biomolecules RNA, DNA and protein, and about the processes that are involved in the production of these biomolecules. In the practical, important methods are performed that are integral to research of biomolecules. The experiments are planned partially by the students in a research plan.
Exit qualifications	Design Experiment Quality control Results analysis Management and administration Reporting and presenting Planning and project-based working Teamwork Managing professional development
Professional task	Carrying out life science research.
Beroepsproducten	
Cohesion	LS3 builds on LS1A,B,C and LS2A,B,C and prepares for the main phase of Life Science. LS3 is divided into three course units, each worth 5 study credits. LS3K (Knowledge), LS3P (practical), LS3T (theme, project).
Mandatory participation	Attendance at practicals is compulsory for participation in LS3P-PL.

Maximum number of participants	**-**
Compensation options	**-**
Activities and/or instructional formats	Practicals DNA isolation Agarose gel electrophoresis Restriction digestion PCR Protein extraction Protein purification Protein concentration determination SDS-PAGE *Teaching methods: lab practicals and lab journal* Workgroups Practical theory / expert Theoretical background and designing experiment plan for protein isolation, protein purification, protein concentration measurement, SDS PAGE Using and referencing sources of literature *Working methods: lecture*
Required literature	The latest edition of: - Reece, J.B. et al. Campbell Biology (latest edition). San Francisco: Pearson/Benjamin Cummings - Tro, N.J., Principles of chemistry, a molecular approach. Upper Saddle River, New Jersey: Prentice Hall/ Pearson. - Various. BINAS handbook for the natural sciences and mathematics (1st edition, English). Groningen: Noordhoff Uitgevers. - Agostino, M., Practical Bioinformatics. New York: Garland Science.
Required software / required materials	LabArchives, Small laptop (or tablet)
Recommended literature	The latest edition of: - Holmes, D.A., Reed, R., Jones, A.M., Dean, J. Practical Skills in Biomolecular Sciences, (4th revised ed.) New York NY: Pearson Education Ltd.
Examination	
	LS3P-PL
Name [exams or modular exams]	Practical with lab journal
Code [exams or modular exams]	LS3P-PL
Exam and modular exam format(s)	Individual, Practical, Written
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Terms 3. There is only one opportunity per academic year for the modular exams PL (EER paragraph 8.5)

Permitted resources	CLC Bio, LabArchives, internet, calculator
Method of enrolment for exam / enrolment period	Participation in ECU LS3P is sufficient for enrolment in LS3P-PL
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner based on assessment form (practical lecturer).
Compensation possibility	-
Competences and indicators	Competence 1: Design 1.1.4. Forms a hypothesis based on the research question. 1.1.6. Understands and applies simple English literature relevant to the given context. Competence 2: Experiment 2.1.1. Reads and understands the practical guide; understands the theoretical background of the main steps of the methods. 2.1.2. Performs calculations prior to beginning lab work. 2.1.4. Carries out experiments accurately according to the protocol. 2.1.5. Carries out the experiment within the given time frame. Competence 3: Results analysis 3.1.1. Carries out results analysis according to the prescribed methods; performs error analysis in the correct manner (if applicable). 3.1.2. Evaluates the obtained results based on their accuracy and reliability. 3.1.3. Makes conclusions relating to the initial research question (if possible). 3.1.4. Discusses the execution of the experiment and results. Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules. Competence 5: Management and administration 5.1.1. Encodes chemicals and samples; stores these in the prescribed manner. 5.1.2. Leaves the workplace tidy and clean. 5.1.3. Manages and archives data in lab journal (aim, experiment description, alterations, results, conclusion) and if relevant, other ways of storing data. Competence 6: Reporting and presenting 6.1.1. Reports their research according to the products criteria for lab journal and reports; level 1: uses correct spelling and grammar; is aware of the scientific style; uses simple and logical structure; describes results so the reader can understand; uses clearly labelled figures and tables.

	6.1.3 Is familiar with the international conventions of scientific and academic writing. Competence 7: Methodology 7.1.3. Works according to the previously described plan. Competence 11: Professional development 11.1.5. Has study skills required by higher professional education; is motivated and determination. In the context of: chromosomal DNA isolation, Plasmid DNA isolation Restriction enzyme analysis of chromosomal and plasmid DNA PCR, agarose gel electrophoresis, protein isolation, protein purification, protein determination, SDS-PAGE
Assessment criteria	See assessment form Practical with lab journal, level I on #OnderwijsOnline - General Information.
Test matrix	See Assessment form Practical with lab journal, Level I on #OnderwijsOnline - general information.

Course unit 3T: LS3T (5 credits)

	LS3T
General information	
Target group/groups	Full-time Students Main phase - Biology and Medical Laboratory Research, Life Science level 1. MLO transfer students
Name of unit of study	ECU 3T: Molecular biology and biochemical research of DNA and protein
Code of unit of study	LS3T
Lecture period	Term 3
ECTS credits	5 stp
Study load in hours	140 SBU
Study hours (contact hours)	Lesson/contact hours avg. 3.5 lesson hours per week, 2.6 clock hours per week Total 24.5 lesson hours (periods) /term= 18.5 clock hours Planned time for self-study: 121.5 full hours Total: 140 hours
Entry requirements for unit of study	HAVO (higher general continued education)/VWO (pre-university) diploma with the profile Nature and Technology or Nature and Health, and course units CHLS1A,B,C and CHLS2A,B,C. MLO transfer students, accelerated route for MLO or VWO students.
Content and organisation	
General description	In this course unit, students learn about the molecular and biochemical properties of the biomolecules RNA, DNA and protein, and about the processes that are involved in the production of these biomolecules. Students learn to use databases and IT tools to analyse DNA, RNA and proteins. In the practical, important methods are performed that are integral to research of biomolecules. The experiments are planned partially by the students in a research plan. Students learn to use literature to search for the theoretical background

	of the methods and thereby determine which method is appropriate for their research purpose.
Exit qualifications	Design Experiment Quality control Results analysis Reporting and presenting Planning and project-based working Teamwork Managing professional development
Professional task	Carrying out life science research.
Beroepsproducten	Research plan (Op)
Cohesion	LS3 builds on CHLS1A,B,C and CHLS2A,B,C and prepares for the main phase of Life Science. LS3 is divided into three course units, each worth 5 study credits. LS3K (Knowledge), LS3P (practical), LS3T (theme, project).
Mandatory participation	For participation in the modular exam IPS participation in the tutor meetings is obligatory.
Maximum number of participants	**-**
Compensation options	**-**
Activities and/or instructional formats	Workgroups Tutor Assignments Theoretical background DNA isolation Using sources of literature Designing experimental plan for restriction enzyme analysis PCR theoretical background Designing experiments for PCR Safety and lab calculations Properties of proteins in solution Protein purification Results analysis *Methods: tutor meetings, interactive expert meetings, group work* Workgroups Research plan Theoretical background and designing experiment plan for protein isolation, protein purification, protein concentration measurement, SDS PAGE Using and referencing sources of literature *Methods: group work, workshop: Design*
Required literature	The latest edition of: - Reece, J.B. et al. Campbell Biology, San Francisco: Pearson/Benjamin Cummings - Tro, N.J., Principles of chemistry, a molecular approach. Upper Saddle River, New Jersey: Prentice Hall / Pearson. Various. BINAS handbook for the natural sciences and mathematics (1st edition, English). Groningen: Noordhoff Uitgevers. - Agostino, M., Practical Bioinformatics. New York: Garland Science.
Required software / required materials	

Recommended literature	The latest edition of: - Holmes, D.A., Reed, R., Jones, A.M., Dean, J. Practical Skills in Biomolecular Sciences, (4th revised ed.) New York NY: Pearson Education Ltd.
Examination	
	LS3T-Op
Name [exams or modular exams]	Research plan
Code [exams or modular exams]	LS3T-Op
Exam and modular exam format(s)	Group, Written
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 3, Term 4
Permitted resources	Non-graphical calculator, internet, CLC-bio
Method of enrolment for exam / enrolment period	Participation in ECU LS3T gives automatic registration for LS3T-Op
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner based on assessment form (practical lecturer).
Compensation possibility	-
Competences and indicators	Competence 1: Design 1.1.1. Identifies relevant background information required to answer the research question. 1.1.2. Knows the criteria defining reliable sources of information in scientific research. 1.1.3. Consults simple and relevant sources of scientific information. These sources are presented in the assignment. 1.1.4. Forms a hypothesis based on the research question. 1.1.5. Integrates information into a simple research plan. 1.1.6. Understands and applies simple English literature relevant to the given context. Competence 2: Experiment 2.1.1. Reads and understands the practical guide; understands the theoretical background of the main steps of the methods. 2.1.2. Performs calculations prior to beginning lab work. 2.1.3. Ensures that all requirements are present before beginning the experiment. Competence 3: Results analysis 3.1.3. Makes conclusions relating to the initial research question (if possible). Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules.

	4.1.3. Uses controls, and uses these to assess the reliability of the results. Competence 6: Reporting and presenting 6.1.1. Reports their research according to the products criteria for lab journal and reports; level 1: uses correct spelling and grammar; is aware of the scientific style; uses simple and logical structure; describes results so the reader can understand; uses clearly labelled figures and tables. 6.1.3. Is familiar with the international conventions of scientific and academic writing. Competence 7: Methodology 7.1.1. Plans and organises activities in a simple work plan. Competence 8: Teamwork Performance in a group 8.1.1. Adheres to rules. 8.1.2. Makes a valuable contribution to the group In the context of: Protein isolation Protein purification Protein determination SDS-PAGE
Assessmentcriteria	See also assessment form for the Research plan OWE3LS on #OnderwijsOnline - General information.
Test matrix	~ 20% theoretical background of methods;~ 70% plan;~ 10% structure/layout/writing See assessment form research plan on #OnderwijsOnline - General information.
	LS3T-IPV
Name [exams or modular exams]	IPS
Code [exams or modular exams]	LS3T-IPV
Exam and modular exam format(s)	Individual, In writing, Oral
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Term 3. There is only one opportunity per academic year for the modular exam IPS (EER paragraph 8.5)
Permitted resources	Non-graphical calculator, internet, CLC-bio
Method of enrolment for exam / enrolment period	Participation in ECU LS3T gives automatic registration for LS3T-IPV
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on attendance and participation (tutor).
Compensation possibility	-

Competences and indicators	Competence 7: Methodology 7.1.2. Plans the study tasks. 7.1.3. Works according to the previously described plan. Competence 8: Teamwork Performance in a group 8.1.1. Adheres to rules. 8.1.2. Makes a valuable contribution to the group. Communication - Is able to communicate about their assignment with peers and lecturers applying basic rules of communication, if necessary under supervision of the lecturer: 8.1.6.Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.1.5.Verbally expresses their opinion/messages clearly. 8.1.12. Is aware of the international character of the professional community Competence 11: Professional development 11.1.5. Has study skills required by higher professional education; is motivated and determined. 11.1.6. Is aware of internationally accepted codes of scientific conduct.
Assessmentcriteria	The student: - has prepared for the meeting by completing the assignment to be discussed, and also completed the required reading for the following assignment to be discussed; - is able to show weekly assignments to the tutor (according to agreement, in writing or as a presentation); - in all assignments all required aspects are complete; - fulfils his role(s) (e.g. chairperson, secretary, etc.; k.o.); - adheres to the rules agreed upon (k.o.); - asks questions and shares knowledge regarding the assignment during tutor meetings; verbalizes these clearly and audibly, maintains eye contact; allows others to finish speaking; - offers feedback to group and class members and is open to receiving feedback.
	LS3T-T
Name [exams or modular exams]	Theme test
Code [exams or modular exams]	LS3T-T
Exam and modular exam format(s)	Individual, In writing, Open Questions
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 3, resit end of term 4
Permitted resources	non-graphical calculator
Method of enrolment for exam / enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the assessment period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.

Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is scheduled in the following teaching period. The discussion of exams taken in a resit period is scheduled at the end of the education period. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	Two examiners for construction and evaluation. Assessment by one examiner using the correction model (theory lecturer).
Compensation possibility	-
Competences and indicators	Competence 1: Design 1.1.2. Knows the criteria defining reliable sources of information in scientific research. 1.1.3. Consults simple and relevant sources of scientific information. The sources are presented in the assignment. Competence 2: Experimenting 2.1.1. Reads and understands the practical guide; understands the theoretical background of the main steps of the methods. 2.1.2. Performs calculations prior to beginning lab work. Competence 3: Results analysis 3.1.1. Carries out results analysis according to the prescribed methods; performs error analysis in the correct manner (if applicable). 3.1.3. Makes conclusions relating to the initial research question (if possible). 3.1.4. Discusses the execution of the experiment and results. Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules. Competence 7: Methodology 7.1.1. Plans and organises activities in a simple work plan. In the context of: Isolation of chromosomal and plasmid DNA Determination of DNA concentration and purity Restriction enzyme analysis PCR, agarose gel electrophoresis protein isolation, protein purification, protein determination, SDS-PAGE properties of DNA, RNA, proteins

Assessmentcriteria	The student: - can explain the basic steps of a protocol for DNA or protein isolation and evaluate whether an unknown protocol is suitable for these purposes; - knows the principles of PCR, restriction enzyme analysis, protein isolation methods, protein purification methods, terms and protein SDS-PAGE and can apply it in practice (e.g. controls, designing, experimenting, analyzing results and plans) - can perform calculations, in the context of practical examples, on DNA extraction and analysis and protein isolation, purification, identification and analysis. - makes a statement about safety measures for substances used in the practical based on the MSDS; - can make statements about properties of DNA, RNA and proteins
Test matrix	5-10% points for safety and work planning; 10-20% points results analysis; 15-25% points for calculations; Other points for design and background of the methods.

Course unit 4K: LS4K (5 credits)

	LS4K
General information	
Target group/groups	Full-time students Biology and Medical Laboratory Research, Life Sciences. MLO transfer students
Name of unit of study	ECU 4K: Knowledge about medical diagnostics
Code of unit of study	LS4K
Lecture period	Term 4
ECTS credits	5 stp
Study load in hours	140 SBU
Study hours (contact hours)	Planned lesson/contact hours 4 lesson periods per week= 28 lesson periods per term = 21 hours Planned time for self-study: 119 hours Total: 140 hours
Entry requirements for unit of study	HAVO (higher general continued education)/VWO (pre-university) diploma with the profile Nature and Technology or Nature and Health, and course units CHLS1A,B,C and CHLS2A,B,C. MBO diploma level 4 and course unit CHLS1A,B,C and CHLS2A,B,C. MLO transfer students.
Content and organisation	
General description	In this course unit, students learn about working in a medical laboratory and become acquainted with medical diagnostics. To gain knowledge about cells, their structure and function in the field of medical microbiology, cytological and histological techniques.
Exit qualifications	
Professional task	Carrying out life science research.
Beroepsproducten	

Cohesion	LS4 builds on CHLS1A,B,C and CHLS2A,B,C and prepares for the main phase. LS4 is divided into three course units, each worth 5 study credits. LS4K (Knowledge), LS4P (practical), LS4T (theme, project). LS4K is followed by LS4T and LS4P.
Mandatory participation	**-**
Maximum number of participants	**-**
Compensation options	**-**
Activities and/or instructional formats	Supporting subject Human biology The cell: form and function Cells, tissues and organ systems Cell cycle and tumor formation Cellular signaling The immune system Heart and blood vessels, form and function *Working methods: lecture* Supporting subject Microbiology Structure of bacteria cells Metabolism of the bacteria cell Microbiological growth Infections: human and microorganism contamination, pathogenicity, virulence, antibiotics, chemotherapy The role of microbiota *Working methods: lecture*
Required literature	The latest edition of: - Reece.J.B., Campbell Biology, New York, NY: Pearson Education. - Madigan, M. T., Martinko, J.M., Brock, Biology of Microorganisms New York NY: Pearson Education Ltd.
Required software / required materials	-
Recommended literature	**-**
Examination	
	LS4K-K
Name [exams or modular exams]	Theory exam
Code [exams or modular exams]	LS4K-K
Exam and modular exam format(s)	In writing, Multiple choice, Individual
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 4, resit end term 4
Permitted resources	Non-graphical calculator

Method of enrolment for exam / enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the assessment period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • At the end of term 4 the discussion is held before the start of the resit period of term 4. • Indicate for an exam made in a resit period to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	Two examiners for construction and evaluation. Assessment by one examiner using the correction model (theory lecturer).
Compensation possibility	-
Competences and indicators	Knowledge of microbiology Knowledge of human biology
Assessment criteria	The student is able to: - name the components of the bacterial cell and function of the various components; - explain various metabolisms of bacteria (including glucose metabolism);can describe morphology and classification of bacteria; - name and explain the role of microbiota; - identify and explain the environmental factors and survival of bacteria, including extreme conditions (also under laboratory conditions); - interpret a bacterial growth curve and reproduce it; - calculate the generation time, the number of divisions and the number of cells for a given bacterial culture. explain the different types of antibiotics and the effect on the bacterial cell; - explain how a bacterial cell protects itself from an antibiotic (resistance);explain how the process of a urinary tract infection progresses with an explanation of the functions of the organs involved and diagnostics. - explain the role of bacteria in case of disease. The student is able to: - name the components of the human cell and function of the various components; - describe the structure of tissues and organ systems; - describe the structure, properties of membranes and transport processes; - explain how the form and function of human cells are necessary for life; - explain how cells communicate with each other and name the mechanisms; - identify the components of the cell cycle; - explain tumor growth, neoplasms and metastases; - name and explain the composition and properties of blood, and blood circulation; - explain how the immune system works
Test matrix	50% Human biology 50% Microbiology

Course unit 4P: LS4P (5 credits)

	LS4P
General information	
Target group/groups	Full-time students Biology and Medical Laboratory Research, Life Sciences. MLO transfer students
Name of unit of study	ECU 4P: Practical medical diagnostics
Code of unit of study	LS4P
Lecture period	Term 4
ECTS credits	5 stp
Study load in hours	140 SBU
Study hours (contact hours)	Planned lesson/contact hours: 10 lesson periods/week, 70 lesson periods/term = 52.5 hours Planned time for self-study: 87.5 hours Total: 140 hours
Entry requirements for unit of study	HAVO (higher general continued education)/VWO (pre-university) diploma with the profile Nature and Technology or Nature and Health, and course units CHLS1A,B,C and CHLS2A,B,C. MBO diploma level 4 and course unit CHLS1A,B,C and CHLS2A,B,C. MLO transfer students
Content and organisation	
General description	In this course unit, students learn about working in a medical laboratory and conducting research in the field of medical microbiology and cyto histopathology. To develop necessary competencies to perform the professional task, knowledge gained about cells, their structure and function and practical skills are taught in the field of medical microbiology, cytological and histological techniques.
Exit qualifications	Experimenting Research results analysis Quality control Reporting and presenting Management and administration Planning and project-based working Teamwork Advising Professional development
Professional task	Carrying out life science research
Beroepsproducten	Labjournal as part of practical (P)
Cohesion	LS4 builds on CHLS1A,B,C and CHLS2A,B,C and prepares for the main phase. LS4 is divided into three course units, each worth 5 study credits. LS4K (Knowledge), LS4P (practical), LS4T (theme, project). LS4P is followed by LS4T and LS4K.
Mandatory participation	LS4-P: attendance at practicals is compulsory. One missed practice session (with good reason) can be caught up in the extra lesson provided. More missed practical lessons results in no assessment carried out for LS4-P.
Maximum number of participants	-
Compensation options	-

Activities and/or instructional formats	Supporting subject Practical work Microscopic and macroscopic morphology Microbiological techniques Quantitative research Determination of Gram positive and Gram negative bacteria. Bacterial urine test Antibiotic determination Cytology and histopathology Blood: May-Grünwald staining, counting cells, blood group typing *Teaching methods: lab practicals* Supporting subject Practical theory / expert Theoretical background of the experiments *Teaching methods: combined lectures/response classes*
Required literature	The latest edition of: - Practical guide "Medical diagnostics" Course LS4, J.M. Schellekens H. Dijkman G.H.F. van Kerkhoff, herziene versie: J.E. Tuininga, M.C.M. Balemans
Required software / required materials	LabArchives
Recommended literature	
Examination	
	LS4P-P
Name [exams or modular exams]	Practical
Code [exams or modular exams]	LS4P-P
Exam and modular exam format(s)	Practical
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 4. There is only one opportunity per academic year for the modular exam P (EER paragraph 8.5) When the practical test is missed due to illness and the student has officially reported sick, or personal circumstances (for review to the course coordinator and/or Examination Board) then the student has the right to another chance.
Permitted resources	Regular calculator
Method of enrolment for exam / enrolment period	Participation in ECU LS4P is sufficient for enrolment in LS4P-P
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner based on assessment form (Practical lecturer).
Compensation possibility	P = (Average products + Assessment practical + practical exam)/3. Practical must be ≥ 5.5. Practical exam and products ≥ 4.0.

Competences and indicators	Competence 1: Design 1.1.4. Forms a hypothesis based on the research question. Competence 2: Experimenting 2.1.1. Reads and understands the practical guide; understands the theoretical background of the main steps of the methods. 2.1.2. Performs calculations prior to beginning lab work. 2.1.4. Carries out experiments accurately according to the protocol. Competence 3: Results analysis 3.1.1. Carries out results analysis according to the prescribed methods; performs error analysis in the correct manner (if applicable). 3.1.3. Makes conclusions relating to the initial research question (if possible). 3.1.4. Discusses the execution of the experiment and results. Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules. Competence 5: Management and administration 5.1.1. encodes chemicals and samples; stores these in the prescribed manner. 5.1.2. Leaves the workplace tidy and clean. 5.1.3. Manages and archives data in lab journal (aim, experiment description, alterations, results, conclusion) and if relevant, other ways of storing data. Competence 6: Reporting and presenting 6.1.1. Reports their research according to the products criteria for lab journal and reports; level 1: -uses correct spelling and grammar; -is aware of the scientific style; -uses simple and logical structure; -describes results so the reader can understand; -uses clearly labelled figures and tables. Competence 7: Methodology 7.1.3. Works according to the previously described plan. Competence 11: Professional development 11.1.4. Has study skills required by higher professional education; motivated and determined. In the context of: safe microbiological techniques - good microbiological techniques – microscopy - microscopic morphology of bacteria - bacterial growth on different media - determination of Gram positive cocci - determination of Gram negative rods - histology techniques -cytological staining - histology staining - histology and cytology - microbiological analysis of urinary tract infection - antibiotic sensitivity determination - blood group typing - making and staining a blood smear - differential counting of leukocytes

Assessment criteria	Products: See Assessment forms on #OnderwijsOnline - General information. Assessment Practical Level 1 semester 2: See Assessment form on #OnderwijsOnline - General information. Practical exam: The student individually executes one or more experiments that were also done in lab practical classes. The student is evaluated on the correct performance of the experiments according to the learned protocols and drawing the right conclusions.
Test matrix	Practical test: ~ 5% GMT, SMT ~ 16% Macroscopic morphology ~ 31% Determination ~ 16% Histology ~ 16% Urinary tract infection ~ 16% Blood

Course unit 4T: LS4T (5 credits)

	LS4T
General information	
Target group/groups	Full-time students Biology and Medical Laboratory Research, Life Sciences. MLO transfer students
Name of unit of study	ECU 4T: Medical Diagnostics Project
Code of unit of study	LS4T
Lecture period	Term 4
ECTS credits	5 stp
Study load in hours	140 SBU
Study hours (contact hours)	Planned lesson/contact hours~ 5 lesson periods/week, 35 lesson periods/term = 26 hours Planned time for self-study: 114 hours Total: 140 hours
Entry requirements for unit of study	HAVO (higher general continued education)/VWO (pre-university) diploma with the profile Nature and Technology or Nature and Health, and course units CHLS1A,B,C and CHLS2A,B,C. MBO diploma level 4 and course units CHLS1A,B,C and CHLS2A,B,C. MLO transfer students
Content and organisation	
General description	In this course unit, students learn about working in a medical laboratory and become acquainted with medical diagnostics. To develop necessary competencies to perform the professional task, knowledge gained about cells, their structure and function and practical skills are taught in the field of medical microbiology, cytological and histological techniques. Regarding the competence "research analysis", a report is created containing an analysis of experimental data. Advice is given based on a case study.
Exit qualifications	Experimenting Research results analysis Quality control

	Reporting and presenting Management and administration Planning and project-based working Teamwork Advising Professional development
Professional task	Carrying out life science research
Beroepsproducten	Report (V) Advice Presentation (AP)
Cohesion	LS4 builds on CHLS1A,B,C and CHLS2A,B,C and prepares for the main phase. LS4 is divided into three course units, each worth 5 study credits. LS4K (Knowledge), LS4P (practical), LS4T (theme, project). LS4T is followed by LS4K and LS4P.
Mandatory participation	LS4T-IPV: presence in tutor lessons is compulsory.
Maximum number of participants	**-**
Compensation options	**-**
Activities and/or instructional formats	Tutor meetings Tasks and assignments in the areas of: Microbiology, histology and medical diagnostics *Methods: tutor meetings* Workshop Working safely with biological agents Risk and safety, risk analysis Pathogens, physical containment, biological containment Risk classes and containment levels GMT, SMT in practice *Teaching methods: training* Workshops Results analysis Interpretation of research results Drawing the correct conclusions from results Results analysis *Teaching methods: training* Workshop Professional Skills 3 Professional attitude Communication Co-operation *Teaching methods: training + team meeting*
Required literature	The latest edition of: - Reece. J.B., Campbell Biology, New York, NY: Pearson Education. - Holmes,D.A., Reed, R., Jones, A.M., Dean, J. Practical Skills in Biomolecular Sciences, New York, NY: Pearson Education Ltd. - Madigan,M. T., Martinko, J.M., Brock, Biology of Microorganisms New York NY: Pearson Education Ltd. - van 't Leven, I., Veiligheid en milieu in laboratoria, Utrecht: Syntax Media.
Required software / required materials	-
Recommended literature	**-**

Examination	
	LS4T-V
Name [exams or modular exams]	Research report
Code [exams or modular exams]	LS4T-V
Exam and modular exam format(s)	In writing, Group
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 4, resit Term 4
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in LS4T is sufficient for enrolment in LS4T-V
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner based on assessment form (practical lecturer).
Compensation possibility	-
Competences and indicators	Competence 1 Design 1.1.1. Identifies relevant background information required to answer the research question. Competence 2: Experimenting 2.1.1. Reads and understands the practical guide; understands the theoretical background of the main steps of the methods. Competence 3: Results analysis Data processing 3.1.1. Carries out results analysis according to the prescribed methods; performs error analysis in the correct manner (if applicable). Validation 3.1.2. Evaluates the obtained results based on their accuracy and reliability. Conclusions and discussion. 3.1.3. Makes conclusions relating to the initial research question (if possible). 3.1.4. Discusses the execution of the experiment and results. Competence 6 Reporting and presenting 6.1.1. Reports their research according to the products criteria for lab journal and reports; level 1: - uses correct spelling and grammar; - is aware of the scientific style; - uses simple and logical structure; - describes results so the reader can understand; - uses clearly labelled figures and tables.

	In the context of: - Determining colony forming units, OD measurement - Determination of specific growth rate and generation time of a bacterial culture
Assessment criteria	See assessment form 'Research report: Course 4LS on #OnderwijsOnline - General information.
Test matrix	80% Content, 20% Text See assessment form 'Research report: Course 4LS on #OnderwijsOnline - General information.
	LS4T-IPV
Name [exams or modular exams]	IPS
Code [exams or modular exams]	LS4T-IPV
Exam and modular exam format(s)	Individual, Oral
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Term 4. There is only one opportunity per academic year for the modular exam IPS (EER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS4T is sufficient for enrolment in LS4T-IPV
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on attendance and participation (tutor).
Compensation possibility	
Competences and indicators	Competence 7: Methodology 7.1.3. Works according to the previously described plan. Competence 8: Teamwork Performance in a group 8.1.1. Adheres the rules. 8.1.2. Makes a valuable contribution to the group Communication - Is able to communicate about their assignment with peers and lecturers applying basic rules of communication: 8.1.6. Maintains eye contact with conversation partner; 8.1.7. Gives others opportunity to speak; 8.1.8. Verbally expresses their opinion/messages. Competence 11: Professional development 11.1.4. Has study skills required by higher professional education; is motivated and determined.

Assessment criteria	The student: • has prepared for the meeting by completing the assignment to be discussed, and also completed the required reading for the following assignment to be discussed; • is able to show weekly assignments to the tutor (according to agreement, in writing or as a presentation); • all required aspects are complete in all assignments; • fulfils his/her roles (Chair, secretary etc.); • adheres to the rules agreed upon (k.o.); • asks questions and shares knowledge regarding the assignment during tutor meetings; verbalizes these clearly and audibly, maintains eye contact; • allows others to finish speaking; • offers feedback to group- and class members and is open to receiving feedback.
	LS4T-T
Name [exams or modular exams]	Theme test
Code [exams or modular exams]	LS4T-T
Exam and modular exam format(s)	In writing, Individual
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 4, resit Term 4.
Permitted resources	Non-graphical calculator
Method of enrolment for exam / enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the assessment period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • At the end of term 4 the discussion is held before the start of the resit period of term 4. • Indicate for an exam made in a resit period to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	Two examiners for construction and evaluation. Assessment by one examiner using the correction model (theory lecturer).
Compensation possibility	
Competences and indicators	Competence 2: Experimenting 2.1.1. Reads and understands the practical guide; understands the theoretical background of the main steps of the methods. 2.1.2. Performs calculations prior to beginning lab work. Competence 3: Results analysis

	3.1.1. Carries out results analysis according to the prescribed method; performs error analysis in the correct manner (if applicable). 3.1.2. Evaluates the obtained results based on their accuracy and reliability. 3.1.3. Makes conclusions relating to the initial research question (if possible). Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules. 4.1.3. Uses controls and uses these to assess the reliability of the results. In the context of: safe microbiological techniques good microbiological techniques determination of disinfection sensitivity microscopic morphology of bacteria Bacterial growth on different media determination of Gram positive cocci determination of Gram negative rods histology techniques microscopy cytological staining histology staining microbiological analysis of urinary tract infection antibiotic sensitivity determination blood group typing: making and staining a blood smear differential counting of leukocytes Structure and function of animal cells coeliac disease
Assessment criteria	The student: • describes and explains the rules and measures regarding safe and good microbiological techniques; • can perform calculations based on tests in the practical (dilution series, colony forming units); • recognizes and describes the microscopic morphology of the bacteria that were introduced in the practical; • knows the definition of and differences between selective, elective and enriched media, and can describe the properties of these. • describes the steps in the identification of Gram positive cocci and Gram negative rods and draws the right conclusion of the results; • describes the different steps in microbiological research of urinary tract infections and draws the right conclusions; • describes the steps and background of the cytological and histological stains and microscopy that have been introduced in the practical; • recognizes and describes the different components of blood and understands how a blood type determination works; • describes the structure and function of intestinal epithelium and the relationship between structure and function; • describes the symptoms, the cause and diagnosis of a patient with coeliacs or urinary tract infection.

Test matrix	~5% safety ~5% calculations ~50% for the context subjects and the microbiology applications ~40% for the context subjects and the cytohistology applications
	LS4T-AP
Name [exams or modular exams]	Advice Presentation
Code [exams or modular exams]	LS4T-AP
Exam and modular exam format(s)	Oral, Group
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Term 4, resit Term 4.
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS4T is sufficient for enrolment in LS4T-AP
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner based on assessment form (Tutor).
Compensation possibility	-
Competences and indicators	Competence 6: Reporting and presenting 6.1.5. Presents research to a target audience with similar knowledge background, applies general presentation techniques and answers questions: uses correct spelling and grammar; describes results so the reader can understand; uses clearly labelled figures and tables; there is an introduction-body-conclusion structure to the presentation; speaks clearly and coherently; has upright posture and hands are freely used; makes eye contact with the audience; makes organised and clear slides or other visual products Competence 8: Team work - Performance in a group 8.1.2. Makes a valuable contribution to the group Competence 10: Advising 10.1.1. Understands the needs and practical requirements. 10.1.2. Advises about purchase of reagents on the basis of product specifications and sales conditions. In the context of a suitable case study.
Assessment criteria	See assessment form for the Advice Presentation LS4 on #OnderwijsOnline - General information.
Test matrix	See form: Advice Presentation on #OnderwijsOnline - General information.

	LS4T-HBO
Name [exams or modular exams]	Competency Card
Code [exams or modular exams]	LS4T-HBO
Exam and modular exam format(s)	Oral, In writing, Individual
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Year 1
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS4T is sufficient for enrolment in LS4T-HBO
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on assessment form (Tutor, study coach, workshop lecturer). Each examiner assesses their own part. The SCC enters a Satisfactory if the card is complete.
Compensation possibility	-
Competences and indicators	Competence 6: Reporting and presenting 6.1.2. Takes minutes of meetings according to product criteria for meeting minutes; level 1. 6.1.3. Is familiar with the international conventions of scientific and academic writing. 6.1.6. In English: Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. Competence 8: Team work 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.1.8. Verbally expresses their opinion/messages. Competence 9: Leadership - Meetings 9.1.1. Composes an agenda in a standard format and uses it to chair a meeting.
Assessment criteria	See assessment form ‘Agenda/Chairperson, level I’ on #OnderwijsOnline - General information. 2 signatures (=satisfactory) for ‘Agenda’ and 2 for ‘Leading PBL group’ on Competency card are required. See assessment form ‘Meeting minutes, level I’ on #OnderwijsOnline - General information. 2 signatures (=satisfactory) on the competency card are required Internationalisation: The student - actively participates in a tutormeeting in English course LS 1/2

	- actively participates in a tutormeeting in English course LS3 - explains in English a practical action in LS4
Test matrix	See assessment forms on #OnderwijsOnline - General information.
	LS4T-ST
Name [exams or modular exams]	Mini-internship
Code [exams or modular exams]	LS4T-ST
Exam and modular exam format(s)	Individual, Writing
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Year 1
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS4T is sufficient for enrolment in LS4T-ST
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on participation (study coach).
Compensation possibility	
Competences and indicators	Competence 8: Team work - Internationalisering 8.1.12. Is aware of the international character of the professional community. Competence 11: Professional development 11.1.2. Works on learning aims as described in the PDP and collated competency assessment products. 11.1.3. Reflects critically on own performance and learning process; learns from mistakes. 11.1.5. Has study skills required by higher professional education; is motivated and determined. 11.1.6. Is aware of internationally accepted codes of scientific conduct.
Assessment criteria	Participation in the mini-internship. Describing the experience in a report.
	LS4T-FG2 / LS4T-FG3
Name [exams or modular exams]	LS4T-FG2: Performance review 2 / LS4T-FG3: Performance review 3
Code [exams or modular exams]	LS4T-FG2 / LS4T-FG3
Exam and modular exam format(s)	Oral, Individual
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0

Exam opportunities	Semester 2
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS4T is sufficient for enrolment in LS4T-FG2 and LS4T-FG3
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner (Study coach).
Compensation possibility	-
Competences and indicators	Competence 8: Teamwork and communication 8.1.1. Adheres to rules. Competence 11: Professional development 11.1.2. Works on learning aims as described in the PDP and collated competency assessment products 11.1.3. Reflects critically on own performance and learning process; learns from mistakes. 11.1.5. Has study skills required by higher professional education; is motivated and determined.
Assessment criteria	- Students meets agreements, is punctual, and has completed the preparatory assignment (e.g. DPF is orderly). - The student can demonstrate that he has actively worked on the learning outcomes that are described in the PDP. - The student methodically critically reviews his/her learning process, identifies what went well, and what didn't go well, identifies the causes of these, and links it to his/her own actions. A plan for improvement in the future is formulated. - The student shows a pro-active attitude and is motivated. He/she shows determination in his study.
	LS4T-POP
Name [exams or modular exams]	PDP
Code [exams or modular exams]	LS4T-POP
Exam and modular exam format(s)	Individual, Written
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Term 4, resit Term 4.
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS4T is sufficient for enrolment in LS4T-POP
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on assessment form (Study coach).
Compensation possibility	
Competences and indicators	Competence 11: Professional development 11.1.1. Formulates PDP according to guidelines.

Assessment criteria	See assessment form 'PDP level I'V on #OnderwijsOnline - General information
Test matrix	See assessment form 'PDP level I' on #OnderwijsOnline - General information
	LS4T- LPO PS3
Name [exams or modular exams]	Professional Skills
Code [exams or modular exams]	LS4T- LPO PS3
Exam and modular exam format(s)	Individual, Written, Oral
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Term 4. There is only one opportunity per academic year for participation in the workshop (EER Paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS4T is sufficient for enrolment in LS4T-LPO-PS3
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on participation (workshop lecturer).
Compensation possibility	-
Competences and indicators	Competence 8: Teamwork Performance in a group 8.1.1. Adheres to rules. 8.1.2. Makes a valuable contribution to the group. Communication Is able to communicate about their assignment with peers and lecturers applying basic rules of communication: 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.1.8. Verbally expresses their opinion/messages. 8.1.9. Accepts and gives feedback, is active in conflict resolution Competence 11: Professional development 11.1.3. Reflects critically on own performance and learning process; learns from mistakes.
Assessment criteria	Participation in the Professional Skills Workshop and participation in the team meeting is compulsory.

9.2 Units of study of the post-propaedeutic phase

The post-propaedeutical phase of the study degree program includes the following eductional units with the associated studyload.

A. Full-time biology and medical laboratory research (Dutch)

Level 2, Graduation level

a. Course unit 5A1: BM5A1 (10 credits)
b. Course unit 5A2: BM5A2 (10 credits)
c. Course unit 6A1: BM6A1 (10 credits)
d. Course unit 6A2: BM6A2 (10 credits)
e. Course unit 5B: BM5B (10 credits)
f. Course unit 6B: BM6B (10 credits)
g. Course unit 5C: BM5C (10 credits)
h. Course unit 6C: BM6C (10 credits)

Level 3, Professional level

Graduation specialisation Biotechnology

i. Course unit 8: BMLS8 (30 credits)
j. Course unit 11: BM11 (30 credits)
k. Course unit 12: BM12 (30 credits)

Graduation subject Molecular Plant Biology:

l. Course unit 9: BMLS9 (30 credits)
m. Course unit 11: BM11 (30 credits)
n. Course unit 12: BM12 (30 credits)

Graduation specialisation biomedical research:

o. Course unit 10: BMLS10 (30 credits)
p. Course unit 11: BM11 (30 credits)
q. Course unit 12: BM12 (30 credits)

r. Course unit 11: M11Mm (30 credits) – when combined with minor M_ATBC_DMM
s. Course unit 11: M11Kc (30 credits) – when combined with minor M_ATBC_DCH

B. Full-time Life Sciences

Level 2, Graduation level

a. Course unit 5A1: LS5A1 (10 study credits)
b. Course unit 5A2: LS5A2 (10 study credits)
c. Course unit 6A1: LS6A1 (10 study credits)
d. Course unit 6A2: LS6A2 (10 study credits)
e. Course unit 5B: LS5B (10 study credits)
f. Course unit 6B: LS6B (10 study credits)
g. Course unit 5C: LS5C (10 study credits)
h. Course unit 6C: LS6C (10 study credits)

Level 3, Professional level

Graduation specialisation Biotechnology

i. Course unit 8: BMLS8 (30 study credits)
j. Course unit 11: LS11 (30 study credits)
k. Course unit 12: LS12 (30 study credits)

Graduation subject Molecular Plant Biology:

l. Course unit 9: BMLS9 (30 study credits)
m. Course unit 11: LS11 (30 study credits)
n. Course unit 12: LS12 (30 study credits)

Graduation specialisation biomedical research:

o. Course unit 10: BMLS10 (30 study credits)
p. Course unit 11: LS11 (30 study credits)
q. Course unit 12: LS12 (30 study credits)

This section only contains the Course unit descriptions of the English variant of the study program. The Dutch Course unit descriptions can be found in the Onderwijs en Examenregeling of the study program Biologie en Medisch Laboratoriumonderzoek.

Course unit 5A1: LS5A1 (10 study credits)

	LS5A1
General information	
Target group/groups	Full-time students main phase BML, Life Science
Name of unit of study	ECU 5A1: Professional skills-1 (Level 2)
Code of unit of study	LS5A1
Lecture period	Term 1 and 2 (Semester 1)
ECTS credits	10 stp
Study load in hours	280 SBU
Study hours (contact hours)	Planned lesson/contact hours: 4 lesson hours (periods) per week; 28 periods per term, 56 periods per semester= 42 clock hours Planned time for self-study: 238 hours Total: 280 hours
Entry requirements for unit of study	Participation in course unit LS3 and LS4 or the abridged track for MLO/VWO students. Minor scientific research: Propaedeutical exam Chemistry, Bioinformatics or Biology and Medical Laboratory Research
Content and organisation	
General description	In this course unit you work on professional products relating to biological and medical laboratory research. The professional products in this course unit mainly focus on result analysis and reading international scientific literature.
Exit qualifications	Design Experiment Quality control Reporting and presenting Teamwork Guiding/Supervising Advising Professional development
Professional task	Carrying out life science research.

Beroepsproducten	Research plan (PvA) Literature review (V) Poster (Po)
Cohesion	This course further develops competencies and knowledge from course units 1-4. Students who take course unit LS5A1 follow it in the context of course unit LS5B and LS5C molecular and biochemical research.
Mandatory participation	Attendance at the tutor groups is a prerequisite for participation in the modular examination IPS. Attendance at workshops and work discussions is compulsory.
Maximum number of participants	
Compensation options	
Activities and/or instructional formats	**Supporting subject Work discussion** Assignments leading to products such as a research plan, literature review and poster. Interpretation of research results Drawing the correct conclusions from results Results analysis *Working methods: Work discussion* **Supporting subject Ethics** *Teaching methods: combined lectures/response classes* **Supporting subject Scientific writing** *Teaching methods: Lectures*
Required literature	**-**
Required software / required materials	
Recommended literature	
Examination	
	LS5A1-PvA
Name [exams or modular exams]	Research plan
Code [exams or modular exams]	LS5A1-PvA
Exam and modular exam format(s)	Group, In writing
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 1 or 2, resit Term 2 or 3
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS5A1 gives automatic registration for LS5A1-PVA

Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner using the assessment form (Practical lecturer).
Compensation possibility	
Competentces and indicators	Competence 1: Design - Defining the research question 1.2.1. Independently identifies relevant background information required to answer the research question. Gathering information and developing a research plan. 1.2.2. Searches for, selects and integrates information from relevant scientific research. 1.2.4. Forms intermediate research questions and related a hypothesis based on the given research question. 1.2.5. Integrates information into a comprehensive research plan (e.g. justifying the chosen method, describing necessary controls and availability of equipment). 1.2.6. Understands and applies moderate English literature relevant to the given context. 1.2.7. Is aware of the broader research context of their own experiments. Competence 2: Experimenting Preparation 2.1.2. Performs calculations prior to beginning lab work. 2.2.1. Is able to explain the basic steps of the experiments. Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules. 4.1.3. Uses controls, and uses these to access the reliability of the results. Competence 6: Reporting and presenting - Text 6.2.1. Reports their research in the form of a research report/lab journal/poster according to on-house (HLO) guidelines (product criteria for lab journal and research report; level 2:uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text; is aware of the cohesion between the different sections of text; the documents structure conforms to guidelines used in professional practise; the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; describes all relevant data in a summary. 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. Competence 7: Methodology 7.2.1. Plans and organises activities in a work plan that covers a duration of at least 4 practical lessons. Competence 10: Advising 10.1.1. Understands the needs and practical requirements. 10.1.2. Advises about purchase of reagents on the basis of product specifications and sales conditions.

	Competence 11: Professional development 11.2.6. Is aware of internationally accepted codes of scientific conduct. In the context of: Course Units LS5B and LS5C, Molecular and Biochemical research (for students who take Course Unit LS5B and LS5C)
Beoordelingscriteria	See assessment form 'Research plan' on #OnderwijsOnline - general information
Test matrix	See assessment form 'Research plan' on #OnderwijsOnline - general information
	LS5A1-V
Name [exams or modular exams]	Literature review
Code [exams or modular exams]	LS5A1-V
Exam and modular exam format(s)	Individual, In writing
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 1 or 2, resit Term 2 or 3
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS5A1 gives automatic registration for LS5A1-V
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner using the assessment form (course coordinator, theory lecturer, tutor, practical lecturer).
Compensation possibility	
Competences and indicators	Competence 1: Design 1.2.1. Independently identifies relevant background information required to answer the research question. 1.2.2.Searches for, selects and integrates information from relevant scientific sources. 1.2.6. Understands and applies moderate English literature relevant to the given context. 1.2.7. Is aware of the broader research context of their own experiments. Competence 6: Reporting and presenting- Text 6.2.1. Reports their research in the form of a research report/lab journal/poster according to in-house (HLO) guidelines (product criteria for lab journal and research report; level 2:uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text; is aware of the cohesion between the different sections of text; the documents structure conforms to guidelines used in professional practise; the report contains a reference list. The text references to the literature in this list; describes results so the reader can

	understand; uses clearly labelled figures and tables; describes all relevant data in a summary. 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. Competence 11: Professional development 11.2.6. Is aware of internationally accepted codes of scientific conduct. In the context of: Course Units LS5B and LS6C, Molecular and Biochemical research (for students who take Course Unit LS5B and LS5C)
Assessment criteria	See assessment form: Literature review on #OnderwijsOnline - general information
Test matrix	See assessment form: Literature review on #OnderwijsOnline - general information
	LS5A1-Po
Name [exams or modular exams]	Poster
Code [exams or modular exams]	LS5A1-Po
Exam and modular exam format(s)	Group, In writing
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 1 or 2, resit Term 2 or 3
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS5A1 gives automatic registration for LS5A1-Po
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner using the assessment form (course coordinator, theory lecturer, tutor, practical lecturer).
Compensation possibility	
Competences and indicators	Competence 1: Design 1.2.1. Independently identifies relevant background information required to answer the research question. 1.2.2. Searches for, selects and integrates information from relevant scientific sources. 1.2.6. Understands and applies moderate English literature relevant to the given context. 1.2.7. Is aware of the broader research context of their own experiments. Competence 6: Reporting and presenting – Text 6.2.1. Reports their research in the form of a research report/lab journal/poster according to in-house (HLO) guidelines (product criteria for lab journal and research

	report; level 2:uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text; is aware of the cohesion between the different sections of text; the documents structure conforms to guidelines used in professional practise; the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; describes all relevant data in a summary. 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. Competence 8: Team work Communication - Is able to communicate about their assignment with peers and lecturers applying basic rules of communication: 8.1.6. Maintains eye contact with conversation partner. 8.2.8. Verbally expresses their opinion/message clearly. 8.2.10. Interacts with conversation partner. Competence 11: Professional development 11.2.6. Is aware of internationally accepted codes of scientific conduct. In the context of: Course Units LS5B and LS6C, Molecular and Biochemical research (for students who take Course Unit LS5B and LS5C)
Assessment criteria	See assessment form 'Poster' on #OnderwijsOnline - general information.
Test matrix	See assessment form 'Poster' on #OnderwijsOnline - general information.
	LS5A1-IPV1 / LS5A1-IPV2
Name [exams or modular exams]	IPS
Code [exams or modular exams]	LS5A1-IPV1 / LS5A1-IPV2
Exam and modular exam format(s)	Oral, Individual
Judgement	Satisfactory/ Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Term 1 or 2. There is only one opportunity per academic year for the modular exams IPS (EER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS5A1 gives automatic registration for LS5A1-IPV1/ LS5A1-IPV2
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on attendance and participation (tutor).
Compensation possibility	

Competences and indicators	Competence 6: Reporting and presenting 6.2.5 In English: Is able to conduct discussions on work-related subject Competence 8: Team work - Performance in a group 8.1.1. Adheres the rules. 8.1.2. Makes a valuable contribution to the group. 8.2.3. Makes clear agreements with others and keeps to these. 8.2.4. Recognizes their own role in a group and is aware of other roles in the group. Works harmoniously with others. Communication - Is able to communicate about their assignment with peers and lecturers applying basic rules of communication: 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.1.9. Is active in conflict resolution. 8.2.5. Takes initiative in the conversation. 8.2.8. Verbally expresses their opinion/message clearly. 8.2.10. Interacts with conversation partner. Internationalization 8.2.12. Is aware of the intercultural differences in the professional field. Competence 11 Professional development 11.1.3. Reflects critically on own performance and learning process; learns from mistakes. 11.2.5. Works with integrity, adjusts to new situations, shows determination and is a motivated student. 11.2.6. Is aware of internationally accepted codes of scientific conduct.
Assessment criteria	The student: - has prepared the meeting by completing assignment to be discussed, and also completed the required reading for the following assignment to be discussed (k.o.). - is able to show assignment products to the tutor (according to agreements, in writing or as a presentation); in all assignments all aspects required are complete (k.o.); - fulfils his role(s) (e.g. chairperson, secretary, etc.; k.o.); - adheres to the rules agreed upon (k.o.); - asks questions and shares knowledge regarding the assignment during tutor meetings; - verbalises these clearly and audibly, maintains eye contact. - allows others to finish speaking and interacts with conversation partner; - offers feedback to group- and class members and is open to receiving feedback. - makes a positive contribution to the group by showing initiative and managing conflicts that arise.
	LS5A1-FG1
Name [exams or modular exams]	Performance review 1
Code [exams or modular exams]	LS5A1-FG1

Exam and modular exam format(s)	Individual, In writing, Oral
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Term 1 or 2, resit Term 2 or 3
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS5A1 gives automatic registration for LS5A1-FG1
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner (study coach).
Compensation possibility	
Competences and indicators	Competence 8: Team work 8.1.1. Adheres to rules. 8.2.1. Makes clear agreements with others and keeps to these. 8.2.3. Takes initiative in the conversation. 8.1.3. Maintains eye contact with conversation partner. 8.1.4. Gives others opportunity to speak. 8.2.4. Verbally expresses their opinion/message clearly. 8.2.5. Interacts with conversation partner. 8.1.6. Is active in conflict resolution. Competence 11 Professional development 11.2.1. Identifies strengths and weaknesses. 11.2.2. Formulates POP based on strength-weakness analysis. 11.2.3. Works on learning aims as described in the PDP and collated competency assessment products. 11.2.4. Reflects critically on own performance and learning process; learns from mistakes. 11.2.5. Works with integrity, adjusts to new situations, shows determination and is a motivated student.
Assessment criteria	- The student independently makes agreements, keeps to these agreements and is prepared. - The student can demonstrate that he has actively worked on the learning outcomes that are described in the PDP. - In the portfolio, the documents are clearly archived and clearly coupled to the competences which they prove. - The student looks methodically and critically at his/her learning process, identifies what went well, and what didn't go well, names the causes of these, and links it to his/her own actions. A plan for improvement in the future is formulated. - The student reflects on their study attitude as well as professional competencies. - The student shows a pro-active attitude and is motivated. - The student shows perseverance in his study and is able to adapt to different circumstances. - The student acts with integrity.

	LS5A1-Et
Name [exams or modular exams]	Ethics
Code [exams or modular exams]	LS5A1-Et
Exam and modular exam format(s)	Individual, In writing, Oral
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Term 1 or 2. For participation in the workshop there is one chance per academic year (EER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS5A1 gives automatic registration for LS5A1-Et
Discussion and review	For questions about the assessment you can contact the examiner..
Number of examiners	Assessment by one examiner based on participation and handing in the assignment (workshop lecturer).
Compensation possibility	
Competences and indicators	Competence 11: Professional development 11.1.6. Is aware of internationally accepted codes of scientific conduct. 11.2.7. Forms an educated opinion towards the ethical aspects of the profession.
Assessment criteria	Participation in the workshop, the activity and preparation of the assignment is required for a satisfactory grade.

Course unit 5A2: LS5A2 (10 study credits)

	LS5A2
General information	
Target group/groups	Full-time students main phase LSL, Life Science
Tags	["fase_hoofdfase", "variant_voltijd", "speciaal_english"]
Name of unit of study	ECU 5A2: Professional skills-2 (level 2)
Code of unit of study	LS5A2
Lecture period	Term 3 and 4 (Semester 2)
ECTS credits	10 stp
Study load in hours	280 SBU
Study hours (contact hours)	Planned lesson/contact hours: 4 lesson hours (periods) per week; 28 periods per term, 56 periods per semester= 42 clock hours Planned time for self-study: 238 hours Total: 280 hours

Entry requirements for unit of study	Participation in course unit LS3 and LS4 or the abridged track for MLO/VWO students. Minor scientific research: Foundation year Chemistry, Bioinformatics or Biology and Medical Laboratory Research
Content and organisation	
General description	In this course unit you will work on professional products relating to biological and medical laboratory research. The professional products in this course unit mainly focus on result analysis and reading international scientific literature for the benefit of a result-driven discussion.
Exit qualifications	Design Experiment Results analysis Reporting and presenting Quality control Planning and project-based working Advising Teamwork Professional development
Professional task	Carrying out life science research.
Professional products	Research plan (PvA) Research report (V) Presentation (Pr)
Cohesion	This course further develops competencies and knowledge from course units 1-4. Students who take course unit LS5A2 follow it in the context of course unit LS5B and LS5C molecular and biochemical research.
Mandatory participation	Attendance at the tutor groups is a prerequisite for participation in the modular examination IPS. Attendance at work discussions and workshops is compulsory.
Maximum number of participants	
Compensation options	
Activities and/or instructional formats	**Supporting subject Work discussion** Assignments leading to products such as a research plan, literature review and poster. Interpretation of research results Drawing the correct conclusions from results Describing results and discussion. *Working methods: Work discussion* **Supporting subject LPO Networking skills** Workshop for the purpose of applying for an internship or a future job *Teaching methods: training* **Supporting subject LPO Job application** Workshop for the purpose of applying for an internship or a future job *Teaching methods: training*

	Supporting subject Scientific writing *Teaching methods: Lectures*
Required literature	-
Required software / required materials	
Recommended literature	
Examination	
	LS5A2-PvA
Name [exams or modular exams]	Research plan
Code [exams or modular exams]	LS5A2-PvA
Exam and modular exam format(s)	Group, In writing
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 3 or 4, resit Term 4
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS5A2 gives automatic registration for LS5A2-PVA
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner using the assessment form (Practical lecturer).
Compensation possibility	
Competences and indicators	Competence 1: Design - Defining the research question 1.2.1. Independently identifies relevant background information required to answer the research question.Gathering information and developing a research plan. 1.2.2. Searches for, selects and integrates information from relevant scientific research. 1.2.4. Forms intermediate research questions and related a hypothesis based on the given research question. 1.2.5. Integrates information into a comprehensive research plan (e.g. justifying the chosen method, describing necessary controls and availability of equipment). 1.2.6. Understands and applies moderate English literature relevant to the given context. 1.2.7. Is aware of the broader research context of their own experiments. Competence 2: Experimenting - Preparation 2.1.2. Performs calculations prior to beginning lab work. 2.2.1. Is able to explain the basic steps of the experiments. Competence 4: Quality control

	4.1.1. Is aware of the health and safety rules and works according to these rules. 4.1.3. Uses controls, and uses these to access the reliability of the results. Competence 6: Reporting and presenting - Text 6.2.1. Reports their research in the form of a research report/lab journal/poster according to on-house (HLO) guidelines (product criteria for lab journal and research report; level 2:uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text; is aware of the cohesion between the different sections of text; the documents structure conforms to guidelines used in professional practise; the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; describes all relevant data in a summary 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. Competence 7: Methodology 7.2.1. Plans and organises activities in a work plan that covers a duration of at least 4 practical lessons. Competence 10: Advising 10.1.1. Understands the needs and practical requirements. Competence 11: Professional development 11.2.6. Is aware of internationally accepted codes of scientific conduct. In the context of:Course Units LS5B and LS5C, Molecular and Biochemical research (for students who take Course Unit LS5B and LS5C)
Assessment criteria	See assessment form ‘Research plan’ on #OnderwijsOnline - General information
Test matrix	See assessment form ‘Research plan’ on #OnderwijsOnline - General information
	LS5A2-V
Name [exams or modular exams]	Research report
Code [exams or modular exams]	LS5A2-V
Exam and modular exam format(s)	Group, In writing
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 3 or 4, resit Term 4
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS5A2 gives automatic registration for LS5A2-V
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.

Number of examiners	Assessment by one examiner based on assessment form (Practical lecturer).
Compensation possibility	
Competences and indicators	Competence 1: Design 1.2.2. Searches for, selects and integrates information from relevant scientific sources. 1.2.4. Forms intermediate research questions and related a hypothesis based on the given research question. 1.2.6. Understands and applies moderate English literature relevant to the given context. 1.2.7. Is aware of the broader research context of their own experiments. Competence 2: Experimenting 2.2.1. Is able to explain the basic steps of the experiments. Competence 3: Results analysis 3.1.2. Evaluates the obtained results based on their accuracy and reliability. 3.2.1. Carries out results analysis using appropriate methods; uses statistics (if applicable). 3.2.3. Independently makes conclusions relating to the initial research question (if possible). 3.2.5. Relates results with results from their other experiments and also to data in published literature. 3.2.6. Suggest improvements to improve the execution of the research. Competence 4: Quality control 4.1.3.Uses controls, and uses these to assess the reliability of the results. Competence 6: Reporting and presenting 6.2.1. Reports their research in the form of a research report/lab journal/poster according to in-house (HLO) guidelines (product criteria for lab journal and research report; level 2:uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text; is aware of the cohesion between the different sections of text; the documents structure conforms to guidelines used in professional practise; the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; describes all relevant data in a summary. 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. Competence 11: Professional development 11.2.6. Is aware of internationally accepted codes of scientific conduct. In the context of: Course Units LS5B and LS5C, Molecular and Biochemical research (for students who take Course Unit LS5B and LS5C)

Assessment criteria	See assessment form 'Research report' on #OnderwijsOnline - General Information In the context of: Course units LS5B and LS5C, molecular and biochemical research (for students who take Course unit LS5B and LS5C)
Test matrix	See assessment form 'Research report' on #OnderwijsOnline - General Information
	LS5A2-Pr
Name [exams or modular exams]	Presentation
Code [exams or modular exams]	LS5A2-Pr
Exam and modular exam format(s)	Group, Presentation
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 3 or 4, resit Term 4
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS5A2 gives automatic registration for LS5A2-Pr
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by two examiners based on assessment form (Course coordinator, theory lecturer, tutor, practical lecturer).
Compensation possibility	
Competences and indicators	Competence 1: Design 1.2.1. Independently identifies relevant background information required to answer the research question. 1.2.2.Searches for, selects and integrates information from relevant scientific sources. 1.2.4. Forms intermediate research questions and related a hypothesis based on the given research question. 1.2.5. Integrates information into a comprehensive research plan (e.g. justifying the chosen method, describing necessary controls and availability of equipment). 1.2.6. Understands and applies moderate English literature relevant to the given context. Competence 6: Reporting and presenting - Presentation 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. 6.2.5. Presents research to a target audience with similar knowledge background in a clear manner; applies general presentation techniques and answers questions: there is an introduction-body-conclusion structure to the presentation; speaks clearly and coherently; has upright posture and hands

	are freely used; makes eye contact with the audience; makes organised and clear slides or other visual products; verbal and visual messages complement each other; Uses visual aids in PowerPoint to support; holds an on-topic discussion with the audience. Competence 11: Professional development 11.1.6. Is aware of internationally accepted codes of scientific conduct. In the context of: Course Units LS5B and LS5C, Molecular and Biochemical research (for students who take Course Unit LS5B and LS5C)
Assessment criteria	See assessment form 'Presentation' on #OnderwijsOnline - General Information. In the context of:LS5A2-Pr: Course units LS5B and LS5C, molecular and biochemical research (for students who take ECU LS5B and LS5C)
Test matrix	See assessment form 'Presentation' on #OnderwijsOnline - General Information.
	LS5A2-IPV3 / LS5A2-IPV4
Name [exams or modular exams]	IPS
Code [exams or modular exams]	LS5A2-IPV3 / LS5A2-IPV4
Exam and modular exam format(s)	Oral, Individual
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Term 3 or 4, resit Term 4. There is only one opportunity per year for the modular exam IPS (EER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS5A2 gives automatic registration for LS5A2-IPV3/ LS5A3-IPV4
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on attendance and participation (tutor).
Compensation possibility	
Competences and indicators	Competence 6: Reporting and presenting 6.2.5 In English: Is able to conduct discussions on work-related subject Competence 8: Team work - Performance in a group 8.1.1. Adheres the rules. 8.1.2. Makes a valuable contribution to the group. 8.2.3. Makes clear agreements with others and keeps to these. 8.2.4. Recognizes their own role in a group and is aware of other roles in the group. Works harmoniously with others. Communication - Is able to communicate about their assignment with peers and lecturers applying basic rules of communication: 8.1.6. Maintains eye contact with conversation partner.

	8.1.7. Gives others opportunity to speak. 8.1.9. Is active in conflict resolution. 8.2.5. Takes initiative in the conversation. 8.2.8. Verbally expresses their opinion/message clearly. 8.2.10. Interacts with conversation partner. Internationalization 8.2.12. Is aware of the intercultural differences in the professional field. Competence 11 Professional development 11.1.3. Reflects critically on own performance and learning process; learns from mistakes. 11.2.5. Works with integrity, adjusts to new situations, shows determination and is a motivated student. 11.2.6. Is aware of internationally accepted codes of scientific conduct.
Assessment criteria	The student: - has prepared the meeting by completing assignment to be discussed, and also completed the required reading for the following assignment to be discussed (k.o.). - is able to show assignment products to the tutor (according to agreements, in writing or as a presentation); in all assignments all aspects required are complete (k.o.); - fulfils his role(s) (e.g. chairperson, secretary, etc.; k.o.); - adheres to the rules agreed upon (k.o.); - asks questions and shares knowledge regarding the assignment during tutor meetings; - verbalises these clearly and audibly, maintains eye contact. - allows others to finish speaking and interacts with conversation partner; - offers feedback to group- and class members and is open to receiving feedback. - makes a positive contribution to the group by showing initiative and managing conflicts that arise.
	LS5A2-Net
Name [exams or modular exams]	LPO SCV Networking skills
Code [exams or modular exams]	LS5A2-Net
Exam and modular exam format(s)	Individual, In writing, Oral
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Term 3 or 4, resit term 4. There is only one opportunity per year to attend the workshop (EER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS5A2 gives automatic registration for LS5A2-Net
Discussion and review	For questions about the assessment you can contact the examiner.

Number of examiners	Assessment by one examiner based on attendance and participation (workshop lecturer).
Compensation possibility	
Competences and indicators	Competence 8: Team work Communication- Is able to communicate about their assignment with peers and lecturers applying basic rules of communication: 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.1.9. Is active in conflict resolution. 8.2.5. Takes initiative in the conversation 8.2.8. Verbally expresses their opinion/message clearly. 8.2.10. Interacts with conversation partner.
Assessment criteria	Participation in the LPO Workshop networking skills is compulsory and execution of the assignment.
	LS5A2-HBO
Name [exams or modular exams]	Competency card
Code [exams or modular exams]	LS5A2-HBO
Exam and modular exam format(s)	Individual, In writing, Oral
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Second year
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS5A2 gives automatic registration for LS5A2-HBO
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on assessment form (Tutor, study coach, workshop lecturer).
Compensation possibility	
Competences and indicators	Competence 6: Reporting and presenting 6.2.2. Takes minutes of meetings according to product criteria for meeting minutes; level 2. 6.2.5. Presents research to a target audience with similar knowledge background in a clear manner; applies general presentation techniques and answers questions: there is an introduction-body-conclusion structure to the presentation; speaks clearly and coherently; has upright posture and hands are freely used; makes eye contact with the audience; makes organised and clear slides or other visual products; verbal and visual messages complement each other; Uses visual aids in PowerPoint to support; holds an on-topic discussion with the audience. Competence 8: Team work

	8.1.6. Maintains eye contact with conversation partner. 8.2.8. Verbally expresses their opinion/message clearly. 8.2.10. Interacts with conversation partner. Competence 9: Leadership 9.2.1. Composes an agenda in a standard format and uses it to independently lead a meeting.
Assessment criteria	See assessment form on #OnderwijsOnline - General Information.
	LS5A2-FG2
Name [exams or modular exams]	Performance review 2
Code [exams or modular exams]	LS5A2-FG2
Exam and modular exam format(s)	Individual, In writing, Oral
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Term 3 or 4, resit in consultation with study coach
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS5A2 gives automatic registration for LS5A2-FG2
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on assessment form (study coach).
Compensation possibility	
Competences and indicators	Competence 8: Team work 8.1.1. Adheres to rules. 8.2.1. Makes clear agreements with others and keeps to these. 8.2.3. Takes initiative in the conversation. 8.1.3. Maintains eye contact with conversation partner. 8.1.4. Gives others opportunity to speak. 8.2.4. Verbally expresses their opinion/message clearly. 8.2.5. Interacts with conversation partner. 8.1.6. Is active in conflict resolution. Competence 11 Professional development 11.2.1. Identifies strengths and weaknesses. 11.2.2. Formulates POP based on strength-weakness analysis. 11.2.3. Works on learning aims as described in the PDP and collated competency assessment products. 11.2.4. Reflects critically on own performance and learning process; learns from mistakes. 11.2.5. Works with integrity, adjusts to new situations, shows determination and is a motivated student.
Assessment criteria	- The student independently makes agreements, keeps to these agreements and is prepared.

	- The student can demonstrate that he has actively worked on the learning outcomes that are described in the PDP. - In the portfolio, the documents are clearly archived and clearly coupled to the competences which they prove. - The student looks methodically and critically at his/her learning process, identifies what went well, and what didn't go well, names the causes of these, and links it to his/her own actions. A plan for improvement in the future is formulated. - The student reflects on their study attitude as well as professional competencies. - The student shows a pro-active attitude and is motivated. - The student shows perseverance in his study and is able to adapt to different circumstances. - The student acts with integrity.
	LS5A2-LPO-St
Name [exams or modular exams]	LPO Job Application
Code [exams or modular exams]	LS5A2-LPO-St
Exam and modular exam format(s)	Individual, In writing, Oral
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Term 3 or 4. There is only one opportunity per academic year for the workshop (EER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS5A2 gives automatic registration for LS5A2-St
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on participation (workshop lecturer).
Compensation possibility	
Competences and indicators	Competence 8: Team work 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.2.5. Takes initiative in the conversation. 8.2.8. Verbally expresses their opinion/message clearly. 8.2.10. Interacts with conversation partner. Competence 11: Professional development - 11.1.2. Works on learning aims as described in the PDP and collated competency assessment products. 11.2.5. Works with integrity, adjusts to new situations, shows determination and is a motivated student.
Assessment criteria	Participation in the job application workshop is signed off. Making the preparational assignment is a requirement for participation in the workshop.

	LS5A2-Co
Name [exams or modular exams]	Coaching assignment
Code [exams or modular exams]	LS5A2-Co
Exam and modular exam format(s)	Individual, Writing
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Term 3 or 4, resit Term 4
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS5A2 gives automatic registration for LS5A2-Co
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner based on assessment form (study coach).
Compensation possibility	
Competences and indicators	Competence 9: LeadershipCoaching 9.2.2 Adjusts supervision manner to suit the level and personalities of the fellow students. 9.2.3 Is able to motivate others.
Assessment criteria	Coaching is assessed with the aid of: Assessment form ‘Coaching, to be signed by study coach’. The form can be found on #OnderwijsOnline - general information.
Test matrix	See assessment form ‘Coaching, to be signed by study coach’ on #OnderwijsOnline - General information.

Course unit 6A1: LS6A1 (10 study credits)

	LS6A1
General information	
Target group/groups	Full-time students main phase BML, Life Science
Name of unit of study	ECU 6A1: Professional skills-1 (level 2)
Code of unit of study	LS6A1
Lecture period	Term 1 and 2 (Semester 1)
ECTS credits	10 stp
Study load in hours	280 SBU
Study hours (contact hours)	Planned lesson/contact hours: 4 lesson hours (periods) per week; 28 periods per term, 56 periods per semester= 42 clock hours Planned time for self-study: 238 hours Total: 280 hours
Entry requirements for unit of study	Participation in course unit LS3 and LS4 or the abridged track for MLO/VWO students.

	Minor scientific research: Propaedeutical exam Chemistry, Bioinformatics or Biology and Medical Laboratory Research
Content and organisation	
General description	In this course unit you work on professional products relating to biological and medical laboratory research. The professional products in this course unit mainly focus on result analysis and reading international scientific literature.
Exit qualifications	Design Experiment Quality control Reporting and presenting Teamwork Guiding/Supervising Advising Professional development
Professional task	Carrying out life science research.
Beroepsproducten	Research plan (PvA) Literature review (V) Poster (Po)
Cohesion	This course further develops competencies and knowledge from course units 1-4.Students who take course unit LS6A1 follow it in the context of course unit LS6B and LS6C interactions between humans, plants and micro-organism.
Mandatory participation	Attendance at the tutor groups is a prerequisite for participation in the modular examination IPS. Attendance at workshops and work discussions is compulsory.
Maximum number of participants	
Compensation options	
Activities and/or instructional formats	**Supporting subject Research project** Assignments leading to products such as a research plan, and poster. Interpretation of research results Drawing the correct conclusions from results Results analysis *Working methods: Practical & Work discussion* **Supporting subject Ethics** *Teaching methods: combined lectures/response classes* **Supporting subject Scientific writing** *Teaching methods: Lectures*
Required literature	**-**
Required software / required materials	
Recommended literature	
Examination	
	LS6A1-PvA

Name [exams or modular exams]	Research plan
Code [exams or modular exams]	LS6A1-PvA
Exam and modular exam format(s)	Group, In writing
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 1 or 2, resit Term 2 or 3
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS6A1 gives automatic registration for LS6A1-PVA
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner using the assessment form (Course coordinator, Theory Lecturer, Tutor, Practical lecturer).
Compensation possibility	
Competences and indicators	Competence 1: Design - Defining the research question 1.2.1. Independently identifies relevant background information required to answer the research question. Gathering information and developing a research plan. 1.2.2. Searches for, selects and integrates information from relevant scientific research. 1.2.4. Forms intermediate research questions and related a hypothesis based on the given research question. 1.2.5. Integrates information into a comprehensive research plan (e.g. justifying the chosen method, describing necessary controls and availability of equipment). 1.2.6. Understands and applies moderate English literature relevant to the given context. 1.2.7. Is aware of the broader research context of their own experiments. Competence 2: Experimenting Preparation 2.1.2. Performs calculations prior to beginning lab work. 2.2.1. Is able to explain the basic steps of the experiments. Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules. 4.1.3. Uses controls, and uses these to access the reliability of the results. Competence 6: Reporting and presenting - Text 6.2.1. Reports their research in the form of a research report/lab journal/poster according to on-house (HLO) guidelines (product criteria for lab journal and research report; level 2:uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text; is aware of the

	cohesion between the different sections of text; the documents structure conforms to guidelines used in professional practise; the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; describes all relevant data in a summary. 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. Competence 7: Methodology 7.2.1. Plans and organises activities in a work plan that covers a duration of at least 4 practical lessons. Competence 10: Advising 10.1.1. Understands the needs and practical requirements. 10.1.2. Advises about purchase of reagents on the basis of product specifications and sales conditions. Competence 11: Professional development 11.2.6. Is aware of internationally accepted codes of scientific conduct. In the context of: Course units LS6C, LS6B interactions between human, plant and micro-organism (for students who take course unit LS6B and LS6C)
Assessment criteria	See assessment form ‘ Research plan’ on #OnderwijsOnline - General Information.
Test matrix	See assessment form ‘ Research plan’ on #OnderwijsOnline - General Information.
	LS6A1-V
Name [exams or modular exams]	Literature review
Code [exams or modular exams]	LS6A1-V
Exam and modular exam format(s)	Individual, Writing
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 1 or 2, resit Term 2 or 3
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS6A1 gives automatic registration for LS6A1-V
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner based on assessment form (Course coordinator, theory lecturer, tutor, practical lecturer).
Compensation possibility	

Competences and indicators	Competence 1: Design 1.2.1. Independently identifies relevant background information required to answer the research question. 1.2.2.Searches for, selects and integrates information from relevant scientific sources. 1.2.6. Understands and applies moderate English literature relevant to the given context. 1.2.7. Is aware of the broader research context of their own experiments. Competence 6: Reporting and presenting- Text 6.2.1. Reports their research in the form of a research report/lab journal/poster according to in-house (HLO) guidelines (product criteria for lab journal and research report; level 2:uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text; is aware of the cohesion between the different sections of text; the documents structure conforms to guidelines used in professional practise; the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; describes all relevant data in a summary. 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. Competence 11: Professional development 11.2.6. Is aware of internationally accepted codes of scientific conduct. In the context of: Course units LS6C, LS6B interactions between human, plant and micro-organism (for students who take course unit LS6B and LS6C).
Assessment criteria	See assessment form: Literature review on #OnderwijsOnline - general information
Test matrix	See assessment form “Literature review" on #OnderwijsOnline - General information.
	LS6A1-Po
Name [exams or modular exams]	Poster
Code [exams or modular exams]	LS6A1-Po
Exam and modular exam format(s)	Group, Writing
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 1 or 2, resit Term 2 or 3
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS6A1 gives automatic registration for LS6A1-Po
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.

Number of examiners	Assessment by one examiner based on assessment form (Course coordinator, theory lecturer, tutor, practical lecturer).
Compensation possibility	
Competences and indicators	Competence 1: Design 1.2.1. Independently identifies relevant background information required to answer the research question. 1.2.2. Searches for, selects and integrates information from relevant scientific sources. 1.2.6. Understands and applies moderate English literature relevant to the given context. 1.2.7. Is aware of the broader research context of their own experiments. Competence 6: Reporting and presenting - Text 6.2.1. Reports their research in the form of a research report/lab journal/poster according to in-house (HLO) guidelines (product criteria for lab journal and research report; level 2:uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text; is aware of the cohesion between the different sections of text; the documents structure conforms to guidelines used in professional practise; the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; describes all relevant data in a summary. 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. Competence 8: Team work Communication - Is able to communicate about their assignment with peers and lecturers applying basic rules of communication: 8.1.6. Maintains eye contact with conversation partner. 8.2.8. Verbally expresses their opinion/message clearly. 8.2.10. Interacts with conversation partner. Competence 11: Professional development 11.2.6. Is aware of internationally accepted codes of scientific conduct. In the context of: Course units LS6C, LS6B interactions between human, plant and micro-organism (for students who take course unit LS6B and LS6C)
Assessment criteria	See assessment form ‘Poster’ on #OnderwijsOnline - general information.
Test matrix	See assessment form ‘Poster’ on #OnderwijsOnline - General information.
	LS6A1-IPV1 / LS6A1-IPV2
Name [exams or modular exams]	IPS
Code [exams or modular exams]	LS6A1-IPV1 / LS6A1-IPV2
Exam and modular exam format(s)	Oral, Individual

Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Term 1 or 2. There is only one opportunity per academic year for the modular exams IPS (EER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS6A1 gives automatic registration for LS6A1-IPV1/ LS6A1-IPV2
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on attendance and participation (tutor).
Compensation possibility	
Competences and indicators	Competence 6: Reporting and presenting 6.2.5 In English: Is able to conduct discussions on work-related subject Competence 8: Team work - Performance in a group 8.1.1. Adheres the rules. 8.1.2. Makes a valuable contribution to the group. 8.2.3. Makes clear agreements with others and keeps to these. 8.2.4. Recognizes their own role in a group and is aware of other roles in the group. Works harmoniously with others. Communication - Is able to communicate about their assignment with peers and lecturers applying basic rules of communication: 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.1.9. Is active in conflict resolution. 8.2.5. Takes initiative in the conversation. 8.2.8. Verbally expresses their opinion/message clearly. 8.2.10. Interacts with conversation partner. Internationalization 8.2.12. Is aware of the intercultural differences in the professional field. Competence 11 Professional development 11.1.3. Reflects critically on own performance and learning process; learns from mistakes. 11.2.5. Works with integrity, adjusts to new situations, shows determination and is a motivated student. 11.2.6. Is aware of internationally accepted codes of scientific conduct.

Assessment criteria	The student: - has prepared the meeting by completing assignment to be discussed, and also completed the required reading for the following assignment to be discussed (k.o.). - is able to show assignment products to the tutor (according to agreements, in writing or as a presentation); in all assignments all aspects required are complete (k.o.); - fulfils his role(s) (e.g. chairperson, secretary, etc.; k.o.); - adheres to the rules agreed upon (k.o.); - asks questions and shares knowledge regarding the assignment during tutor meetings; - verbalises these clearly and audibly, maintains eye contact. - allows others to finish speaking and interacts with conversation partner; - offers feedback to group- and class members and is open to receiving feedback. - makes a positive contribution to the group by showing initiative and managing conflicts that arise.
	LS6A1-FG1
Name [exams or modular exams]	Performance review 1
Code [exams or modular exams]	LS6A1-FG1
Exam and modular exam format(s)	Individual, In writing, Oral
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Term 1 or 2, resit Term 2 or 3.
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS6A1 gives automatic registration for LS6A1-FG1
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner (Study coach).
Compensation possibility	
Competences and indicators	Competence 8: Team work 8.1.1. Adheres to rules. 8.2.1. Makes clear agreements with others and keeps to these. 8.2.3. Takes initiative in the conversation. 8.1.3. Maintains eye contact with conversation partner. 8.1.4. Gives others opportunity to speak. 8.2.4. Verbally expresses their opinion/message clearly. 8.2.5. Interacts with conversation partner. 8.1.6. Is active in conflict resolution.

	Competence 11 Professional development 11.2.1. Identifies strengths and weaknesses. 11.2.2. Formulates POP based on strength-weakness analysis. 11.2.3. Works on learning aims as described in the PDP and collated competency assessment products. 11.2.4. Reflects critically on own performance and learning process; learns from mistakes. 11.2.5. Works with integrity, adjusts to new situations, shows determination and is a motivated student.
Assessment criteria	- The student independently makes agreements, keeps to these agreements and is prepared. - The student can demonstrate that he has actively worked on the learning outcomes that are described in the PDP. - In the portfolio, the documents are clearly archived and clearly coupled to the competences which they prove. - The student looks methodically and critically at his/her learning process, identifies what went well, and what didn't go well, names the causes of these, and links it to his/her own actions. A plan for improvement in the future is formulated. - The student reflects on their study attitude as well as professional competencies. - The student shows a pro-active attitude and is motivated. - The student shows perseverance in his study and is able to adapt to different circumstances. - The student acts with integrity.
	LS6A1-Et
Name [exams or modular exams]	Ethics
Code [exams or modular exams]	LS6A1-Et
Exam and modular exam format(s)	Individual, Writing, Oral
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Term 1 or 2. For participation in the workshop there is one chance per academic year (EER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS6A1 gives automatic registration for LS6A1-Et
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on participation and handing in the assignment (workshop lecturer).
Compensation possibility	
Competences and indicators	Competence 11: Professional development 11.1.6. Is aware of internationally accepted codes of scientific conduct.

	11.2.7. Forms an educated opinion towards the ethical aspects of the profession.
Assessment criteria	Participation in the workshop, the activity and preparation of the assignment is required for a satisfactory grade.

Course unit 6A2: LS6A2 (10 study credits)

	LS6A2
General information	
Target group/groups	Full-time students main phase Life Sciences.
Name of unit of study	ECU 6A2: professional skills-2 (level 2)
Code of unit of study	LS6A2
Lecture period	Term 3 and 4 (Semester 2)
ECTS credits	10 stp
Study load in hours	280 SBU
Study hours (contact hours)	Planned lesson/contact hours: 4 lesson hours (periods) per week; 28 periods per term, 56 periods per semester = 42 clock hours Planned time for self-study: 258 hours Total: 280 hours
Entry requirements for unit of study	Participation in course unit LS3 and LS4 or the abridged track for MLO/VWO students. Minor scientific research: Foundation year Chemistry, Bioinformatics
Content and organisation	
General description	In this course unit you will work on professional products relating to biological and medical laboratory research. The professional products in this course unit mainly focus on result analysis and reading international scientific literature for the benefit of a result-driven discussion.
Exit qualifications	Design Experiment Results analysis Reporting and presenting Quality control Planning and project-based working Advising Teamwork Professional development
Professional task	Carrying out life science research.
Professional products	Research plan (PvA) Research report (V) Presentation (Pr)
Cohesion	This course further develops competencies and knowledge from course units 1-4. Students who take course unit LS6A2 follow it in the context of course unit LS6B and LS6C interactions between humans, plants and micro-organism.
Mandatory participation	Attendance at the tutor groups is a prerequisite for participation in the modular examination IPS. Attendance at work discussions and workshops is compulsory.

Maximum number of participants	
Compensation options	
Activities and/or instructional formats	**Supporting subject Research project** Practical assignments leading to products such as a research plan, and research report. Interpretation of research results Drawing the correct conclusions from results Describing results and discussion. *Working methods: Practical & Work discussion* **Supporting subject LPO Networking skills** Workshop for the purpose of applying for an internship or a future job *Teaching methods: training* **Supporting subject LPO Job application** Workshop for the purpose of applying for an internship or a future job *Teaching methods: training* **Supporting subject Scientific writing** *Teaching methods: Lectures*
Required literature	-
Required software / required materials	
Recommended literature	
Examination	
	LS6A2-PvA
Name [exams or modular exams]	Research plan
Code [exams or modular exams]	LS6A2-PvA
Exam and modular exam format(s)	Group, In writing
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 3 or 4, resit Term 4
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS6A2 gives automatic registration for LS6A2-PVA
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner based on assessment form (course coordinator, theory lecturer, tutor, practical lecturer).

Compensation possibility	
Competences and indicators	Competence 1: Design - Defining the research question 1.2.1. Independently identifies relevant background information required to answer the research question.Gathering information and developing a research plan. 1.2.2. Searches for, selects and integrates information from relevant scientific research. 1.2.4. Forms intermediate research questions and related a hypothesis based on the given research question. 1.2.5. Integrates information into a comprehensive research plan (e.g. justifying the chosen method, describing necessary controls and availability of equipment). 1.2.6. Understands and applies moderate English literature relevant to the given context. 1.2.7. Is aware of the broader research context of their own experiments. Competence 2: ExperimentingPreparation 2.1.2. Performs calculations prior to beginning lab work. 2.2.1. Is able to explain the basic steps of the experiments. Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules. 4.1.3. Uses controls, and uses these to access the reliability of the results. Competence 6: Reporting and presenting - Text 6.2.1. Reports their research in the form of a research report/lab journal/poster according to on-house (HLO) guidelines (product criteria for lab journal and research report; level 2:uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text; is aware of the cohesion between the different sections of text; the documents structure conforms to guidelines used in professional practise; the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; describes all relevant data in a summary 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. Competence 7: Methodology 7.2.1. Plans and organises activities in a work plan that covers a duration of at least 4 practical lessons. Competence 10: Advising 10.1.1. Understands the needs and practical requirements. Competence 11: Professional development 11.2.6. Is aware of internationally accepted codes of scientific conduct. In the context of: Course Units LS6B and LS6C, Interaction between human, plant and micro-organisms (for students who take Course Unit LS6B and LS6C)

Assessment criteria	See assessment form 'Research plan' on #OnderwijsOnline - General information
Test matrix	See assessment form 'Research plan' on #OnderwijsOnline - General information.
	LS6A2-V
Name [exams or modular exams]	Research report
Code [exams or modular exams]	LS6A2-V
Exam and modular exam format(s)	Group, In writing
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 3 or 4, resit Term 4
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS6A2 gives automatic registration for LS6A2-V
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner based on assessment form (course coordinator, theory lecturer, tutor, practical lecturer).
Compensation possibility	
Competences and indicators	Competence 1: Design 1.2.2. Searches for, selects and integrates information from relevant scientific sources. 1.2.4. Forms intermediate research questions and related a hypothesis based on the given research question. 1.2.6. Understands and applies moderate English literature relevant to the given context. 1.2.7. Is aware of the broader research context of their own experiments. Competence 2: Experimenting 2.2.1. Is able to explain the basic steps of the experiments. Competence 3: Results analysis 3.1.2. Evaluates the obtained results based on their accuracy and reliability. 3.2.1. Carries out results analysis using appropriate methods; uses statistics (if applicable). 3.2.3. Independently makes conclusions relating to the initial research question (if possible). 3.2.5. Relates results with results from their other experiments and also to data in published literature. 3.2.6. Suggest improvements to improve the execution of the research.

	Competence 4: Quality control 4.1.3.Uses controls, and uses these to assess the reliability of the results. Competence 6: Reporting and presenting 6.2.1. Reports their research in the form of a research report/lab journal/poster according to in-house (HLO) guidelines (product criteria for lab journal and research report; level 2:uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text; is aware of the cohesion between the different sections of text; the documents structure conforms to guidelines used in professional practise; the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; describes all relevant data in a summary. 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. Competence 11: Professional development 11.2.6. Is aware of internationally accepted codes of scientific conduct. In the context of: Course Units LS6B and LS6C, Interaction between human, plant and micro-organisms (for students who take Course Unit LS6B and LS6C)
Assessment criteria	See assessment form 'Research report' on #OnderwijsOnline - General Information In the context of: Course units LS6C, LS6B interactions between human, plant and micro-organism (for students who take course unit LS6B and LS6C)
Test matrix	See assessment form 'Research report' on #OnderwijsOnline - General information
	LS6A2-Pr
Name [exams or modular exams]	Presentation
Code [exams or modular exams]	LS6A2-Pr
Exam and modular exam format(s)	Group, Presentation
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 3 or 4, resit Term 4
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS6A2 gives automatic registration for LS6A2-Pr
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.

Number of examiners	Assessment by two examiners based on assessment form (Course coordinator, theory lecturer, tutor, practical lecturer).
Compensation possibility	
Competences and indicators	Competence 1: Design 1.2.1. Independently identifies relevant background information required to answer the research question. 1.2.2.Searches for, selects and integrates information from relevant scientific sources. 1.2.4. Forms intermediate research questions and related a hypothesis based on the given research question. 1.2.5. Integrates information into a comprehensive research plan (e.g. justifying the chosen method, describing necessary controls and availability of equipment). 1.2.6. Understands and applies moderate English literature relevant to the given context. Competence 6: Reporting and presenting - Presentation 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. 6.2.5. Presents research to a target audience with similar knowledge background in a clear manner; applies general presentation techniques and answers questions: there is an introduction-body-conclusion structure to the presentation; speaks clearly and coherently; has upright posture and hands are freely used; makes eye contact with the audience; makes organised and clear slides or other visual products; verbal and visual messages complement each other; Uses visual aids in PowerPoint to support; holds an on-topic discussion with the audience. Competence 11: Professional development 11.1.6. Is aware of internationally accepted codes of scientific conduct. In the context of: Course units LS6C, LS6B interactions between human, plant and micro-organism (for students who take course unit LS6B and LS6C)
Assessment criteria	See assessment form ‘Presentation’ on #OnderwijsOnline - General Information. In the context of: Course units LS6C, LS6B interactions between human, plant and micro-organism (for students who take course unit LS6B and LS6C)
Test matrix	See assessment form ‘Presentation’ on #OnderwijsOnline - General Information.
	LS6A2-IPV3 / LS6A2-IPV4
Name [exams or modular exams]	IPS
Code [exams or modular exams]	LS6A2-IPV3 / LS6A2-IPV4
Exam and modular exam format(s)	Oral, Individual
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory

Weight factor of modular exam	0
Exam opportunities	Term 3 of 4. There is only one opportunity per year for the modular exams IPS (EER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS6A2 gives automatic registration for LS6A2-IPV3/ LS6A3-IPV4
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on attendance and participation (tutor).
Compensation possibility	
Competences and indicators	Competence 6: Reporting and presenting 6.2.5 In English: Is able to conduct discussions on work-related subject Competence 8: Team work - Performance in a group 8.1.1. Adheres the rules. 8.1.2. Makes a valuable contribution to the group. 8.2.3. Makes clear agreements with others and keeps to these. 8.2.4. Recognizes their own role in a group and is aware of other roles in the group. Works harmoniously with others. Communication - Is able to communicate about their assignment with peers and lecturers applying basic rules of communication: 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.1.9. Is active in conflict resolution. 8.2.5. Takes initiative in the conversation. 8.2.8. Verbally expresses their opinion/message clearly. 8.2.10. Interacts with conversation partner. Internationalization 8.2.12. Is aware of the intercultural differences in the professional field. Competence 11 Professional development 11.1.3. Reflects critically on own performance and learning process; learns from mistakes. 11.2.5. Works with integrity, adjusts to new situations, shows determination and is a motivated student. 11.2.6. Is aware of internationally accepted codes of scientific conduct.

Assessment criteria	The student: - has prepared the meeting by completing assignment to be discussed, and also completed the required reading for the following assignment to be discussed (k.o.). - is able to show assignment products to the tutor (according to agreements, in writing or as a presentation); in all assignments all aspects required are complete (k.o.); - fulfils his role(s) (e.g. chairperson, secretary, etc.; k.o.); - adheres to the rules agreed upon (k.o.); - asks questions and shares knowledge regarding the assignment during tutor meetings; - verbalises these clearly and audibly, maintains eye contact. - allows others to finish speaking and interacts with conversation partner; - offers feedback to group- and class members and is open to receiving feedback. - makes a positive contribution to the group by showing initiative and managing conflicts that arise.
	LS6A2-Net
Name [exams or modular exams]	LPO Networking skills
Code [exams or modular exams]	LS6A2-Net
Exam and modular exam format(s)	Individual, In writing, Oral
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Term 3 or 4, resit term 4. There is only one opportunity per year to attend the workshop (EER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS6A2 gives automatic registration for LS6A2-Net
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on assessment form (workshop lecturer).
Compensation possibility	
Competences and indicators	Competence 8: Team work Communication- Is able to communicate about their assignment with peers and lecturers applying basic rules of communication: 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.1.9. Is active in conflict resolution. 8.2.5. Takes initiative in the conversation 8.2.8. Verbally expresses their opinion/message clearly. 8.2.10. Interacts with conversation partner.
Assessment criteria	Participation in the LPO Workshop networking skills and participation in a external network meeting is compulsory.

	LS6A2-HBO
Name [exams or modular exams]	Competency card
Code [exams or modular exams]	LS6A2-HBO
Exam and modular exam format(s)	Individual, In writing, Oral
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	2nd year
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS6A2 gives automatic registration for LS6A2-HBO
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on assessment forms (Tutor, study coach, lecturer workshop).
Compensation possibility	
Competences and indicators	Competence 6: Reporting and presenting 6.2.2. Takes minutes of meetings according to product criteria for meeting minutes; level 2. 6.2.5. Presents research to a target audience with similar knowledge background in a clear manner; applies general presentation techniques and answers questions: there is an introduction-body-conclusion structure to the presentation; speaks clearly and coherently; has upright posture and hands are freely used; makes eye contact with the audience; makes organised and clear slides or other visual products; verbal and visual messages complement each other; Uses visual aids in PowerPoint to support; holds an on-topic discussion with the audience. Competence 8: Team work 8.1.6. Maintains eye contact with conversation partner. 8.2.8. Verbally expresses their opinion/message clearly. 8.2.10. Interacts with conversation partner. Competence 9: Leadership 9.2.1. Composes an agenda in a standard format and uses it to independently lead a meeting.
Assessment criteria	See assessment form on #OnderwijsOnline - General Information.
	LS6A2-FG2
Name [exams or modular exams]	Performance review 2
Code [exams or modular exams]	LS6A2-FG2

Exam and modular exam format(s)	Individual, In writing, Oral
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Term 3 of 4
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS6A2 gives automatic registration for LS6A2-FG2
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on assessment form (study coach).
Compensation possibility	
Competences and indicators	Competence 8: Team work 8.1.1. Adheres to rules. 8.2.1. Makes clear agreements with others and keeps to these. 8.2.3. Takes initiative in the conversation. 8.1.3. Maintains eye contact with conversation partner. 8.1.4. Gives others opportunity to speak. 8.2.4. Verbally expresses their opinion/message clearly. 8.2.5. Interacts with conversation partner. 8.1.6. Is active in conflict resolution. Competence 11 Professional development 11.2.1. Identifies strengths and weaknesses. 11.2.2. Formulates POP based on strength-weakness analysis. 11.2.3. Works on learning aims as described in the PDP and collated competency assessment products. 11.2.4. Reflects critically on own performance and learning process; learns from mistakes. 11.2.5. Works with integrity, adjusts to new situations, shows determination and is a motivated student.
Assessment criteria	- The student independently makes agreements, keeps to these agreements and is prepared. - The student can demonstrate that he has actively worked on the learning outcomes that are described in the PDP. - In the portfolio, the documents are clearly archived and clearly coupled to the competences which they prove. - The student looks methodically and critically at his/her learning process, identifies what went well, and what didn't go well, names the causes of these, and links it to his/her own actions. A plan for improvement in the future is formulated. - The student reflects on their study attitude as well as professional competencies. - The student shows a pro-active attitude and is motivated. - The student shows perseverance in his study and is able to adapt to different circumstances. - The student acts with integrity.

	LS6A2-LPO-St
Name [exams or modular exams]	LPO Job Application
Code [exams or modular exams]	LS6A2-LPO-St
Exam and modular exam format(s)	Individual, In writing, Oral
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Term 3 or 4. There is only one opportunity per academic year for the workshop (EER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS6A2 gives automatic registration for LS6A2-St
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on participation (workshop lecturer).
Compensation possibility	
Competences and indicators	Competence 8: Team work 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.2.5. Takes initiative in the conversation. 8.2.8. Verbally expresses their opinion/message clearly. 8.2.10. Interacts with conversation partner. Competence 11: Professional development - 11.1.2. Works on learning aims as described in the PDP and collated competency assessment products. 11.2.5. Works with integrity, adjusts to new situations, shows determination and is a motivated student.
Assessment criteria	Participation in the job application workshop is signed off. Making the preparational assignment is a requirement for participation in the workshop.
	LS6A2-Co
Name [exams or modular exams]	Coaching assignment
Code [exams or modular exams]	LS6A2-Co
Exam and modular exam format(s)	Individual, Writing
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0

Exam opportunities	Term 3 or 4, resit Term 4
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS6A2 gives automatic registration for LS6A2-Co
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner based on assessment form (study coach).
Compensation possibility	
Competences and indicators	Competence 9: LeadershipCoaching 9.2.2 Adjusts supervision manner to suit the level and personalities of the fellow students. 9.2.3 Is able to motivate others.
Assessment criteria	Coaching is assessed with the aid of: Assessment form 'Coaching, to be signed by study coach'. The form can be found on #OnderwijsOnline - general information.
Test matrix	See assessment form 'Coaching, to be signed by study coach' on #OnderwijsOnline - General information.

Course unit 5B: LS5B (10 study credits)

	LS5B
General information	
Target group/groups	Full-time students main phase BML, Life Science
Name of unit of study	ECU 5B: Molecular and biochemical research practical
Code of unit of study	LS5B
Lecture period	Term 1 and 2 (Semester 1) / Term 3 and 4 (Semester 2)
ECTS credits	10 stp
Study load in hours	280 SBU
Study hours (contact hours)	Planned lesson/contact hours: 10 theory/tutor hours/week, = 70 hours of class/period = 140 clock hours/period = 105 clock hours/semester 1 hour/week work discussion = 14 hours of class/semester = 10,5 clock hours/semester work discussion. Planned time for self-study: 175 hours Total: 290,5 hours
Entry requirements for unit of study	Participation in course unit LS3 and LS4 or the abridged track for MLO/VWO students. Minor scientific research: Propaedeutical exam Chemistry, Bioinformatics or Biology and Medical Laboratory Research Participation in the practical lessons is only allowed if the safety exam is passed. Transfer students in the main phase must pass the safety exam in the first year of enrolment.
Content and organisation	
General description	An important aspect in the life sciences is to identify important genes and then making corresponding (recombinant) proteins. This kind of experiments takes place both in an industrial/biotechnological environment as well as in a

	medical/academic environment. Before proteins can be produced, the associated gene must first be mapped. If this information is available, the DNA will be obtained and possibly modified. By isolating the DNA and then cloning it can be transferred to a suitable expression system. The protein will be expressed and followed by isolation, purification and characterisation of the protein. The protein should now be tested for functionality. This line of genetics and cloning to protein expression is central to this module. In the first part of the semester, working with DNA and genetic analysis is the central theme. The second part of the semester will focus on protein, protein expression, purification and characterization of proteins. ("Analyze" and “production" of the Biodiscovery-chain).In this module will be on the practice in which working with DNA and proteins. The whole process of genes, then amplify it to expression of proteins to the analysis of proteins is discussed.
Exit qualifications	Design Experimenting Results analysis Quality control Management and administration Reporting and presenting Planning and project-based working
Professional task	Carrying out life science research
Professional products	Lab journal
Cohesion	This course further develops competencies and knowledge from course units 1-4.Course unit LS5B is part of the theme "molecular and biochemical research" which also includes the course units LS5A and LS5C. Knowledge and competencies practiced within the theme (LS5A, LS5B and LS5C) may be assessed in this course unit.
Mandatory participation	Attendance in the practical lessons and work discussions is a prerequisite for participation in modular exams P1 and P2.
Maximum number of participants	
Compensation options	
Activities and/or instructional formats	**Supporting subject Practical work** Cloning strategies Gene expression Protein/metabolite purification, detection and characterization **Supporting subject work discussion** Techniques, cloning strategies Results analysis Quality control Management and administration Reporting and presenting *Teaching methods: lab practicals and work discussion*
Required literature	Practical protocols
Required software / required materials	LabArchives
Recommended literature	
Examination	

	LS5B-P1
Name [exams or modular exams]	Practical
Code [exams or modular exams]	LS5B-P1
Exam and modular exam format(s)	Practical, Individual
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 1 or Term 3. There is only one opportunity per academic year for the modular exam P1. (EER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS5B gives automatic registration for LS5B-P1
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by two examiners based on assessment form (Practical lecturer).
Compensation possibility	
Competences and indicators	Competence 1: Design 1.2.4. Forms intermediate research questions and related a hypothesis based on the given research question. 1.2.6. Understands and applies moderate English literature relevant to the give context. Competence 2: Experimenting 2.1.2. Performs calculations prior to beginning lab work. 2.1.5. Carries out the experiments within the given time frame. 2.2.1. Is able to explain the basic steps of the experiments. 2.2.3. Ensures that all requirements are present before beginning the experiment, makes solutions. 2.2.4. Carries out experiments according to the protocol in order to obtain reliable, reproducible data; is aware of what he/she is doing at all times. 2.2.6. Attempts to work on multiple experiments at the same time (multitasking). 2.2.7. Attempts to trouble shoot experiments when problems are encountered. Competence 3: Results analysis 3.2.1. Carries out results analysis using appropriate methods; uses statistics (if applicable). 3.1.2. Evaluates the obtained results based on their accuracy and reliability. 3.1.4. Discusses the execution of the experiment and results. 3.2.3. Independently makes conclusions relating to the initial research question (if possible). 3.2.5. Relates results with results from their other experiments and also to data in published literature. 3.2.6. Suggests improvements to improve the execution of the research.

	Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules. 4.1.3. Uses controls, and uses these to assess the reliability of the results. 4.2.2. Uses advanced materials and equipment correctly. Competence 5: Management and administration 5.2.1. Encodes chemicals and samples; stores these in the correct manner. 5.2.2. Contributes to an efficiently functioning lab (tidies up, reports when reagents are nearly finished, performs minor maintenance of equipment). 5.2.3. Manages and archives data in lab journal (aim, experiments description, alterations, results, conclusion) and if relevant, other ways of storing data so that others can understand it. Competence 6: Reporting and presenting 6.2.1. Reports their research in the form of a research report/lab journal/poster according to in-house (HLO) guidelines (product criteria for lab journal and research report; level 2:uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text; is aware of the cohesion between the different sections of text; the documents structure conforms to guidelines used in professional practise; the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; describes all relevant data in a summary. 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. Competence 7: Methodology 7.2.2. Works according to plan, also under time constraints. 7.2.3. Ensures that goals are reached and if necessary, makes adjustments to activities. 7.2.4. Is flexible in changing circumstances. Competence 11: Professional development 11.1.5. Has study skills required by higher professional education; is motivated, has determined. In the context of: Carrying out a metabolic engineering strategy to achieve (higher) production of a metabolite as in the given case study This protein will be, where necessary, purified, characterized, quantified and tested for activity.
Beoordelingscriteria	See assessment form ‘Practical” on #OnderwijsOnline - General Information. Participation in the practical lessons is only allowed if the safety exam is passed. Transfer students in the main phase must pass the safety exam in the first year of enrolment.
Test matrix	See assessment form ‘Practical” on #OnderwijsOnline – general information

	LS5B-P2
Name [exams or modular exams]	Practical
Code [exams or modular exams]	LS5B-P2
Exam and modular exam format(s)	Practical, Individual
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 2 or Term 4. There is only one opportunity per academic year for the modular exam P2. (EER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS5B gives automatic registration for LS5B-P2
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by two examiners based on assessment form (Practical lecturer).
Compensation possibility	
Competences and indicators	Competence 1: Design 1.2.4. Forms intermediate research questions and related a hypothesis based on the given research question. 1.2.6. Understands and applies moderate English literature relevant to the give context. Competence 2: Experimenting 2.1.2. Performs calculations prior to beginning lab work. 2.1.5. Carries out the experiments within the given time frame. 2.2.1. Is able to explain the basic steps of the experiments. 2.2.3. Ensures that all requirements are present before beginning the experiment, makes solutions. 2.2.4. Carries out experiments according to the protocol in order to obtain reliable, reproducible data; is aware of what he/she is doing at all times. 2.2.6. Attempts to work on multiple experiments at the same time (multitasking). 2.2.7. Attempts to trouble shoot experiments when problems are encountered. Competence 3: Results analysis 3.2.1. Carries out results analysis using appropriate methods; uses statistics (if applicable). 3.1.2. Evaluates the obtained results based on their accuracy and reliability. 3.1.4. Discusses the execution of the experiment and results. 3.2.3. Independently makes conclusions relating to the initial research question (if possible). 3.2.5. Relates results with results from their other experiments and also to data in published literature. 3.2.6. Suggests improvements to improve the execution of the research.

	Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules. 4.1.3. Uses controls, and uses these to assess the reliability of the results. 4.2.2. Uses advanced materials and equipment correctly. Competence 5: Management and administration 5.2.1. Encodes chemicals and samples; stores these in the correct manner. 5.2.2. Contributes to an efficiently functioning lab (tidies up, reports when reagents are nearly finished, performs minor maintenance of equipment).Administration 5.2.3. Manages and archives data in lab journal (aim, experiments description, alterations, results, conclusion) and if relevant, other ways of storing data so that others can understand it. Competence 6: Reporting and presenting 6.2.1. Reports their research in the form of a research report/lab journal/poster according to in-house (HLO) guidelines (product criteria for lab journal and research report; level 2:uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text; is aware of the cohesion between the different sections of text; the documents structure conforms to guidelines used in professional practise; the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; describes all relevant data in a summary. 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. Competence 7:Methodology 7.2.1. Plans and organises activities resulting in a work plan that covers a duration of at least 4 practical lessons. 7.2.2. Works according to plan, also under time constraints 7.2.3. Ensures that goals are reached and if necessary, makes adjustments to activities. 7.2.4. Is flexible in changing circumstances. Competence 11: Professional development 11.1.5. Has study skills required by higher professional education; is motivated, has determined. In the context of: Carrying out a metabolic engineering strategy to achieve (higher) production of a metabolite as in the given case study This protein will be, where necessary, purified, characterized, quantified and tested for activity.
Assessment criteria	See assessment form ‘Practical” on #OnderwijsOnline - General information.
Test matrix	See assessment form ‘Practical” on #OnderwijsOnline – general information

Course unit 6B: LS6B (10 study credits)

	LS6B
General information	
Target group/groups	Full-time students main phase Life Sciences.
Name of unit of study	ECU 6B: Molecular and biochemical research practical
Code of unit of study	LS6B
Lecture period	Term 3 and 4 (Semester 2) / Term 1 and 2 (Semester 1)
ECTS credits	10 stp
Study load in hours	280 SBU
Study hours (contact hours)	Planned lesson/contact hours: 10 lesson hours per week, 2 lesson hours practical theory= 84 lesson hours per term= 168 lesson hours per semester = 126 clock hours Planned time for self-study: 154 hours Total: 280 hours
Entry requirements for unit of study	Participation in course unit LS3 and LS4 or the abridged track for MLO/VWO students. Minor scientific research: Propaedeutical exam Chemistry, Bioinformatics or Biology and Medical Laboratory Research Participation in the practical lessons is only allowed if the safety exam is passed. Transfer students in the main phase must pass the safety exam in the first year of enrolment.
Content and organisation	
General description	Central to this theme is the variety of interactions that take place between human, plant and microorganism. The consequence of these interactions can be both a favourable as unfavourable effect on one or more organisms. To understand these different interactions well, plant biology, human biology, microbiology and immunology are topics that are covered. Among others, infectious diseases and antibiotic resistance, the innate and acquired immune system and the plant response to internal and external signals are topics to be covered. The focus is on “discovery" of the Biodiscovery-chain.
Exit qualifications	Design Experimenting Results analysis Quality control Management and administration Reporting and presenting Planning and project-based working
Professional task	Carrying out life science research
Beroepsproducten	Labjournal
Cohesion	This course further develops competencies and knowledge from course units 1-4. Course unit LS6B is part of the theme "interactions between humans, plants and microorganisms" which also includes the Course units LS6A and LS6C. Knowledge and competencies practiced within the theme (LS6A, LS6B and LS6C) may be assessed in this course unit.
Mandatory participation	Attendance in the practical lessons is a prerequisite for participation in modular exams Pi, Pm, Ph and Pp.
Maximum number of participants	

Compensation options	
Activities and/or instructional formats	**Supporting subject Practical & Theory of the lab practicals plant biology** Plant cell and tissue culture Plant Physiology Biobased economy Phytopathology *Teaching methods: lab practicals and lectures/response classes* **Supporting subject practical & Theory of the lab practicals Microbiology** General microbiological techniques Diagnostic study of pathogenic microorganisms Research on antimicrobial activity Research on antimicrobial resistance *Teaching methods: lab practicals and lectures/response classes* **Supporting subject Practical & Theory of the lab practicals histology** Tissue processing, fixation, antigenicity Paraffin and frozen sections Histology staining Microscopy *Teaching methods: lab practicals and lectures/response classes* **Supporting subject Practical & Theory of the lab practicals cell immunology** Animal cell culture Flow cytometry ELISA Functional immunological testing *Teaching methods: lab practicals and lectures/response classes* **Supporting subject Practical & Theory of the lab practicals cytology** Basics of cervical and lung cytology. Immature cells in cervical and lung cytology. Major infections and inflammations in cervical and lung cytology. Inflammation, cell adaptation and carcinoma of the cervix and lung. Analysis of cytological preparations *Teaching methods: lab practicals and lectures/response classes*
Required literature	Practical protocols
Required software / required materials	LabArchives
Recommended literature	The latest edition of: - Reece et al., Campbell Biology. San Fransisco, CA:Pearson Education Inc. - Murphy K., Janeway's Immunobiology, New York NY: Garland Science. - Madigan et al., Brock Biology of Microorganisms. Harlow, England: Pearson Education Ltd. - Mescher, A.L., Junqueira's basic histology. Mc Graw Hill Education
Examination	

	LS6B-Pp
Name [exams or modular exams]	Practical Plant
Code [exams or modular exams]	LS6B-Pp
Exam and modular exam format(s)	Practical, Individual, written labjournal
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 3 or Term 1. There is only one opportunity per academic year for the modular exams Pp. (EER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS6B gives automatic registration for LS6B-Pp
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by two examiners based on assessment form (Practical lecturer).
Compensation possibility	
Competences and indicators	Competence 1: Design 1.2.4. Forms intermediate research questions and related a hypothesis based on the given research question. 1.2.6. Understands and applies moderate English literature relevant to the give context. Competence 2: Experimenting 2.1.2. Performs calculations prior to beginning lab work. 2.1.5. Carries out the experiments within the given time frame. 2.2.1. Is able to explain the basic steps of the experiments. 2.2.3. Ensures that all requirements are present before beginning the experiment, makes solutions. 2.2.4. Carries out experiments according to the protocol in order to obtain reliable, reproducible data; is aware of what he/she is doing at all times. 2.2.6. Attempts to work on multiple experiments at the same time (multitasking). 2.2.7. Attempts to trouble shoot experiments when problems are encountered. Competence 3: Results analysis 3.2.1. Carries out results analysis using appropriate methods; uses statistics (if applicable). 3.1.2. Evaluates the obtained results based on their accuracy and reliability. 3.1.4. Discusses the execution of the experiment and results. 3.2.3. Independently makes conclusions relating to the initial research question (if possible). 3.2.5. Relates results with results from their other experiments and also to data in published literature. 3.2.6. Suggests improvements to improve the execution of the research.

	Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules. 4.1.3. Uses controls, and uses these to assess the reliability of the results. 4.2.2. Uses advanced materials and equipment correctly. Competence 5: Management and administration 5.2.1. Encodes chemicals and samples; stores these in the correct manner. 5.2.2. Contributes to an efficiently functioning lab (tidies up, reports when reagents are nearly finished, performs minor maintenance of equipment). 5.2.3. Manages and archives data in lab journal (aim, experiments description, alterations, results, conclusion) and if relevant, other ways of storing data so that others can understand it. Competence 6: Reporting and presenting 6.2.1. Reports their research in the form of a research report/lab journal/poster according to in-house (HLO) guidelines (product criteria for lab journal and research report; level 2:uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text; is aware of the cohesion between the different sections of text; the documents structure conforms to guidelines used in professional practise; the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; describes all relevant data in a summary. 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. Competence 7: Methodology 7.2.2. Works according to plan, also under time constraints. 7.2.3. Ensures that goals are reached and if necessary, makes adjustments to activities. 7.2.4. Is flexible in changing circumstances. Competence 11: Professional development 11.1.5. Has study skills required by higher professional education; is motivated, has determined. In the context of: Plant cell and tissue culture, Plant Physiology, Biobased economy, Phytopathology
Assessment scriteria	See assessment form ‘Practical” on #OnderwijsOnline - General information. Participation in the practical lessons is only allowed if the safety exam is passed. Transfer students in the main phase must pass the safety exam in the first year of enrolment.
Test matrix	See assessment form ‘Practical” on #OnderwijsOnline - General information.
	LS6B-Pm

Name [exams or modular exams]	Practical Microbiology
Code [exams or modular exams]	LS6B-Pm
Exam and modular exam format(s)	Practical, Individual, written labjournal
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 3 or Term 1. There is only one opportunity per academic year for the modular exams Pm. (EER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS6B gives automatic registration for LS6B-Pm
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by two examiners based on assessment form (Practical lecturer).
Compensation possibility	
Competences and indicators	Competence 1: Design 1.2.4. Forms intermediate research questions and related a hypothesis based on the given research question. 1.2.6. Understands and applies moderate English literature relevant to the give context. Competence 2: Experimenting 2.1.2. Performs calculations prior to beginning lab work. 2.1.5. Carries out the experiments within the given time frame. 2.2.1. Is able to explain the basic steps of the experiments. 2.2.3. Ensures that all requirements are present before beginning the experiment, makes solutions. 2.2.4. Carries out experiments according to the protocol in order to obtain reliable, reproducible data; is aware of what he/she is doing at all times. 2.2.6. Attempts to work on multiple experiments at the same time (multitasking). 2.2.7. Attempts to trouble shoot experiments when problems are encountered. Competence 3: Results analysis 3.2.1. Carries out results analysis using appropriate methods; uses statistics (if applicable). 3.1.2. Evaluates the obtained results based on their accuracy and reliability. 3.1.4. Discusses the execution of the experiment and results. 3.2.3. Independently makes conclusions relating to the initial research question (if possible). 3.2.5. Relates results with results from their other experiments and also to data in published literature. 3.2.6. Suggests improvements to improve the execution of the research.

	Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules. 4.1.3. Uses controls, and uses these to assess the reliability of the results. 4.2.2. Uses advanced materials and equipment correctly. Competence 5: Management and administration 5.2.1. Encodes chemicals and samples; stores these in the correct manner. 5.2.2. Contributes to an efficiently functioning lab (tidies up, reports when reagents are nearly finished, performs minor maintenance of equipment). 5.2.3. Manages and archives data in lab journal (aim, experiments description, alterations, results, conclusion) and if relevant, other ways of storing data so that others can understand it. Competence 6: Reporting and presenting 6.2.1. Reports their research in the form of a research report/lab journal/poster according to in-house (HLO) guidelines (product criteria for lab journal and research report; level 2:uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text; is aware of the cohesion between the different sections of text; the documents structure conforms to guidelines used in professional practise; the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; describes all relevant data in a summary. 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. Competence 7: Methodology 7.2.2. Works according to plan, also under time constraints. 7.2.3. Ensures that goals are reached and if necessary, makes adjustments to activities. 7.2.4. Is flexible in changing circumstances. Competence 11: Professional development 11.1.5. Has study skills required by higher professional education; is motivated, has determined. In the context of: General microbiological techniques Diagnostic study of pathogenic microorganisms Research on antimicrobial activity Research on antimicrobial resistance
Assessment criteria	See assessment form ‘Practical” on #OnderwijsOnline - General information. Participation in the practical lessons is only allowed if the safety exam is passed. Transfer students in the main phase must pass the safety exam in the first year of enrolment.
Test matrix	See assessment form ‘Practical” on #OnderwijsOnline - General information.

	LS6B-Pi
Name [exams or modular exams]	Practical Immunology
Code [exams or modular exams]	LS6B-Pi
Exam and modular exam format(s)	Practical, Individual, written labjournal
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 2 or term 4. There is only one opportunity per academic year for the modular exams Pi. (EER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS6B gives automatic registration for LS6B-Pi
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by two examiners based on assessment form (Practical lecturer).
Compensation possibility	
Competences and indicators	Competence 1: Design 1.2.4. Forms intermediate research questions and related a hypothesis based on the given research question. 1.2.6. Understands and applies moderate English literature relevant to the give context. Competence 2: Experimenting 2.1.2. Performs calculations prior to beginning lab work. 2.1.5. Carries out the experiments within the given time frame. 2.2.1. Is able to explain the basic steps of the experiments. 2.2.3. Ensures that all requirements are present before beginning the experiment, makes solutions. 2.2.4. Carries out experiments according to the protocol in order to obtain reliable, reproducible data; is aware of what he/she is doing at all times. 2.2.6. Attempts to work on multiple experiments at the same time (multitasking). 2.2.7. Attempts to trouble shoot experiments when problems are encountered. Competence 3: Results analysis 3.2.1. Carries out results analysis using appropriate methods; uses statistics (if applicable). 3.1.2. Evaluates the obtained results based on their accuracy and reliability. 3.1.4. Discusses the execution of the experiment and results. 3.2.3. Independently makes conclusions relating to the initial research question (if possible). 3.2.5. Relates results with results from their other experiments and also to data in published literature.

	3.2.6. Suggests improvements to improve the execution of the research. Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules. 4.1.3. Uses controls, and uses these to assess the reliability of the results. 4.2.2. Uses advanced materials and equipment correctly. Competence 5: Management and administration 5.2.1. Encodes chemicals and samples; stores these in the correct manner. 5.2.2. Contributes to an efficiently functioning lab (tidies up, reports when reagents are nearly finished, performs minor maintenance of equipment). 5.2.3. Manages and archives data in lab journal (aim, experiments description, alterations, results, conclusion) and if relevant, other ways of storing data so that others can understand it. Competence 6: Reporting and presenting 6.2.1. Reports their research in the form of a research report/lab journal/poster according to in-house (HLO) guidelines (product criteria for lab journal and research report; level 2:uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text; is aware of the cohesion between the different sections of text; the documents structure conforms to guidelines used in professional practise; the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; describes all relevant data in a summary. 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. Competence 7: Methodology 7.2.2. Works according to plan, also under time constraints. 7.2.3. Ensures that goals are reached and if necessary, makes adjustments to activities. 7.2.4. Is flexible in changing circumstances. Competence 11: Professional development 11.1.5. Has study skills required by higher professional education; is motivated, has determined. In the context of: General microbiological techniques Animal cell culture, Flow cytometry, ELISA, Functional immunological testing
Assessment criteria	See assessment form ‘Practical” on #OnderwijsOnline - General information. Participation in the practical lessons is only allowed if the safety exam is passed. Transfer students in the main phase must pass the safety exam in the first year of enrolment.
Test matrix	See assessment form ‘Practical” on #OnderwijsOnline - General information.

	LS6B-Ph
Name [exams or modular exams]	Practical Histology
Code [exams or modular exams]	LS6B-Ph
Exam and modular exam format(s)	Practical, Individual, written labjournal
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 2 or term 4. There is only one opportunity per academic year for the modular exams Ph. (EER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS6B gives automatic registration for LS6B-Ph
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by two examiners based on assessment form (Practical lecturer).
Compensation possibility	
Competences and indicators	Competence 1: Design 1.2.4. Forms intermediate research questions and related a hypothesis based on the given research question. 1.2.6. Understands and applies moderate English literature relevant to the give context. Competence 2: Experimenting 2.1.2. Performs calculations prior to beginning lab work. 2.1.5. Carries out the experiments within the given time frame. 2.2.1. Is able to explain the basic steps of the experiments. 2.2.3. Ensures that all requirements are present before beginning the experiment, makes solutions. 2.2.4. Carries out experiments according to the protocol in order to obtain reliable, reproducible data; is aware of what he/she is doing at all times. 2.2.6. Attempts to work on multiple experiments at the same time (multitasking). 2.2.7. Attempts to trouble shoot experiments when problems are encountered. Competence 3: Results analysis 3.2.1. Carries out results analysis using appropriate methods; uses statistics (if applicable). 3.1.2. Evaluates the obtained results based on their accuracy and reliability. 3.1.4. Discusses the execution of the experiment and results. 3.2.3. Independently makes conclusions relating to the initial research question (if possible). 3.2.5. Relates results with results from their other experiments and also to data in published literature. 3.2.6. Suggests improvements to improve the execution of the research.

	Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules. 4.1.3. Uses controls, and uses these to assess the reliability of the results. 4.2.2. Uses advanced materials and equipment correctly. Competence 5: Management and administration 5.2.1. Encodes chemicals and samples; stores these in the correct manner. 5.2.2. Contributes to an efficiently functioning lab (tidies up, reports when reagents are nearly finished, performs minor maintenance of equipment). 5.2.3. Manages and archives data in lab journal (aim, experiments description, alterations, results, conclusion) and if relevant, other ways of storing data so that others can understand it. Competence 6: Reporting and presenting 6.2.1. Reports their research in the form of a research report/lab journal/poster according to in-house (HLO) guidelines (product criteria for lab journal and research report; level 2:uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text; is aware of the cohesion between the different sections of text; the documents structure conforms to guidelines used in professional practise; the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; describes all relevant data in a summary. 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. Competence 7: Methodology 7.2.2. Works according to plan, also under time constraints. 7.2.3. Ensures that goals are reached and if necessary, makes adjustments to activities. 7.2.4. Is flexible in changing circumstances. Competence 11: Professional development 11.1.5. Has study skills required by higher professional education; is motivated, has determined. In the context of: Tissue processing, fixation, antigenicity, Paraffin and frozen sections Histology of tissues/organs, Histology staining , Microscopy
Assessment criteria	See assessment form ‘Practical” on #OnderwijsOnline - General information. Participation in the practical lessons is only allowed if the safety exam is passed. Transfer students in the main phase must pass the safety exam in the first year of enrolment.
Test matrix	See assessment form ‘Practical” on #OnderwijsOnline - General information.

	LS6B-Pc
Name [exams or modular exams]	Workshops cytology
Code [exams or modular exams]	LS6B-Pc
Exam and modular exam format(s)	Individual, Written/Oral
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Term 1, 2, 3, 4.
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS6B is sufficient for enrolment in LS6B-Pc
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on presence and active participation (workshop lecturer).
Compensation possibility	-
Competences and indicators	Competence 3: Results analysis 3.2.1. Carries out results analysis using appropriate methods Competence 4: Quality control 4.2.2. Uses advanced materials and equipment correctly
Assessment criteria	Presence and active participation during the workshops is compulsory for a satisfactory result.

Course unit 5C: LS5C (10 study credits)

	LS5C
General information	
Target group/groups	Full-time students main phase Life Science
Name of unit of study	ECU 5C: Molecular and Biochemical research (theory)
Code of unit of study	LS5C
Lecture period	Term 1 and 2 (Semester 1) / Term 3 and 4 (Semester 2)
ECTS credits	10 stp
Study load in hours	280 SBU
Study hours (contact hours)	Planned lesson/contact hours: 9.5 theory/tutor hours/week, = 67 hours of class/period = 50 clock hours/period = 100 clock hours/semester Planned time for self-study: 180 hours Total: 280 hours
Entry requirements for unit of study	Participation in course unit LS3 and LS4 or the abridged track for MLO/VWO students. Minor scientific research: Propaedeutical exam Chemistry, Bioinformatics or Biology and Medical Laboratory Research

Content and organisation	
General description	An important aspect in the life sciences is to identify important genes and then making corresponding (recombinant) proteins. This kind of experiments takes place both in an industrial/biotechnological environment as well as in a medical/academic environment. Before proteins can be produced, the associated gene must first be mapped. If this information is available, the DNA will be obtained and possibly modified. By isolating the DNA and then cloning it can be transferred to a suitable expression system. The protein will be expressed and followed by isolation, purification and characterisation of the protein. The protein should now be tested for functionality. This line of genetics and cloning to protein expression is central to this module. In the first part of the semester, working with DNA and genetic analysis is the central theme. The second part of the semester will focus on protein, protein expression, purification and characterization. ("Analyze" and “production" of the Biodiscovery-chain)This module will cover the theoretical background relating to biochemistry, cell biology, molecular biology and associated bioinformatics, molecular and biochemical techniques.
Exit qualifications	Design Experiment Results analysis Quality control
Professional task	Carrying out life science research.
Beroepsproducten	
Cohesion	This course further develops competencies and knowledge from course units 1-4.Course unit LS5C is part of the theme "molecular and biochemical research" which also includes the course units LS5A and LS5B. Knowledge and competencies practiced within the theme (LS5A, LS5B and LS5C) may be assessed in this course unit.
Mandatory participation	
Maximum number of participants	
Compensation options	
Activities and/or instructional formats	**Supporting subject Biochemistry I** Energy Carriers (ATP, NADH), free energy, oxidation-reduction Photosynthesis Metabolic pathways: Glycolysis, Citric Acid Cycle, Respiratory Chain and Fermentative routes, Transport, storage and breakdown of fats and fatty acids, Gluconeogenesis, Glycogen synthesis and breakdown, Pentose-phosphate-pathway Integration of metabolism pathways *Teaching methods: combined lectures/response classes* **Supporting subject Biochemistry II** Amino acids and folding Degradation of amino acids Post-translational modification and protein targeting Protein interactions and applications Structure proteins and globular proteins Biological activity of proteins Oxygen-binding proteins.

	Enzyme and enzyme kinetics *Teaching methods: combined lectures/response classes* **Supporting subject Molecular biology** Mendelian Genetics DNA replication, transcription, translation, mutation Genetic variation in pro- and eukaryotes Mutations, STR marker analysis, transposons Bacterial Genetics Vectors Regulation of gene expression of prokaryotes and eukaryotes Epigenetics Genomics: genome structure Application of DNA technology *Teaching methods: combined lectures/response classes* **Supporting subject Cell biology** Plant and animal cells and organelles Cell membrane Cell cycle Cytoskeleton Intracellular transport Membrane transport signal transduction *Teaching methods: combined lectures/response classes* **Supporting subject Molecular and biochemical techniques** DNA purification, detection and analysis techniques Recombinant DNA technology PCR techniques and primer design Plant breeding Plant and mammalian transformation Functional gene analysis Pedigree analysis Protein expression, extraction, purification and detection Enzyme activity and kinetics Genetic modification *Teaching methods: combined lectures/response classes* **Supporting subject Bioinformatics I and II** Databases + database searches CLC-Bio Scientific literature search using PubMed PDB, α-helix and β-sheet, 1D-4D BLAST, Multiple alignments Orthologs/Paralogs/Homologs, Phylogeny *Teaching methods: combined lectures/response classes*

Required literature	The latest edition of: - Nelson, D., & Cox, M. e.a. Lehninger Principles of Biochemistry - Alberts, B., & Johnson, A. e.a. Molecular Biology of the Cell, Garland Science - Agostino, M., Practical Bioinformatics. New York, NY: Garland Science.
Required software / required materials	CLC-Bio
Recommended literature	Russel, P.J., iGenetics, a molecular approach. Pierson Higher Education.
Examination	
	LS5C-K1
Name [exams or modular exams]	Knowledge exam 1
Code [exams or modular exams]	LS5C-K1
Exam and modular exam format(s)	In writing, Individual, Multiple choice and/or open questions
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 1, resit during term 2, Term 3, resit during term 4
Permitted resources	
Method of enrolment for exam / enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the exam period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is scheduled in the following teaching period. The discussion of exams taken in a resit period is scheduled at the end of the education period. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	Two examiners for construction and evaluation. Assessment by one examiner using the correction model (theory lecturer).
Compensation possibility	
Competences and indicators	**Biochemistry I, molecular biology and molecular and biochemical techniques** **Biochemistry I** Free energy, ATP and NADH Glycolysis and fermentation Gluconeogenesis Pentose phosphate pathway Glycogen; Synthesis and degradation

	Citric Acid Cycle Respiratory chain and oxidative phosphorylation Photosynthesis Fatty acids, triglycerides, lipoproteins, fatty tissue, lipolysis, β-oxidation and ketogenesis Degradation of amino acids; glucogenic and ketogenic amino acids. Integration of metabolism **Molecular biology** Mendelian Genetics DNA replication, transcription, translation, mutation Genetic variation in pro- and eukaryotes Mutations, STR marker analysis, transposons Bacterial Genetics Vectors Regulation of gene expression of prokaryotes and eukaryotes Epigenetics Genomics: genome structure **Application of DNA technologies**
Assessment criteria	**Biochemistry I, molecular biology and molecular and biochemical techniques** The student has knowledge and understanding of: Free energy, ATP and NADH Glycolysis and fermentation Gluconeogenesis Pentose phosphate pathway Glycogen; Synthesis and degradation Citric Acid Cycle Respiratory chain and oxidative phosphorylation Photosynthesis Fatty acids, triglycerides, lipoproteins, fatty tissue, lipolysis, β-oxidation and ketogenesis Degradation of amino acids; glucogenic and ketogenic amino acids. Integration of metabolism Genetics The student has: - knowledge of the laws of Mendelian genetics and the modes of inheritance; - knowledge of genetic concepts such as dominant, recessive, sex-linked alleles, genes, genotype, phenotype, locus, feature, wild type, mutant, hemizygous, loss of function, gain of function; - knowledge of chromosomes and chromosome mutation (e.g. structure and number); - knowledge of similarities and differences between mitosis and meiosis. Molecular biology - knowledge and insight of the structure and properties of the biomolecules DNA and RNA; - understands the relationship between properties of biomolecules and their localization and cellular function.

	- knowledge and insight in replication process and all molecules involved; - knowledge and insight in the transcription process and all molecules that are involved; - knowledge and insight of the genetic code; - knowledge and insight of the differences between bacteria and eukaryotes regarding replication and transcription; - knowledge and insight in the translation process; knowledge and insight of DNA mutations and the consequences thereof at the protein level. - knowledge and insight into the processes of DNA repair. - knowledge of bacterial genetics, transformation, transduction and conjugation; - knowledge of plant transformation; Recombinant DNA techniques - knowledge and insight into the following DNA techniques: DNA isolation, DNA digestion, DNA gel electrophoresis, PCR, Sequencing. knowledge and understanding of the following recombinant DNA techniques: plasmid isolation, ligation, transformation; - knowledge and insight into the applications of DNA techniques such as molecular markers, DNA typing, making genomic libraries, creating cDNA libraries, whole genome sequencing; - knowledge of CRISPR-cas and RNAi techniques. Genomics - knowledge and insight of gene expression in prokaryotes; - knowledge and insight of gene expression in eukaryotes; - knowledge of gene silencing and RNA interference; - knowledge of epigenetic processes. knowledge of the organization of DNA in chromosomes. - knowledge of genome organization; - knowledge of transposons; - knowledge and insight in the Human Genome Project; - knowledge of the genomic structure of prokaryotes and eukaryotes.
Test matrix	50% Biochemistry I 50% Molecular Biology, including knowledge on molecular techniques
	LS5C-K2
Name [exams or modular exams]	Knowledge exam 2
Code [exams or modular exams]	LS5C-K2
Exam and modular exam format(s)	In writing, Individual, Multiple choice and/or open questions
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 2, resit during term 3, Term 4, resit term 4
Permitted resources	

Method of enrolment for exam / enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the exam period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is scheduled in the following teaching period. The discussion of exams taken in a resit period is scheduled at the end of the education period. At the end of term 4 the discussion is held before the start of the resit period of term 4. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	Two examiners for construction and evaluation. Assessment by one examiner using the correction model (theory lecturer).
Compensation possibility	
Competences and indicators	Biochemistry II: Amino acids, structure formulas, different ion forms, pK and pI definitions, classification in groups. Post-translational modification and protein targeting Peptides and proteins, primary, secondary, tertiary and quaternary structure Protein interactions and applications Structure and function of proteins Protein functions; oxygen-binding proteins Enzyme and enzyme kinetics; enzyme inhibitors Cell biology: Cells and organelles of plants and animals Cell membrane Cell cycle Cytoskeleton Intracellular transport Membrane transport signal transduction
Assessment criteria	**Biochemistry II:** The student: - can draw the basic structure of amino acids and describe and draw (an example) of the side-chains - recognises amino acids from structure formulas, is able to name and identify the group - can draw the different ionic forms of amino acids at different pHs; - describes the definition of pK and pI , can calculate the pI from pK values; - describes the bonds and interactions that lead to primary, secondary, tertiary and quarternary structure of proteins; - recognises secondary basic structures;

	- can name the various post-translational modifications and describe the effect on the properties and function of proteins; - knows the principles of protein targeting (signal sequences, signal patches, gated transport, transmembrane transport, vesicular transport); describes the structure of different structural proteins (collagen, keratin) and relates this to their function; - describes the structure of globular proteins (modules, domains);explains what protein families are and what conserved protein sequences are, is able to recognise these; - describes the function and mechanism of oxygen binding proteins (hemoglobin, myoglobin, F-hemoglobine, sickle cell hemoglobine) and how these are regulated (allosteric regulation, Bohr effect, cooperativity);knows the enzyme classes and based on a reaction, indicate which class of enzyme is the catalysator; - is able to describe the basic principles of enzyme-catalysed reactions (lowering activation energy, role of transition state);can explain what Km, v and Vmax are and can determine or calculate these based on given parameters such as v, [E], [S];knows the core enzyme kinetic formulas (Michelis-Menten, Kcat and Vmax relationship);knows the definition of an international enzyme unit and can calculate this; - can derive the Km and Vmax from a Lineweaver Burk plot; - describes the mechanism of competitive, non-competitive and uncompetitive inhibitors and their influence on Km and Vmax; - can indicate the class of enzyme inhibitor involved based on a Michaelis-Menten or Lineweaver Burk plot with and without enzyme inhibitor. **Cell Biology:** The student: - can name and explain the cells and organelles of plant and animal and the associated functions and properties Cell cycle; cell division and mitosis; - can name and describe the phases of cell division and know how these are regulated. - Cytoskeleton; can name the different parts of the cytoskeleton and describe and explain the functions. - Intracellular transport; protein sorting, vesicle transport, pathways; can describe the different routes of intracellular transport naming. - Membrane structure and transport over the membrane; can describe and explain the structure of the membrane and can explain and explain the different transport possibilities across the membrane. - Cell communication and signal transduction: can explain how different signal transduction systems work and how they are regulated, such as g-protein coupled receptors and tyrosine kinase receptors
Test matrix	Biochemistry II 50% Cell Biology 50% (including the application of the techniques)
	LS5C-T
Name [exams or modular exams]	Theme test
Code [exams or modular exams]	LS5C-T

Exam and modular exam format(s)	In writing, Individual, Open Questions
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 2, resit during term 3, Term 4, resit term 4
Permitted resources	
Method of enrolment for exam / enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the exam period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is scheduled in the following teaching period. The discussion of exams taken in a resit period is scheduled at the end of the education period. At the end of term 4 the discussion is held before the start of the resit period of term 4. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	Two examiners for construction and evaluation. Assessment by one examiner using the correction model (theory lecturer, course coordinator).
Compensation possibility	

Competences and indicators	Competence 1: Design 1.2.5. Integrates information into a comprehensive research plan (e.g. justifying the chosen method, describing necessary controls and availability of equipment). 1.2.7. Is aware of the broader research context of their own experiments. Competence 2: Experiment 2.1.2. Performs calculations prior to beginning lab work. 2.2.1. Is able to explain the basic steps of the experiments. 2.2.7. Attempts to trouble shoot experiments when problems are encountered. Competence 3: Results analysis 3.1.2. Evaluates the obtained results based on their accuracy and reliability. 3.2.1. Carries out results analysis using appropriate methods; uses statistics (if applicable) 3.2.3. Independently makes conclusions relating to the initial research question (if possible). 3.2.5. Relates results with results from their other experiments and also to data in published literature. 3.2.6. Suggests improvement to improve the execution of the research. Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules. 4.1.3. Uses controls, and uses these to assess the reliability of the results. In the context of: Practical case study on cloning strategies, protein expression and protein purification, Cell Biology, Molecular biology, Biochemistry, Molecular and biochemical techniques
Assessment criteria	1. Design: The student: - explains strategies and methods that are used in a research project; - is able to explain the research question and/or hypothesis; - knows the molecular and biochemical principles of the project; - is able to explain the application of databases in the context of a research project. 2. Experimenting: The student: - can describe and explain all materials and methods used; - justifies the controls that are required for the project and practical work; - can design a cloning strategy and development (including. primer design, PCR, restriction, digestions, ligation, hosts, vectors and tags); - can explain the primers sequences or constructs that are suitable/should be designed, based on the DNA sequences and justifies the controls that are necessary; - can explain how genes can be overexpressed to yield the desired products; - knows the chemical properties of the proteins produced and based on this, describe/explain/name methods for purification and quantification. - can explain what the differences are between human cells and in bacteria, plant cells in relation to the above-mentioned points.

	3. Results analysis: The student: - can interpret obtained results and similar results correctly; - draws correct conclusions from obtained results and from case study results; - can perform calculations from obtained and presented case studies. Theory: - has knowledge of the bio-informatics principles; - has knowledge of DNA techniques (molecular techniques); - has knowledge of protein techniques (biochemical techniques); - can apply knowledge and practical skills in cell biology, molecular biology, biochemistry and bio-informatics in theoretical cases.
Test matrix	Different components of theory, tutor, and practical are covered: Design: 25-45 % Experiment 25-45% Results analysis and lab calculations: 25-55% De exam encompasses 40% DNA techniques, 40% protein techniques and 20% bio-informatics.

Course unit 6C: LS6C (10 study credits)

	LS6C
General information	
Target group/groups	Full-time students main phase BML, Life Science
Name of unit of study	ECU 6C: Interactions between human, plant and micro-organism (theory)
Code of unit of study	LS6C
Lecture period	Term 3 and 4 (Semester 2) / Term 1 and 2 (Semester 1)
ECTS credits	10 stp
Study load in hours	280 SBU
Study hours (contact hours)	Planned lesson/contact hours: 8 theory/tutor/workshop-lesson hours/week, 56 lesson hours/period = 112 periods per semester= 84 hours Planned time for self-study: 196 hours Total: 280 hours
Entry requirements for unit of study	Participation in course unit LS3 and LS4 or the abridged track for MLO/VWO students. Minor scientific research: Propaedeutical exam Chemistry, Bioinformatics or Biology and Medical Laboratory Research
Content and organisation	
General description	Central to this theme is the variety of interactions that take place between human, plant and microorganism. The consequence of these interactions can be both a favourable as unfavourable effect on one or more organisms. To understand these different interactions well, plant biology, human biology, microbiology and immunology are topics that are covered. Among others, infectious diseases and antibiotic resistance, the innate and acquired immune system and the plant response to internal and external signals are topics to be covered. In term 1 (first part of the semester), plant biology and microbiology are the central themes. In term 2 (first part of the semester), immunology and human biology are the central themes. The focus is on

	"discovery" of the Biodiscovery-chain. Ultimately, the knowledge gained during this theme (both practice as theory) is examined as an integrated whole.
Exit qualifications	Design Experiment Results analysis Quality control
Professional task	Carrying out life science research
Beroepsproducten	
Cohesion	This course further develops competencies and knowledge from course units 1-4.Course unit LS6C is part of the theme "interactions between humans, plants and microorganisms" which also includes the Course units LS6A and LS6B. Knowledge and competencies practiced within the theme (LS6A, LS6B and LS6C) may be assessed in this course unit.
Mandatory participation	
Maximum number of participants	
Compensation options	
Activities and/or instructional formats	**Supporting subject Plant biology and practical theory Plant biology** Plant cell and tissue culture Plant physiology Plant structures Nutrition and transport Soil and nutrients Reproduction Biotechnology and biobased economy Response to internal and external signals Phytopathology Teaching methods: combined lectures/response classes and tutor meetings **Supporting subject Microbiology and practical theory Microbiology** Microbial diversity Morphology and structure of microorganisms The interaction between microorganisms and other organisms, Contamination, infection and spread (pathogenesis). Infectious diseases Antimicrobial agents to combat infections Resistance to antimicrobial agents Diagnostic research into pathogenic micro-organisms Research into antimicrobial activity Research into antimicrobial resistance *Teaching methods: combined lectures/response classes and tutor meetings* **Supporting subject Immunology and practical theory Immunology** Physical barriers, congenital and acquired immune system Cells and organs of the immune system Innate immune system: complement system, NK cells and phagocytosis Acquired immune system: antigen presentation and B and T cell development and activation, antibodies

	Animal cell culture ELISA, flow cytometry functional immunological tests *Teaching methods: combined lectures/response classes and tutor meetings* **Supporting subject Human biology and practical theory histology** Macroscopic and microscopic construction of cells and tissues Basic tissues (epithelial, connective, muscle, nervous) Organs and organ systems Tissue processing, fixation, antigenicity Paraffin and frozen sections Histology of tissues/organs and histological staining Microscopy *Teaching methods: combined lectures/response classes and tutor meetings* **Supporting subject Cytology** Basic knowledge cervical- and lung cytology. Immature cells cervical- and lung cytology. Important infections and inflammations cervical- and lung cytology. Inflammation, cell adaptation and carcinoma cervical- and lung cytology Analysis of cytological preparations *Teaching methods: combined lectures/response classes* **Supporting subject Data analysis** Describing and organising measurement data Statistical techniques in the analysis of the practical results *Teaching methods: combined lectures/response classes*
Required literature	The latest edition of: - Reece et al., Campbell Biology. San Fransisco, CA:Pearson Education Inc. - Murphy K., Janeway's Immunobiology, New York NY: Garland Science. - Madigan et al., Brock Biology of Microorganisms. Harlow, England: Pearson Education Ltd. - Mescher, A.L., Junqueira's basic histology. Mc Graw Hill Education
Required software / required materials	
Recommended literature	
Examination	
	LS6C-Tmp
Name [exams or modular exams]	Theme test microbiology plant biology
Code [exams or modular exams]	LS6C-Tmp
Exam and modular exam format(s)	In writing, Individual, Open Questions and/or multiple choice questions
Judgement	Grade
Minimum result	5,5

Weight factor of modular exam	1
Exam opportunities	p1, p2, p3, p4 and resit p4
Permitted resources	
Method of enrolment for exam / enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the exam period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is scheduled in the following teaching period. The discussion of exams taken in a resit period is scheduled at the end of the education period. At the end of term 4 the discussion is held before the start of the resit period of term 4. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	Two examiners for construction and evaluation. Assessment by one examiner based on the correction model (theory lecturer)
Compensation possibility	
Competences and indicators	Competence 1: Design 1.2.5. Integrates information into a comprehensive research plan (e.g. justifying the chosen method, describing necessary controls and availability of equipment). 1.2.6. Understands and applies moderate English literature relevant to the given context. 1.2.7. Is aware of the broader research context of their own experiments. Competence 2: Experimenting 2.1.2. Performs calculations prior to beginning lab work. 2.2.1. Is able to explain the basic steps of the experiments. 2.2.7. Attempts to trouble shoot experiments when problems are encountered. Competence 3: Results analysis 3.1.2. Evaluates the obtained results based on their accuracy and reliability. 3.2.1. Carries out results analysis using appropriate methods; uses statistics (if applicable). 3.2.3. Independently makes conclusions relating to the initial research question (if possible). 3.2.5. Relates results with results from their other experiments and also to data in published literature. 3.2.6. Suggest improvements to improve the execution of the research. Competence 4: Quality control 4.1.1. Is aware of the health and safety rule and works according to these rules. 4.1.3. Uses controls, and uses these to assess the reliability of the results.

	In the context of: Plant biology and microbiology. Theory, practical theory and practical.
Assessment criteria	The student can integrate and apply the acquired theoretical knowledge and practical skills related to plant biology and microbiology in a theoretical case study/assignment, through experimental design, lab work and results analysis. 1. Design: The student: - explains strategies and methods that are used in the research case; is able to explain the research question or hypothesis of the case/assignment; - knows the underlying principles of the research in the case/assignment. 2.Experimenting: The student: - can explain and justify all the materials and methods in the case/command; - justifies the controls that are required for the project and practical work; 3. Results analysis: The student - can interpret results obtained and similar results in the case/assignment in a correct manner; - draws correct conclusions from obtained results and from case study results; - can perform calculations on, and apply statistics to results from the case study/assignment. In the context of: Plant biology subjects: Plant cell and tissue culture Plant physiology Plant structures Nutrition and transport Soil and nutrients Reproduction Biotechnology and biobased economy Response to internal and external signals Phytopathology Safety In the context of Microbiology.subjects: Microbial diversity Morphology and structure of microorganisms The interaction between microorganisms and other organisms, Contamination, infection and spread (pathogenesis). Infectious diseases Antimicrobial agents to combat infections Resistance to antimicrobial agents Diagnostic research into pathogenic micro-organisms Research into antimicrobial activity Research into antimicrobial resistance Safety

Test matrix	Knowledge 20-30% Design: 20-30% Experimenting: 20-30% Results analysis, data analysis and (Lab)calculations: 20-30%
	LS6C-Tih
Name [exams or modular exams]	Theme test immunology human biology
Code [exams or modular exams]	LS6C-Tih
Exam and modular exam format(s)	In writing, Individual, Open Questions and/or multiple choice questions
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	p2, p3, p4 and resit p4
Permitted resources	
Method of enrolment for exam / enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the exam period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is scheduled in the following teaching period. The discussion of exams taken in a resit period is scheduled at the end of the education period. At the end of term 4 the discussion is held before the start of the resit period of term 4. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	Two examiners for construction and evaluation. Assessment by one examiner based on the correction model (theory lecturer)
Compensation possibility	
Competences and indicators	Competence 1: Design 1.2.5. Integrates information into a comprehensive research plan (e.g. justifying the chosen method, describing necessary controls and availability of equipment). 1.2.6. Understands and applies moderate English literature relevant to the given context. 1.2.7. Is aware of the broader research context of their own experiments. Competence 2: Experimenting 2.1.2. Performs calculations prior to beginning lab work. 2.2.1. Is able to explain the basic steps of the experiments. 2.2.7. Attempts to trouble shoot experiments when problems are encountered.

	Competence 3: Results analysis 3.1.2. Evaluates the obtained results based on their accuracy and reliability. 3.2.1. Carries out results analysis using appropriate methods; uses statistics (if applicable). 3.2.3. Independently makes conclusions relating to the initial research question (if possible). 3.2.5. Relates results with results from their other experiments and also to data in published literature. 3.2.6. Suggest improvements to improve the execution of the research. Competence 4: Quality control 4.1.1. Is aware of the health and safety rule and works according to these rules. 4.1.3. Uses controls, and uses these to assess the reliability of the results. In the context of: Human biology and Immunology. Theory, practical theory and practical.
Assessment criteria	The student can integrate and apply the acquired theoretical knowledge and practical skills related to plant biology and microbiology in a theoretical case study/assignment, through experimental design, lab work and results analysis. 1. Design: The student: - explains strategies and methods that are used in the research case; is able to explain the research question or hypothesis of the case/assignment; - knows the underlying principles of the research in the case/assignment. 2.Experimenting: The student: - can explain and justify all the materials and methods in the case/command; - justifies the controls that are required for the project and practical work; 3. Results analysis: The student - can interpret results obtained and similar results in the case/assignment in a correct manner; - draws correct conclusions from obtained results and from case study results; - can perform calculations on, and apply statistics to results from the case study/assignment. In the context of: Immunological subjects: Physical barriers, congenital and acquired immune system Cells and organs of the immune system Innate immune system: complement system, NK cells and phagocytosis Acquired immune system: antigen presentation and B and T cell development and activation, antibodies Animal cell culture ELISA, flow cytometry functional immunological tests

	Safety In the context of Human biology.subjects: Macroscopic and microscopic construction of cells and tissues Basic tissues (epithelial, connective, muscle, nervous) Organs and organ systems Tissue processing, fixation, antigenicity Paraffin and frozen sections Histology of tissues/organs and histological staining Microscopy Safety Cytology
Test matrix	Knowledge 20-30% Design: 20-30% Experimenting: 20-30% Results analysis, data analysis and (Lab)calculations: 20-30%

Course unit 8: BMLS8 (30 study credits)

	BMLS8
General information	
Target group/groups	Full-time students Biology of Medical Laboratory Research or Life Sciences, graduation specialisation: Biotechnology
Name of unit of study	OWE 8: Biotechnology / ECU 8: Biotechnology
Code of unit of study	BMLS8
Lecture period	Semester 1 (P1 and P2) and Semester 2 (P3 and P4)
ECTS credits	30 EC
Study load in hours	840 SBU
Study hours (contact hours)	Planned lesson/contact hours Period 1/3: Theory = 4x2u per week x 6 weeks = 48 h Design of Experiments (DOE) workshop 5x2u = 10 h Applied bioinformatics workshop 2x5u=10 h Practical = 40h fermentation & workdiscussion + 25h max workshops (FPLC/vivaflow filtering/CRISPR-Cas) Tutor = 2 h per week x 8 weeks= 16 h Period 2/4: Theory = 2x2u per week x 7 = 28 h Extra time reserved = 8 h Practical = 2x5 h per week x 8 weeks= 80 h + work discussion 2h per week x8 weeks=16h Expert = 2h per week x 8 = 16h Tutor = 2 h per week x 8 = 16 h Total contact hours = p1=165 (123.75 clockhours) & P2=164 (123 clockhours))= 329 h (246.75h clockhours)) Guestlectures in P1/P3 and P2/P4: 2-10h

	Total hours self study= 511 h Total: 840 h
Entry requirements for unit of study	Propedeutical phase should be completed (first study year). IPS from all previous courses must be completed. BM5B/LS5B and BM6B/LS6B must be completed (sufficient). In total 40 credits from the EEUs BM5/LS5 and BM6/LS6 must be completed and at least 2 modular exams from BM5C/LS5C and/or BM6C/LS6C should be sufficient.
Content and organisation	
General description	Biotechnology is a new profession where lab technicians can be of great value. To prepare the student for this field, the Course Biotechnology (BMLS8) is offered. A biotechnological company consists of several sections: molecular biology, upstream processing, and downstream processing. The purpose of the course is the student acquainted with these sections through solving a practical problem. Students will learn several techniques in the different sections. Molecular Biology: molecular biological techniques and knowledge in for example, CRISPR-Cas9, bioinformatics techniques, expression hosts (organisms), expression systems (vectors), and transforming of organisms. Upstream processing: fermentation technology and process optimization, designing media, and the design of experiments. Process design: calculations on different types of cultivations. Downstream processing: biochemical properties of proteins and metabolites (expanding on course LS5) and how to practically use this knowledge. Various purification techniques as HPLC, FPLC, and GC will be addressed. Analytical chemistry techniques will be addressed to, for example, characterize proteins. Ultimately, the student will be skilled and able to be employed in all sections of a biotechnology company. Theme test: Theory + practicals (including workshops) + tutor assignments+ guest lectures Knowledge test 1 = Molecular biology + Upstream processing: producing proteins/metabolites + Process Design Knowledge test 2 = Downstream processing: purifying proteins/metabolites The course unit is taught in English. The exams for students that do not participate in the English variant of the study program, if desired, are provided in Dutch

	and/or can be answered in Dutch. The professional products must be made in English.
Exit qualifications	Design Experiment Analysing results Management and administration Reporting / Presentation Planning and project-based working Teamwork Guiding/Supervising Professional development
Professional task	Carrying out scientific research.
Professional products	Final Report (R) Presentation (Pr) Research plan (PvA)
Cohesion	This course further develops competencies and knowledge from BM5-BM6/LS5-LS6. In particular, the lab and computer skills from BM5/LS5 and BM6/LS6 are applied here in a more complex model.
Mandatory participation	Attendance at the tutor groups is a prerequisite for participation in the IPS modular exam. Attendance at the practical and practical workshops is a prerequisite for participation in Practical modular exams. The assessment of BMLS8-P1 is a knock-out. Obtaining BMLS8-P1 is conditional for entry to the practical of BMLS8-P2.
Maximum number of participants	In semester 1 the maximum number of participants that can enter this course is set to 2 practical classes. Selection procedure for participation for semester 1 academic year 2020-2021: Students registered for BMLS8 who have obtained 30 credits from second year EEU's of the first semester of academic year 2019-2020 after the resits of term 2 can participate. The other available places will be divided over the registered students via lottery. For semester 2 there is no selection procedure for participation.
Compensation options	
Activities and/or instructional formats	**Supporting subject: Molecular biology** CRISPR-Cas9 Post-translational modification of proteins and chaperones. Expression hosts Expression systems Bioinformatics Working methods: lecture/workshop

	Supporting subject: Upstream processing Design of Experiments Fermentation technology Process design Media optimization Working methods: lecture **Supporting subject: Downstream Processing** Biochemistry (proteins) Analytical Chemistry Purification techniques (ie FPLC, HPLC, GC) Working methods: combined lectures/response classes **Practical** Procedure: Practical & workshops Working methods: practical/ workshop
Required literature	-
Required software / required materials	-
Recommended literature	**-**
Examination	
	BMLS8-T
Name [exams or modular exams]	Themetest
Code [exams or modular exams]	BMLS8-T
Exam and modular exam format(s)	Individual, Writing
Judgement	Mark
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 2, resit Term 3. Term 4, resit Term 4
Permitted resources	As indicated on cover page of exam
Method of enrolment for exam / enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the exam period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is scheduled after the exam before the review of the exam. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.

Number of examiners	Two examiners for construction and evaluation. Assessment by one examiner using the correction model (theory lecturer).
Compensation possibility	**-**
Competences and indicators	**Competence 1: Design (level II/III)** *Defining the research question* 1.2.1. Independently identifies relevant background information required to answer the research question. Gathering information and developing a research plan 1.2.2. Searches for, selects and integrates information from relevant scientific sources. 1.3.6. Understands and applies advanced English literature relevant to the given context. **Competence 2: Experimenting (level III)** *Preparation* 2.1.3. Performs calculations prior to beginning lab work. 2.3.1. Is able to explain the theory behind all steps of the experiments. 2.3.4. Carries out experiments following protocol in order to obtain reliable, reproducible data; is able to deviate from/adjust the protocol where needed; is aware of what he/she is doing at all times. **Competence 3: Results analysis (level II/III)** *Data processing* 3.2.1. Carries out results analysis using appropriate methods; uses statistics (if applicable). *Validation* 3.1.2. Evaluates the obtained results based on their accuracy and reliability. *Conclusions and discussion* 3.2.3. Independently makes conclusions relating to the initial research question (if possible). 3.2.5. Relates results with results from their other experiments and also to data in published literature. 3.3.7. Suggests follow-up experiments.
Assessment criteria	1. Experimental Design The student is able to: - analyzing bioinformatics data to setup further experiments; - understand the meaning of experimental design as an efficient procedure for planning experiments; - understand for what kind of experiments experimental design can be applied; - understand that with a well-chosen experimental designs maximizes the amount of "information" that can be obtained for a given amount of experimental effort; - design a process optimization experiment using experimental design. 2: Experimenting The student: - knows the principle of fermentation technology;

	- knows the principle of medium design and can calculate end-concentrations; - knows the principle of growth kinetics; - knows the principle of process control; - knows the principle of using different chromatography techniques; - knows the principle in purifying different kinds of compounds like: sugars, fats, proteins. 3: Results analysis The student: - knows the principle of the statistics used in the research assignments; - is able to interpret bioinformatics data; - is able to interpret data from analytical chemistry tools like FPLC, HPLC, LCMS, GCMS
Test matrix	1: Experimental design ~20% 2: Experimenting ~40% 3: Results analysis ~40%
	BMLS8-R
Name [exams or modular exams]	Report
Code [exams or modular exams]	BMLS8-R
Exam and modular exam format(s)	Group of 2, Writing
Judgement	Mark
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 2, resit term 2 or 3. Term 4, resit Term 4
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in BMLS8 counts as registration for BMLS8-R
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this modular exam.
Number of examiners	Assessment by one examiner based on assessment form (practical teacher/Practical lecturer).
Compensation possibility	-
Competences and indicators	**Competence 1: Design** 1.3.3. Independently searches for, selects and integrates information from relevant scientific sources. 1.3.6. Understands and applies advanced English literature relevant to the given context. 1.3.7. Makes connections between experiments and the broader research context.

	Competence 2: Experimenting 2.3.1. Is able to explain the theory behind all steps of the experiments. **Competence 3: Results analysis** 3.1.4. Discusses the execution of the experiment and results. 3.2.6. Suggests improvements to improve the execution of the research. 3.3.1. Independently carries out results analysis according to the appropriate methods; uses statistics (if applicable). 3.3.2. Independently evaluates the obtained results based on their accuracy and reliability. 3.3.3. Independently makes conclusions relating to the initial research question (if possible) and the broader research context. 3.3.4. Independently discusses results in relation to their other experiments and compares these to published literature. 3.3.7. Suggests follow-up experiments. **Competence 4: Quality control** 4.1.3. Uses controls, and uses these to assess the reliability of the results. **Competence 5: Management and administration** 5.3.3. Manages and archives data in lab journal (aim, experiment description, alterations, results, conclusion) and if applicable, other ways of storing data so that others can use these. **Competence 6: Reporting and presenting** 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. 6.2.4. In English, uses written tasks appropriate to the professional practice to communicate straightforward ideas as defined by CEFR B1 Level Writing. 6.3.1. Reports their research in the form of a research report/lab journal/poster according to international guidelines (product criteria for lab journal and research report level 3):uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text. There is cohesions between the different sections of text;the documents structure conforms to guidelines used in professional practise;the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; all relevant data is described in a summary that is independent to the report. 6.3.6. In English: can interact with a degree of fluency that makes regular interaction with native speakers quite possible.
Assessment criteria	See assessment form on #OnderwijsOnline - Algemene Informatie/ General Information.

Test matrix	See assessment form on #OnderwijsOnline - Algemene Informatie/ General Information.
	BMLS8-Pr
Name [exams or modular exams]	Presentation
Code [exams or modular exams]	BMLS8-Pr
Exam and modular exam format(s)	Group of 2, Oral
Judgement	Mark
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 1, resit during Term 1 or 2. Term 3, resit Term 3 or 4
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in BMLS8 counts as registration for BMLS8-Pr
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this modular exam.
Number of examiners	Assessment by two examiners based on the assessment form (Theory lecturer or tutor).
Compensation possibility	
Competences and indicators	**Competence 3: Results analysis (level II)** *Data processing* 3.2.1. Carries out results analysis using appropriate methods; uses statistics (if applicable). Validation 3.1.2. Evaluates the obtained results based on their accuracy and reliability. *Conclusions and discussion* 3.2.2. Independently makes conclusions relating to the initial research question (if possible). 3.2.3. Relates results with results from their other experiments and also to data in published literature. **Competence 3: Results analysis (level III)** *Conclusion and discussion* 3.3.7. Suggests follow-up experiments. 3.3.3. Independently makes conclusions relating to the initial research question (if possible) and the broader research context. 3.3.5. Independently discusses results in relation to their other experiments and compares these to published literature. **Competence 6: Reporting and presenting** *Text* 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing.

	6.2.4. In English, uses written tasks appropriate to the professional practise to communicate straightforward ideas as defined by CEFR B1 Level Writing. *Presentation* 6.3.5. Presents research to a target audience with similar knowledge background in a clear and persuasive manner; applies general presentation techniques and answers questions (level III):there is a introduction-body-conclusion structure to the presentation; speaks clearly and coherently; has upright posture and hands are freely used; makes eye contact with the audience; makes organised and clear slides or other visual products; verbal and visual messages complement each other; Uses visual aids in PowerPoint to support; holds an on-topic discussion with the audience. 6.3.6. In English: can interact with a degree of fluency that makes regular interaction with native speakers quite possible (CEFR Cambridge B2 level).
Assessment criteria	**1: reporting and presenting** - Indicates the goal of the presentation and the goal matches the assignment. - Presentation structure has a beginning – middle – end with logical coherence. - The presented figures/tables are correctly depicted and complete. **2: results analysis level II** - Results are presented in a critical and impartial manner and analyzed statistically. - Presented results are interpreted on accuracy and reliability. - A correlation/association between the results and the question/aim of the research question is made. **3: results analysis level III** - Relates own research to the overall research on melanoma. - Proposes a new follow-up hypothesis or follow-up experiments.
Test matrix	See assessment form on #OnderwijsOnline - Algemene Informatie/ General Information.
	BMLS8-PvA
Name [exams or modular exams]	Research plan
Code [exams or modular exams]	BMLS8-PvA
Exam and modular exam format(s)	Group, In writing
Judgement	sufficient/insufficient
Minimum result	sufficient
Weight factor of modular exam	0
Exam opportunities	Term 1 or 3, resit in same term

Permitted resources	
Method of enrolment for exam / enrolment period	Participation in BMLS8 counts as registration for BMLS8-PvA
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner based on assessment form
Compensation possibility	
Competences and indicators	Competence 1: Design - Defining the research question 1.2.1. Independently identifies relevant background information required to answer the research question. Gathering information and developing a research plan. 1.2.2. Searches for, selects and integrates information from relevant scientific research. 1.2.4. Forms intermediate research questions and related a hypothesis based on the given research question. 1.2.5. Integrates information into a comprehensive research plan (e.g. justifying the chosen method, describing necessary controls and availability of equipment). 1.2.6. Understands and applies moderate English literature relevant to the given context. 1.2.7. Is aware of the broader research context of their own experiments. Competence 2: Experimenting/ Preparation 2.1.2. Performs calculations prior to beginning lab work. 2.2.1. Is able to explain the basic steps of the experiments. Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules. 4.1.3. Uses controls, and uses these to access the reliability of the results. Competence 6: Reporting and presenting - Text 6.2.1. Reports their research in the form of a research report/lab journal/poster according to on-house (HLO) guidelines (product criteria for lab journal and research report; level 2:uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text; is aware of the cohesion between the different sections of text; the documents structure conforms to guidelines used in professional practise; the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; describes all relevant data in a summary 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. Competence 7: Methodology 7.2.1. Plans and organises activities in a work plan that covers a duration of at least 4 practical lessons. Competence 10: Advising 10.1.1. Understands the needs and practical requirements.

Assessment criteria	See assessment form 'Research plan' on #OnderwijsOnline - General information
Test matrix	See assessment form 'Research plan' on #OnderwijsOnline - General information.
	BMLS8-P1 / BMLS8-P2
Name [exams or modular exams]	Practical 1 / Practical 2
Code [exams or modular exams]	BMLS8-P1 / BMLS8-P2
Exam and modular exam format(s)	Individual, Practical
Judgement	P1: sufficient/insufficient, P2:Mark
Minimum result	P1: sufficient / P2:5,5
Weight factor of modular exam	P1: 0 / P2: 2
Exam opportunities	Term 1 and Term 2. Term 3 and Term 4
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in BMLS8 counts as registration for BMLS8-P1 and BMLS8-P2 The evaluation of P1 is a knock-out. Sufficient evaluation of P1 is a prerequisite for participation in P2. P1 = first 10 weeks (term 1) P2 = second 10 weeks (term 2)
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this modular exam.
Number of examiners	Assessment by two examiners based on assessment form (Practical lecturer).
Compensation possibility	-
Competences and indicators	**Competence 2: Experimenting** *Preparation* 2.1.2. Performs calculations prior to beginning lab work. 2.2.1. Is able to explain the basic steps of the experiments. 2.2.3. Ensures that all requirements are present before beginning the experiment, makes solutions. 2.2.4. Carries out experiments according to the protocol in order to obtain reliable, reproducible data; is aware of what he/she is doing at all times. 2.3.1. Is able to explain the theory behind all steps of the experiments. 2.3.2. Independently ensures that all requirements are present before beginning the experiment, makes solutions. *Execution* 2.1.6. Carries out the experiment within the given time frame. 2.2.4. Carries out experiments according to the protocol in order to obtain reliable, reproducible data; is aware of what he/she is doing at all times.

	2.2.7. Attempts to trouble shoot experiments when problems are encountered. 2.3.4. Carries out experiments following protocol in order to obtain reliable, reproducible data; is able to deviate from/adjust the protocol where needed; is aware of what he/she is doing at all times. 2.3.6. Works on multiple experiments at the same time, and can complete these experiments within the given time frame; adept at switching tasks and keeps a clear overview of all activities. 2.3.7. Trouble shoots if problems are encountered in the experiments. 2.3.8. Is able to master new techniques quickly. **Competence 3: Results analysis** 3.1.4. Discusses the execution of the experiment and results. 3.2.6. Suggests improvements to improve the execution of the research. 3.3.1. Independently carries out results analysis according to the appropriate methods; uses statistics (if applicable). 3.3.2. Independently evaluates the obtained results based on their accuracy and reliability. **Competence 4: Quality (level 2)** 4.1.1. Is aware of the health and safety rules and works according to these rules. 4.2.2. Uses advanced materials and equipment correctly. **Competence 5: Management and Administration (level 3)** 5.2.1. Encodes chemicals and samples; stores these in the correct manner. 5.3.2. Contributes to an efficiently functioning lab (tidies up, reports when reagents are nearly finished, performs minor maintenance of equipment and solves minor malfunctions). *Administration* 5.3.3. Manages and archives data in lab journal (aim, experiment description, alterations, results, conclusion) and if relevant, other ways of storing data so that others can use it. **Competence 7: Methodology** 7.2.2. Works according to plan, also under time constraints. 7.2.3. Ensures that goals are reached and if necessary, makes adjustments to activities. 7.2.4. Is flexible in changing circumstances. **Competence 11: Professional Development**

	11.2.5. Works with integrity, adjusts to new situations, shows determination and is a motivated student.
Assessment criteria	**Skills** The student: - is able to answer questions concerning the methodology of different protocols; - controls if all materials are ready for use at the start of an experiment; - executes the experiment according the guidelines of the protocols; - is able to explain the underlying principle of each step in a protocol; - standardizes equipment at the start of the experiment; - solves simple problems by himself; - makes sure that targets are met and that goals are reached and if necessary adapts the working activities; - anticipates to changing circumstances; - executes experiments according to plan and, if necessary, under time pressure; - demonstrates his ability to execute more experiments simultaneously; - works according to safety and health regulations; - leaves his bench cleaned and tidy; - starts on time, is prepared and has an active working attitude; - shows integrity, adaptability, perseverance and is motivated. **Laboratory notebook** The student: - has his aim, hypothesis, methods, controls, safety and environmental regulations, and calculations noted in his notebook; - keeps track of changes in his methods; - encodes and stores chemicals and samples according to the appropriate method and records this in his notebook; - has analyzed his results according to the appropriate method; - executes the proper error analysis. A justified conclusion is drawn. The laboratory notebook is up to scratch and representative. The evaluation of P1 is a knock-out. Sufficient evaluation of P1 is a prerequisite for participation in P2. P1 = first 10 weeks (term 1) P2 = second 10 weeks (term 2)
Test matrix	See assessment form on #OnderwijsOnline - Algemene Informatie/ General Information.
	BMLS8-K1
Name [exams or modular	Knowledge test 1

exams]	
Code [exams or modular exams]	BMLS8-K1
Exam and modular exam format(s)	Individual, Writing, Multiple Choice
Judgement	Mark
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 1, resit Term 2, Term 3, resit Term 4
Permitted resources	As indicated on cover page of exam
Method of enrolment for exam / enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the exam period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is scheduled in the following teaching period. The discussion of exams taken in a resit period is scheduled at the end of the education period. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	Two examiners for construction and evaluation. Assessment by one examiner using the correction model (theory lecturer).
Compensation possibility	-
Competences and indicators	Knowledge of Module 1:Production of proteins/metabolites
Assessment criteria	The student has knowledge in the following topics: 1. Different types of expression hosts used in biotechnology. The focus will be on bacteria, yeasts, filamentous fungi, and mammalian cell lines. 2. Different types of expression systems. The focus will be on the use of promoter, terminator, ori, and selection markers. 3. Crispr-cas & bioinformatics. This includes being able to design experiments to knock out genes using Crispr-cas and explaining which databases and tools can be used while preparing experimental set-ups. 4. Process design using bioreactors. This includes being able to calculate growth rate, growth yield, maintenance constant, and product formation in a batch, fed-batch and continuous cultivation. **5.** Fermentation technology. This includes knowledge of all the parts of the bioreactor; what they do, can, and how they have to be used. This includes also media design for cultivation. **6.** Design of Experiments. This includes to recognize different types of experiments and how the data should be interpreted.
Test matrix	1: ~15%

	2: ~15% 3: ~5% 4: ~25% 5: ~35% 6: ~5%
	BMLS8-K2
Name [exams or modular exams]	Knowledge Test 2
Code [exams or modular exams]	BMLS8-K2
Exam and modular exam format(s)	Individual, Writing, Multiple choice
Judgement	Mark
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 2, resit Term 3. Term 4, resit Term 4.
Permitted resources	As indicated on cover page of exam
Method of enrolment for exam / enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the exam period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is scheduled after the exam before the review of the exam. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	Two examiners for construction and evaluation. Assessment by one examiner using the correction model (theory lecturer).
Compensation possibility	-
Competences and indicators	Knowledge of Module 2: Downstream Processing
Assessment criteria	The student has knowledge of: 1. different analytical tools like FPLC, HPLC, GC, LCMS, GCMS; also the mathematical processes of these techniques 2. biochemistry – amino acids, post-translation modification, secretion 3. extraction of fats, sugars, and proteins using analytical chemistry tools 4. setting up analytical experiments/assays in characterizing molecules and calculations using these assays
Cesuur	

Test matrix	1. ~30% 2. ~30% 3. ~20% 4. ~20%
	BMLS8-IPV
Name [exams or modular exams]	IPS
Code [exams or modular exams]	BMLS8-IPV
Exam and modular exam format(s)	Individual, IPV/IPS
Judgement	sufficient/insufficient
Minimum result	sufficient
Weight factor of modular exam	0
Exam opportunities	Term 2 or Term 4
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in BMLS8 counts as registration for BMLS8-IPV
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on participation (tutor).
Compensation possibility	-
Competences and indicators	**Competence 6: Reporting and presenting** 6.2.6. In English: Is able to conduct discussions on work-related subjects. 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. 6.2.4. In English, uses written tasks appropriate to the professional practise to communicate straightforward ideas as defined by CEFR B1 Level Writing. **Competence 8: Team Work Performance in a group** 8.1.1. Adheres to the rules. 8.1.2. Makes a valuable contribution to the group. 8.2.3. Makes clear agreements with others and keeps to these. 8.3.1. Recognizes their own role in a group; is aware of other roles in the group and works efficiently in the team structure. Works harmoniously with others. *Communication* Is able to communicate about their assignment with peers and lecturers applying basic rules of communication: 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.1.9. Is active in conflict resolution. 8.2.5. Takes initiative in the conversation. 8.2.8. Verbally expresses their opinion/message clearly. 8.3.9. Is skilled in conflict resolution. 8.3.10. Interacts with conversation partner/ensures the message is understood. 8.3.11. Keeps conversation on topic.

	8.2.12. Is aware of intercultural differences in the professional field.
Assessment criteria	The student: - has prepared the meetings by specifying the answers to the week assignments which are discussed and the assignments which are reviewed (k.o.); - can demonstrate the specified answers to the assignment to the tutor after setting a date (in writing or presentation): in all assignments all issues addressed are answered (k.o.); - fulfils his roles (chair, minute taker, etc.) (k.o.); - recognizes own role and input in the group and knows the other roles in the team; adjusts own work to the work of others; - adheres to the rules agreed on (k.o.); - asks questions and shares knowledge regarding the assignment, during tutor meetings. The student verbalizes clearly and audibly, maintains eye contact; - focuses on the aim of the talk; - lets others finish, interacts with his conversation partner and checks if the message is understood; - gives group and class members feedback and is open to receiving feedback; - offers a positive contribution to the group process by taking initiative and actively resolve conflicts. All projects assignments should be sufficient for assessments Project assignments the score sheets 'Assessment form Plan of Approach' and 'Assessment form Poster' can be found on #OnderwijsOnline - general information.

Course unit 9: BMLS9 (30 study credits)

	BMLS9
General information	
Target group/groups	Full-time students Biology of Medical Laboratory Research or Life Sciences, graduation specialisation: Molecular Plant Biology.
Name of unit of study	OWE 9: Molecular Plant Biology / ECU9: Molecular Plant Biology
Code of unit of study	BMLS9
Lecture period	Semester 1 (P1 and P2) and Semester 2 (P3 and P4)
ECTS credits	30 credits
Study load in hours	840 SBU
Study hours (contact hours)	Planned lesson/contact hours 20.7 lesson hours/week, 144 lesson hours/period = 108.75 hours 19.9 lesson hours/week, 139 lesson hours/period = 104.25 hours Planned time for self-study: Term 1/3 = 310.50 hours Term 2/4 = 315.75 hours

	Total 840 hours
Entry requirements for unitof study	Propaedeutic phase should be completed (first study year). IPS from all previous courses must be completed. BM5B/LS5B and BM6B/LS6B must be completed (sufficient). In total 40 credits from the EEUs BM5/LS5 and BM6/LS6 must be completed and at least 2 modular exams from BM5C/LS5C and/or BM6C/LS6C should be sufficient.
Content and organisation	
General description	Crops for the future Plants are invaluable; they give us food, oxygen, building materials, clothing and fuel. Without plants, our life on earth would be impossible. Since the beginning of agriculture, some 6000 years ago, through the process of domestication, we have changed and adapted plants for our food supply. Plant breeding (crossing plants followed by selection) has taken place for about 100 years and has ensured that there are now plants that are easier to grow and give higher yields. With the advent of the genomics and molecular biology, in the last 10 years it has become possible to study important processes in plants and to further improve the crops to ensure that there is sufficient food for everyone in the future. Developing new crops is extremely important because our food sources are threatened. There is a reduction of agricultural land, climate change and plant diseases that destroy the harvest, while the human population continues to grow. To ensure our food in the future plants should be developed that can still grow efficiently, have a higher nutritional value, resistant to a large number of plant diseases and better able to deal with abiotic stress. To meet this challenge, we will research the nutritional value of different crops by determining the presence of special secondary metabolites. Using CRISPR/Cas technology, we will try to influence the creation of secondary metabolites. During the practical, we will use marker analysis to map the genes involved in the production of secondary metabolites. In addition, you will design an experiment to study the growth and development of plants under stress situations. Finally, students will create a poster that describes how a crop with the current molecular techniques can be improved for future use. In the framework of the Biodiscovery chain, the emphasis in this course is on ‘Discovery’ of plant compounds for various applications and the analysis thereof. The course unit is given twice, in both semesters in the English language. The exams for students that do not participate in the English

	variant of the study program, if desired, are provided in Dutch and/or can be answered in Dutch. The professional products must be made in English
Exit qualifications	Question clarification Design Experiment Analysing results Quality control Management and administration Reporting and presenting Planning and project-based working Teamwork Professional development
Professional task	Carrying out life science research.
Professional products	Research report Carotenoids (Vct) Research report: Growth and development (Vgo) Poster (Po)
Cohesion	This course further develops competencies and knowledge from BM5-BM6/LS5-LS6. In particular now focused on plants. The lab and theory from BM6/LS6 are applied here in a more complex model.
Mandatory participation	Attendance at the tutor groups, workshops and guest lectures is a prerequisite for participation in the IPS modular exam. Attendance at the practical lessons is a prerequisite for participation in the practical modular examination
Maximum number of participants	In semester 1 the maximum number that can enter this course is set to 2 practical classes. Maximum of participants is 28.. In semester 2 there is no maximum number of participants. Selection procedure for participation during semester 1 academic year 2020-2021: Students registered for BMLS9 who have obtained 30 credits from second year EEU's of the first semester of academic year 2019-2020 after the re-sits of term 2 can participate. The other available places will be divided over the registered students via lottery. For semester 2 there is no selection procedure for participation.
Compensation options	
Activities and/or instructional formats	Supporting subjects **Molecular plant biology** Evolution of plants and the genome. Growth and development Plant Biochemistry Plant-pathogen-environment interaction Plant Physiology Domestication Classical and molecular breeding Molecular markers and MAS Plant Transformation and GMOs

	Gene knockouts and mutagenesis Transposons Future Plant Breeding *Work form: Lecture/response classes* **Supporting Workshops** Plant Identification Genetics QTL mapping Poster design CRISPR-Cas *Work form: Lecture* **Supporting Workshops Techniques** qPCR HPLC Bioinformatics Gene mapping *Working methods: Lecture* **Supporting practical lessons** Research of carotenoids in different crops Research of anthocyanins as response on stress (own design) Research of gene expression during growth (own design) and development under stress (own design) Tissue culture research (own design) Petunia and tobacco transformation Protoplasts isolation and plating Protoplast transformation CRISPR-Cas and multiplex cloning QTL analysis KASP analysis HPLC *Working method: Practical* **Social Communication Skills Workshops** Internship preparation/job application Scientific writing *Teaching methods: training*
Required literature	The latest edition of: - Smith, A.M., Sablowski, R. Plant Biology, Oxford: Taylor & Francis Inc. - Wilms, F., Carole Koning-Boucoiran, C., & Czerednik A., Theme guide course unit MPB - Russell, P.J., iGenetics, a molecular approach, (3th revised edition) New York NY: Pearson Education Ltd.

Required software / required materials	MapChart, JoinMap®, MapQTL®
Recommended literature	The last edition of: - Reece. J.B., Campbell Biology, New York, NY: Pearson Education
Examination	
	BMLS9-T
Name [exams or modular exams]	Theme test
Code [exams or modular exams]	BMLS9-T
Exam and modular exam format(s)	In writing, Open Questions , Individual
Judgement	Mark
Minimum result	5,5
Weight factor of modular exam	2
Exam opportunities	Term 2, resit term 3 / Term 4, resit end term 4.
Permitted resources	As indicated on cover page of exam
Method of enrolment for exam / enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the exam period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is scheduled after the exam before the review of the exam. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	Two examiners for construction and evaluation. Assessment by one examiner using the correction model (expert/theory lecturer).
Compensation possibility	
Competences and indicators	Competence 1: Design (Level II/III) 1.2.1. Independently identifies relevant background information required to answer the research question. 1.2.2. Searches for, selects and integrates information from relevant scientific sources. 1.2.6. Understands and applies moderate English literature relevant to the given context.

	Competence 2: Experimenting (Level III) 2.1.2. Performs calculations prior to beginning lab work. 2.3.1. Is able to explain the theory behind all steps of the experiments. 2.3.3. Independently ensures that all requirements are present before beginning the experiment, makes solutions. Competence 3: Results analysis (level II/III) Data processing 3.2.1. Carries out results analysis using appropriate methods; uses statistics (if applicable). Validation 3.1.2. Evaluates the obtained results based on their accuracy and reliability. Conclusions and discussion 3.1.4. Discusses the execution of the experiment and results 3.2.3. Independently makes conclusions relating to the initial research question (if possible). 3.2.5. Relates results with results from their other experiments and also to data in published literature. 3.3.7. Suggests follow-up experiments
Assessment criteria	1. Experimental Design - understand the meaning of experimental design as an efficient procedure for planning experiments; - understand for what kind of experiments can be applied for given topic 2: Experimenting The student knows - the principles of classical and molecular breeding, and future breeding - molecular markers and MAS -- the principles of sequencing technology - the differences between the transposons and transposable elements and their use in breeding - the direct and indirect transformation techniques to obtain GMO plants with overexpression or knock-out genes by using the principle of gene editing with CRISPR-Cas knock-out and RNAi knocked down -- knows the principle of RNA isolation, cDNA synthesis and qPCR; -- knows the principle of HPLC; Student is able to draw the vector for transformation with all basic elements depending on transformation technique 3: Results analysis The student: - knows the principle of the statistics used in the research assignments; - is able to mention the proper controls;

	- is able to interpret bioinformatics data; - is able to interprets gene mapping - is able to interpret data from HPLC, QPCR, QTL
Test matrix	1: Experimental design ~25% 2: Experimenting ~45% 3: Results analysis ~30%
	BMLS9-Vct / BMLS9-Vgo
Name [exams or modular exams]	BMLS9-Vct Research report Carotenoids / BMLS9-Vgo Research report Growth and development
Code [exams or modular exams]	BMLS9-Vct / BMLS9-Vgo
Exam and modular exam format(s)	In writing , Group
Judgement	Mark
Minimum result	BMLS9-Vct: 5.5 / BMLS9-Vgo: 5.5
Weight factor of modular exam	BMLS9-Vct: 1 / BMLS9-Vgo: 1
Exam opportunities	Vct: Term 1, or term 3 resit in consultation / Vgo: Term 2 or 4, resit in consultation
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in BMLS9 counts as registration for BMLS9-Vct and BMLS9-Vgo
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this modular exam.
Number of examiners	Assessment by one examiner based on assessment form (Practical lecturer).
Compensation possibility	
Competences and indicators	Competence 1: Design 1.2.1. Independently identifies relevant background information required to answer the research question. 1.3.3. Independently searches for, selects and integrates information from relevant scientific sources. 1.2.4. Forms intermediate research questions and related a hypothesis based on the given research question. 1.3.5. Makes connections between experiments and the broader research context. 1.3.6. Understands and applies advanced English literature relevant to the given context. Competence 2: Experimenting 2.2.3., (2.3.3.) (Independently) ensures that all requirements are present before beginning the experiment, makes solutions. 2.3.1. Is able to explain the theory behind all steps of the experiments.

	Competence 3: Results analysis 3.1.4. Discusses the execution of the experiment and results. 3.3.1. Independently carries out results analysis using (according to the) appropriate methods; uses statistics (if applicable). 3.3.3. Independently makes conclusions relating to the initial research question (if possible). 3.2.5. Relates result with results from their other experiments and also to data in published literature. 3.2.6. Suggests improvements to improve the execution of the research. 3.3.3. Independently makes conclusions relating to the initial research question (if possible) and the broader research project. 3.3.7. Suggests follow-up experiments. Competence 4: Quality control 4.1.3. Uses controls, and uses these to assess the reliability of the results. Competence 5: Management and administration 5.3.3. Manages and archives data in lab journal (aim, experiments description, alterations, results, conclusion) and if relevant, other ways of storing data so that others can use it. Competence 6: Reporting and presenting 6.2.1. Reports their research in the form of a research report/lab journal/poster according to in-house (HLO) guidelines (product criteria for lab journal and research report; level 2: uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text; is aware of the cohesion between the different sections of text; the documents structure conforms to guidelines used in professional practice; the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; describes all relevant data in a summary. 6.3.1. Reports their research in the form of a research report/lab journal/poster according to international guidelines (product criteria for lab journal and research report level 3): uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text. There is cohesions between the different sections of text; the documents structure conforms to guidelines used in professional practice; the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses

	clearly labelled figures and tables; all relevant data is described in a summary that is independent to the report. 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. 6.3.4. In English, uses written tasks appropriate to the professional practise to communicate straightforward ideas as defined by CEFR B2 Level Writing. In the context of: Vct: Carotenoids Report Vgo: Growth and development
Assessment criteria	See evaluation form 'Research Report Course 9" on #OnderwijsOnline – Algemene Informatie / General Information.
Test matrix	See evaluation form 'Research Report Course 9" on #OnderwijsOnline – Algemene Informatie / General Information.
	BMLS9-Po
Name [exams or modular exams]	Poster
Code [exams or modular exams]	BMLS9-Po
Exam and modular exam format(s)	In writing, Oral, Individual
Judgement	Mark
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 2 or 4, resit in consultation
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in BMLS9 counts as registration for BMLS9-Po
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this modular exam.
Number of examiners	Assessment by two examiners based on assessment form (Theory lecturer or tutor).
Compensation possibility	
Competences and indicators	Competence 1: Design 1.2.1. Independently identifies relevant background information required to answer the research question. 1.2.7. Is aware of the broader research context of their own experiments. 1.3.3. Independently searches for, selects and integrates information from relevant scientific sources. 1.3.4. Independently forms intermediate research questions and related hypothesis based on the given research question. 1.3.5. Independently integrates information into a comprehensive

	research plan (e.g. justifying the chosen method, describing necessary controls and availability of equipment). 1.3.6. Understands and applies advanced English literature relevant to the given context. Competence 2: Experimenting 2.3.1. Is able to explain the theory behind all steps of the experiments. Competence 3: Results analysis 3.3.5. Independently discusses results in relation to their other experiments and compares these to published literature (level 2) Competence 6: Reporting and presenting 6.2.1. Reports their research in the form of a research report/lab journal/poster according to in-house (HLO) guidelines (product criteria for lab journal and research report; level 2:uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text; is aware of the cohesion between the different sections of text; the documents structure conforms to guidelines used in professional practise; the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; describes all relevant data in a summary. 6.3.1. Reports their research in the form of a research report/lab journal/poster according to international guidelines (product criteria for lab journal and research report level 3): uses correct spelling, grammar, sentence structure and scientific style; uses a clear and logical structure in complex passages of text. There is cohesions between the different sections of text; the documents structure conforms to guidelines used in professional practice; the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; all relevant data is described in a summary that is independent to the report. 6.3.5. Presents research to a target audience with similar knowledge backgroud in a clear and persuasive manner; applies general presentation techniques and answers questions: there is an introduction-body-conclusion structure to the presentation; speaks clearly and coherently; has upright posture and hands are freely used; makes eye contact with the audience; makes organised and clear slides or other visual products; verbal and visual messages complement each

	other; Uses visual aids in PowerPoint to support; holds an on-topic discussion with the audience. Competence 8: Team work 8.1.6. Maintains eye contact with conservation partner. 8.2.5. Takes initiative in the conversation. 8.2.8. Verbally expresses their opinion/message clearly. 8.2.10. Interacts with conversation partner. 8.3.11. Keeps conversation on topic. 8.2.12. Is aware of intercultural differences in the professional field In the context of: Applying knowledge of molecular breeding of a crop.
Assessment criteria	See assessment form 'Poster course 9: A new crop" on #OnderwijsOnline – Algemene Informatie / General Information.
Test matrix	See evaluation form 'Poster Course 9: A new crop" on #OnderwijsOnline – Algemene Informatie / General Information.
	BMLS9-P
Name [exams or modular exams]	Practical
Code [exams or modular exams]	BMLS9-P
Exam and modular exam format(s)	Practical, Group, Lab journal: In writing, Individual
Judgement	Mark
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Terms 2 or 4. There is only one opportunity per academic year for the modular exams P (OER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in BMLS9 counts as registration for BMLS9-P
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this modular exam.
Number of examiners	Assessment by two examiners based on assessment form (Practical lecturer).
Compensation possibility	
Competences and indicators	Competencies are assessed at Level 2 (minimum) and level 3 Competence 2: Experimenting Preparation 2.1.2. Performs calculations prior to beginning lab work. 2.1.3. Ensures that all requirements are present before beginning the experiment.

	2.1.5. Carries out the experiments within the given time frame. 2.2.4. Carries out experiments according to the protocol in order to obtain reliable, reproducible data; is aware of what he/she is doing at all times. 2.2.6. Attempts to work on multiple experiments at the same time (multitasking). 2.2.7. Attempts to trouble shoot experiments when problems are encountered. 2.3.1. Is able to explain the theory behind all steps of the experiments. 2.3.3. Independently ensures that all requirements are present before beginning the experiment, makes solutions. 2.3.4. Carries out experiments following protocol in order to obtain reliable, reproducible data; is able to deviate from/adjust the protocol where needed; is aware of what he/she is doing at all times. 2.3.6. Works on multiple experiments at the same time, and can complete these experiments within the given time frame; adept at switching tasks and keeps a clear overview of all activities. 2.3.7. Trouble shoots if problems are encountered in the experiments. 2.3.8. Is able to master new techniques quickly. Competence 3: Results analysis 3.1.4. Discusses the execution of the experimental and results. 3.2.6. Suggests improvements to improve the execution of the research. 3.3.1. Independently carries out results analysis according to the appropriate methods; uses statistics (if applicable). 3.3.2. Independently evaluates the obtained results based on their accuracy and reliability. 3.3.7. Suggests follow-up experiments. Competence 4: Quality control 4.1.1. Is aware of the health and safety rules and works according to these rules. 4.2.2. Calibrates advanced equipment before beginning experiments. Competence 5: Management and administration 5.2.1. Encodes chemicals and samples; stores these in the correct manner. 5.3.2. Contributes to an efficiently functioning lab (tidies up, reports when reagents are nearly finished, performs minor maintenance of equipment and solves minor malfunctions). 5.3.3. Manages and archives data in lab journal (aim, experiments description, alterations, results, conclusion) and if relevant, other ways of storing data so that others can use it.

	Competence 7: Methodology 7.2.2. Works according to plan, also under time constraints. 7.2.3. Ensures that goals are reached and if necessary, makes adjustments to activities. 7.2.4. Is flexible in changing circumstances. Competence 11: Professional Development 11.2.5. Works with integrity, adjusts to new situations, shows determination and is a motivated student.
Assessment criteria	See assessment form “Practical course 9” on #OnderwijsOnline – Algemene Informatie / General Information. The evaluation of P1 is a knock-out. Sufficient evaluation of P1 is a prerequisite for participation in P2. P1 = first 10 weeks (term 1) P2 = second 10 weeks (term 2) **Skills** The student: - is able to answer questions concerning the methodology of different protocols; - controls if all materials are ready for use at the start of an experiment; - executes the experiment according the guidelines of the protocols; - is able to explain the underlying principle of each step in a protocol; - standardizes equipment at the start of the experiment; - solves simple problems by himself; - makes sure that targets are met and that goals are reached and if necessary adapts the working activities; - anticipates to changing circumstances; - executes experiments according to plan and, if necessary, under time pressure; - demonstrates his ability to execute more experiments simultaneously; - works according to safety and health regulations; - leaves his bench cleaned and tidy; - starts on time, is prepared and has an active working attitude; - shows integrity, adaptability, perseverance and is motivated. **Laboratory notebook** The student: - has his aim, hypothesis, methods, controls, safety and environmental regulations, and calculations noted in his notebook; - keeps track of changes in his methods; - encodes and stores chemicals and samples according to the appropriate method and records this in his notebook;

	- has analyzed his results according to the appropriate method; - executes the proper error analysis. A justified conclusion is drawn. The laboratory notebook is up to scratch and representative.
Test matrix	See assessment form “Practical course 9” on #OnderwijsOnline – Algemene Informatie / General Information 60% practical 40% lab journal
	BMLS9-K
Name [exams or modular exams]	Knowledge exam
Code [exams or modular exams]	BMLS9-K
Exam and modular exam format(s)	In writing, Individual
Judgement	Mark
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Term 1, resit term 2. Term 3, resit during term 4
Permitted resources	
Method of enrolment for exam / enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the exam period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is scheduled in the following teaching period. The discussion of exams taken in a resit period is scheduled at the end of the education period. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	Two Examiners for the construction and assessment (expert/lecturer). One Examiner for the assessment based on the correction model (lecturer).
Compensation possibility	
Competences and indicators	Knowledge of molecular plant physiology from P1 semester 1/P3 semester 2
Assessment criteria	Plant Identification

	The student: - is able to describe the various plant organs; - is able to describe the external characteristics of different plant families; - is able to name examples of plants and crops from different plant families. Plant evolution The student is able to describe the evolution from algae to angiosperm. Growth and development The student: - is able to describe the development of the plant from embryo to plant and the genes that are involved as well as their function; - can describe pollination and fertilisation; - is able to describe the development of the flower and the genes that are involved as well as their function; - is able to describe the similarities and differences between shoot and root meristem. Plant Biochemistry The student: - knows photosynthesis, photorespiration and the GS-GOGAT system. Secondary metabolites The student knows important classes of secondary metabolites and their function in plants and usage by humans. Plant interaction with different organisms The student: - can describe the life cycle of various pathogen groups and name examples of organisms; - can name several mechanisms of plant defences; - can describe the zig-zag model; - can describe the symbiosis with fungi - can describe the symbiosis with Rhizobia and mechanism of nitrogen fixation Plant-environment interaction and response (stress). The student - can name the various forms of abiotic stress and describe the effect on the plant and the response of the plant. - knows the genes and proteins important in the response - knows principles of plant response to environmental stimuli and genes /proteins involved in the response

	- knows the role of signaling molecules (hormones) in the response Plant Domestication and Origins of Agriculture The student: - can describe the process of domestication; - can name several characteristics of plant domestication and give examples. Plant Transformation The student: - can describe the DNA transfer from Agrobacterium to the plant; - has knowledge of different transformation techniques for genetic modification of plants. - knows the basic principles of CRISPR-Cas technology
Test matrix	~12% Plant metabolism ~50% Plant Physiology ~12% Plant-pathogen interaction ~ 8% Plant identification and domestication ~12% Plant evolution ~ 6% Plant transformation
	BMLS9-IPV
Name [exams or modular exams]	IPS
Code [exams or modular exams]	BMLS9-IPV
Exam and modular exam format(s)	Individual, Oral
Judgement	Sufficient/Insufficient
Minimum result	Sufficient
Weight factor of modular exam	0
Exam opportunities	Term 2 or term 4. There is only one opportunity per academic year for the modular exam IPS (OER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in BMLS9 counts as registration for BMLS9-IPV
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by one examiner based on participation (tutor).
Compensation possibility	
Competences and indicators	**Competence 6: Reporting and presenting** 6.2.6. In English: Is able to conduct discussions on work-related subjects.

	6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. 6.2.4. In English, uses written tasks appropriate to the professional practice to communicate straightforward ideas as defined by CEFR B1 Level Writing. **Competence 8: Team work** Performance in a group 8.1.1. Adheres the rules. 8.1.2. Makes a valuable contribution to the group. 8.2.1. Makes clear agreements with others and keeps to these. 8.3.1. Recognises their own role in a group; is aware of other roles in the group and works efficiently in the team structure. Works harmoniously with others. Communication Is able to communicate about their assignment with peers and lecturers applying basic rules of communication: 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.2.5. Takes initiative in the conversation. 8.2.8. Verbally expresses their opinion/message clearly. 8.2.12. Is aware of intercultural differences in the professional field. 8.3.9. Is skilled in conflict resolution. 8.3.10. Interacts with conversation partner/ensures the message is understood. 8.3.11. Keeps conversation on topic.
Assessment criteria	The student: - has prepared the meeting by completing assignment to be discussed, and also completed the required reading for the following assignment to be discussed (k.o.); - is able to show assignment products to the tutor (according to agreements, in writing or as a presentation); in all assignments all aspects required are complete (k.o.); - fulfils his role(s) (e.g. chair, minutes taker, etc).; (k.o.); - recognizes their role and contribution to the group and knows what other roles there are in the team; deals with this adequately; adjusts working style to others; - adheres to the rules agreed upon (k.o.); - asks questions and shares knowledge regarding the assignment during tutor meetings; verbalises these clearly and audibly, maintains eye contact; - keeps to the aim of the conversation; - allows others to finish speaking and interacts with conversation partner; - offers feedback to group- and class members and is open to receiving feedback;

	- makes a positive contribution to the group by showing initiative and managing conflicts that arise. All projects assignments should be sufficient for the IPS assessment

Course unit 10: BMLS10 (30 study credits)

	BMLS10
General information	
Target group/groups	Full-time students Biology of Medical Laboratory Research or Life Sciences, graduation specialisation: Biomedical research
Name of unit of study	Onderwijseenheid 10: Biomedical Research / ECU 10: Biomedical Research
Code of unit of study	BMLS10
Lecture period	Term 1 and 2, 3 and 4
ECTS credits	30 stp
Study load in hours	840 SBU
Study hours (contact hours)	Planned lesson/contact hours: 10 practical hours per week, 11.4 theory-practical hours a week gives 150 lesson hours per term = 112.5 clock hours Planned time for self-study: 307,5 clock hours per term Total: 420 clock hours per period, a total of 840 hours the whole semester
Entry requirements for unit	1. Registration in Alluris 2. Propaedeutic phase should be completed (first study year). 3. IPS from all previous courses must be completed. BM5B/LS5B and BM6B/LS6B must be completed (sufficient). In total 40 credits from the EEUs BM5/LS5 and BM6/LS6 must be completed 4. At least 2 modular exams from BM5C/LS5C and/or BM6C/LS6C should be sufficient.
Content and organisation	
General description	In this course, different model systems are used to study tumor development. The semester will be split into two blocks. In one block, the practical work will mainly focus on cell culture and in the other block students will be working with the nematode Caenorhabditis elegans. In both cases, the experiments will look at the biological processes that contribute to cancer. The research questions come from various scientific institution such as the research of Dr. A Zijlstra (VanderBilt University, Nashville, US) and the research of Prof. A. Woollard (University of Oxford, Oxford, UK). In the framework of the biodisocovery chain, the emphasis of this course lies on the discovery and analysis of molecules and processes that play a role in the development of cancer.

	Theme test BLM model: Melanoma and microenvironment + Practical work + Tutor Assignments to study BLM model. Theme test C. elegans model: Developmental biology + Molecular diagnostics + Practical work + Tutor Assignments to study C. elegans model. Knowledge exam 1 = Module 1: Pathogenesis- disease in cells. Knowledge exam 2 = Module 2: Fighting pathogenesis: immunology of infectious diseases and Cancer To familiarise the students with the international work field will work with two assignments from international clients. Our English Life Sciences and the Dutch-speaking cohort will work together. Every year we expect a number of exchange students from our international partner educational institutions such as Bonn Rhein Siegh HochSchule (Germany) and Dundee University (Scotland). These exchange students give the degree programme a unique character and challenges our students to work with students with other (International) backgrounds. The language of instruction is English. The written exams for students that do not participate in the English variant of the study program, if desired, are provided in Dutch and/or can be answered in Dutch. The professional products must be made in English.
Exit qualifications	Design Experiment Analysing results Management and administration Reporting / Presentation Planning and project-based working Teamwork Guiding/Supervising Professional development
Professional task	Carrying out scientific research.
Professional products	Short communication (Sc) Project proposal defence (Pv)
Cohesion	This course further develops competencies and knowledge from BM5/LS5 and BM6/LS6. The developed laboratory and analysis skills are applied here in a more complex model.
Mandatory participation	Attendance at the tutor groups, PLE and guest lectures is a prerequisite for participation in IPS modular exams. Attendance at the practical lessons is a prerequisite for participation in the practical modular examination.
Maximum number of participants	In semester 1, the maximum number of participants that can enter this course is set to 4 practical classes (each class a maximum of 15 people). In semester 2 there is no maximum number of participants.

	The selection procedure for participation: this specialisation has a maximum number of students that may participate. Students that have collected 30 credits after semester 1 of the second year will be selected immediately and can participate, if they meet the entry requirements at start. The other available places will be divided over the registered students via a lottery.
Compensation options	
Activities and/or instructional formats	**Supporting subject Pathogenesis: cell biology of cancer** Carcinogenesis Signal transduction GTPases Cell division and apoptosis Carcinogenesis (hallmarks of cancer) Post-translational modification of proteins and chaperones. Cell-cell adhesion and cell-matrix adhesion Signaling in cancer Cell polarity *Working methods: lecture* **Supporting subject Controlling the pathogenesis: Immunology** **of infectious diseases and cancer** Immunology Immunobased therapies for cancer and pathogens Virology Nomenclature *Working methods: lecture* **Supporting subject Scientific approach to studying pathogenesis.** Molecular diagnostics ~omics Developmental biology Statistics *Working methods: combined lectures/response classes* **Practical** *Procedure: Practical*
Required literature	The latest edition of: - Alberts, B., Johnson, A. e.a. Molecular Biology of the Cell, Garland Science. - Dimmock, N., Easton, A., Introduction to Modern Virology. Hoboken (New Jersey): John Wiley and Sons Ltd. - Murphy, K., & Weaver, C. Janeway's immunobiology. Garland Sciences (New York and London), Ww Norton & Co - Website for statistics: http://www.biostathandbook.com
Required software /	

required materials	
Recommended literature	- Nelson DL &; Cox MM, Lehninger, Principles of Biochemistry, International edition.
Examination	
	BMLS10-Tb
Name [exams or modular exams]	Theme test
Code [exams or modular exams]	BMLS10-Tb
Exam and modular exam format(s)	Individual, written
Judgement	Mark
Minimum result	5.5
Weight factor of modular exam	1
Exam opportunities	term 1, term 2, term 3, term 4, resit term 4
Permitted resources	
Method of enrolment for exam / enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the exam period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. Term 1 and 3: The discussion of the exam is scheduled in the following teaching period. Term 2: The discussion of the exam is scheduled after the exam before the review of the exam. At the end of term 4 the discussion is held before the start of the resit period of term 4. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	Two examiners for construction and evaluation. Assessment by one examiner using the correction model (theory lecturer, course coordinator).
Compensation possibility	
Competences and indicators	Competence 1: Design (level II/III) Defining the research question 1.2.1. Independently identifies relevant background information required to answer the research question. Gathering information and developing a research plan 1.2.2. Searches for, selects and integrates information from relevant scientific sources.

	1.3.6.Understands and applies advanced English literature relevant to the given context. Competence 2: Experimenting (level III) Preparation 2.1.2. Performs calculations prior to beginning lab work. 2.3.1. Is able to explain the theory behind all steps of the experiments. 2.3.3. Independently ensures that all requirements are present before beginning the experiment, makes solutions. Competence 3: Results analysis (level II/III) Validation 3.1.2. Evaluates the obtained results based on their accuracy and reliability. Data processing 3.2.1. Carries out results analysis using appropriate methods; uses statistics (if applicable). Conclusions and discussion 3.2.3. Independently makes conclusions relating to the initial research question (if possible). 3.2.5. Relates results with results from their other experiments and also to data in published literature. 3.3.7. Suggests follow-up experiments.
Assessment criteria	1. Experimental Design The student: - is able to explain research questions of tumour development and progression; - understands the molecular principles of ALCAM-related research; - understands the components of the tumour micro environment and its relation to tumour progression and metastasis; - understands the scientific model (organism) used and can relate this to other models used. 2. Experimenting The student: - can calculate end concentrations; - knows the principle of culturing BLM cells; - knows the principle of RNA isolation, cDNA synthesis and qPCR; - knows the principle of gelatin zymography; - knows the principle of HPLC and mass spectrometry; - understands the principle of ~omics experiments. 3. Results analysis The student: - knows the principle of the statistics used in the research assignments; - is able to mention the proper controls; - is able to interpret QPCR, Zymography, ~omics data.

Test matrix	1. Experimental design ~20% 2. Experimenting ~ 60% 3. Results analysis ~20%
	BMLS10-Tc
Name [exams or modular exams]	Theme test
Code [exams or modular exams]	BMLS10-Tc
Exam and modular exam format(s)	Individual, written
Judgement	Mark
Minimum result	5.5
Weight factor of modular exam	1
Exam opportunities	term 1, term 2, term 3, term 4, resit term 4
Permitted resources	
Method of enrolment for exam / enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the exam period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. Term 1 and 3: The discussion of the exam is scheduled in the following teaching period. Term 2: The discussion of the exam is scheduled after the exam before the review of the exam. At the end of term 4 the discussion is held before the start of the resit period of term 4. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	Two examiners for construction and evaluation. Assessment by one examiner using the correction model (theory lecturer, course coordinator).
Compensation possibility	
Competences and indicators	Competence 1: Design (level II/III) Defining the research question 1.2.1. Independently identifies relevant background information required to answer the research question. Gathering information and developing a research plan 1.2.2. Searches for, selects and integrates information from relevant scientific sources.

	1.3.6. Understands and applies advanced English literature relevant to the given context. Competence 2: Experimenting Preparation 2.1.2. Performs calculations prior to beginning lab work. 2.3.1. Is able to explain the theory behind all steps of the experiments. 2.3.3. Independently ensures that all requirements are present before beginning the experiment, makes solutions. Competence 3: Results analysis (level II/III) Data processing 3.2.1. Carries out results analysis using appropriate methods; uses statistics (if applicable). Validation 3.1.2. Evaluates the obtained results based on their accuracy and reliability. Conclusions and discussion 3.2.3. Independently makes conclusions relating to the initial research question (if possible). 3.2.5. Relates results with results from their other experiments and also to data in published literature. 3.3.7. Suggests follow-up experiments.
Assessment criteria	1. Experimental design The student: - understands the C. elegans-related research in the context of developmental biology; - understands the multidisciplinary approach to study tumour development and progression indicated with the provided articles of the research assignments; - understands the scientific model (organism) used and can relate this to other models used. 2. Experimenting The student: - can calculate end concentrations; - knows the principle of culturing C. elegans; - knows the principle of RNAi; - knows the principle of western blotting; - knows the principle of Immunofluorescence; - is able to mention and understand the use of proper controls. 3. Results analysis The student is able to interpret RNAi, Immunofluoresence data and Western blot data. 4: Molecular Diagnostics The student has knowledge of Molecular Diagnostic tools and applications.
Test matrix	1. Experimental design ~15%

	2. Experimenting ~ 50% 3. Results analyses ~15% 4. Molecular Diagnostics ~20%
	BMLS10-Sc
Name [exams or modular exams]	Short communication
Code [exams or modular exams]	BMLS10-Sc
Exam and modular exam format(s)	Group, Writing
Judgement	Mark
Minimum result	5.5
Weight factor of modular exam	1
Exam opportunities	Term 1, resit Term 2. Term 3, resit term 4
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in BMLS10 counts as registration for BMLS10-Sc
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this modular exam.
Number of examiners	Assessment by one examiner based on assessment form (Theory lecturers, course coordinator).
Compensation possibility	
Competences and indicators	Competence 1: Design (level II) Gathering information and developing a research plan 1.2.2. Searches for, selects and integrates information from relevant scientific sources. 1.2.4. Forms intermediate research questions and related a hypothesis based on the given research question. 1.2.5. Integrates information into a comprehensive research plan (e.g. justifying the chosen method, describing necessary controls and availability of equipment). 1.2.7. Is aware of the broader research context of their own experiments. 1.3.6. Understands and applies advanced English literature relevant to the given context. Competence 2: Experimenting 2.3.3. Independently ensures that all requirements are present before beginning the experiment, makes solutions. Competence 3: Results analysis Data processing 3.2.1. Carries out results analysis using appropriate methods; uses statistics (if applicable). (level II). Validation

	3.1.2. Evaluates the obtained results based on their accuracy and reliability. (level II). 3.3.3. Independently makes conclusions relating to the initial research question (if possible) (level II) and the broader research context. (level III). Competence 5: Management Administration 5.2.3. Manages and archives data in lab journal (aim, experiment description, alterations, results, conclusion) and if relevant, other ways of storing data so that others can understand it. Competence 6: Reporting and presenting Text 6.2.1. Reports their research in the form of a research report/lab journal/poster according to in-house (HLO) guidelines (product criteria for lab journal and research report. (level II): - uses correct spelling, grammar, sentence structure and scientific style; - uses a clear and logical structure in complex passages of text; - is aware of the cohesion between the different sections of text; the documents structure conforms to guidelines used in professional practice; - the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; uses clearly labelled figures and tables; describes all relevant data in a summary. 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. Reporting 6.3.1. Reports their research in the form of a research report/lab journal/poster according to international guidelines (product criteria for lab journal and research report. (level III): - uses correct spelling, grammar, sentence structure and scientific style; - uses a clear and logical structure in complex passages of text. There is cohesions between the different sections of text; the documents structure conforms to guidelines used in professional practice; - the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; - uses clearly labelled figures and tables; all relevant data is described in a summary that is independent to the report. 6.3.4. In English, uses written tasks appropriate to the professional practice to communicate straightforward ideas as defined by CEFR Cambridge B2 Level Writing.

Assessment Criteria	Layout: All components of a short communication are presented coherently and professional knowledge is applied. English and the preferred spellings are those of the Oxford English Dictionary. Paper is written in the third person in an objective, formal, and impersonal style. AI units, symbols are presented correctly. Body of the paper is organised into logical sections: 1. Summary 2. Materials and methods 3. Results 4. Discussion and conclusion 5. List of references In general: content should be scientifically correct. See Assessment form Short communication on #OnderwijsOnline - General Information.
Test matrix	See Assessment form Short communication on #OnderwijsOnline – General information.
	BMLS10-Pv
Name [exams or modular exams]	Defence project proposal
Code [exams or modular exams]	BMLS10-Pv
Exam and modular exam format(s)	Group, Oral
Judgement	Mark
Minimum result	5.5
Weight factor of modular exam	1
Exam opportunities	Term 2, resit Term 2 or 3. Term 4, resit Term 4
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in BMLS10 counts as registration for BMLS10-Pv
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this modular exam.
Number of examiners	2 examiners for assessment using the assessment form (tutors, practical teachers, lecturers, course coordinators)
Compensation possibility	
Competences and indicators	Competence 3: Results analysis (level II/III) Validation 3.1.2. Evaluates the obtained results based on their accuracy and reliability. Data processing 3.2.1. Carries out results analysis using appropriate methods; uses statistics (if applicable). Conclusions and discussion

	3.2.3. Independently makes conclusions relating to the initial research question (if possible). 3.2.5. Relates results with results from their other experiments and also to data in published literature. 3.3.3. Independently makes conclusions relating to the initial research question (if possible) and the broader research context. 3.3.5. Independently discusses results in relation to their other experiments and compares these to published literature. 3.3.7. Suggests follow-up experiments. Competence 6: Reporting and presenting Presentation 6.3.5. Presents research to a target audience with similar knowledge background in a clear and persuasive manner; applies general presentation techniques and answers questions. (level III):there is a introduction-body-conclusion structure to the presentation; speaks clearly and coherently; has upright posture and hands are freely used; makes eye contact with the audience; makes organised and clear slides or other visual products; verbal and visual messages complement each other; Uses visual aids in PowerPoint to support; holds an on-topic discussion with the audience. 6.3.6. In English: can interact with a degree of fluency that makes regular interaction with native speakers quite possible (CEFR Cambridge B2 level).
Assessment criteria	1: reporting and presenting - Indicates the goal of the presentation and the goal matches the assignment. - Presentation structure has a beginning – middle – end with a logical flow. - The presented figures/tables are correctly depicted and complete. 2: results analysis level II - Results are presented in a critical and impartial manner and analysed statistically. - Presented results are interpreted on accuracy and reliability. - A correlation/association between the results and the question/aim of the research question is made. 3: results analysis level III - Relates own research to the overall research on cancer. - Proposes a new follow-up hypothesis or follow-up experiments. See assessment form Project proposal on #OnderwijsOnline – General information.
Test matrix	See Assessment Form Project proposal on #OnderwijsOnline – General information.
	BMLS10-P
Name [exams or modular	Practical

exams]	
Code [exams or modular exams]	BMLS10-P
Exam and modular exam format(s)	Individual, Practical
Judgement	Mark
Minimum result	5.5
Weight factor of modular exam	2
Exam opportunities	Term 1 and 2. Term 3 and 4. There is only one opportunity per academic year for the modular exam P (OS paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in BMLS10 counts as registration for BMLS10-P
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this modular exam.
Number of examiners	Assessment by (at least 2) course 10 examiners based on assessment form (Practical lecturer).
Compensation possibility	
Competences and indicators	Competence 2: Experimenting Preparation 2.1.2. Performs calculations prior to beginning lab work. ‘ 2.2.1. Is able to explain the basic steps of the experiments. 2.2.3. Ensures that all requirements are present before beginning the experiment, makes solutions. 2.3.1. Is able to explain the theory behind all steps of the experiments. 2.3.3. Independently ensures that all requirements are present before beginning the experiment, makes solutions. Execution 2.1.5. Carries out the experiment within the given time. 2.2.4. Carries out experiments according to the protocol in order to obtain reliable, reproducible data; is aware of what he/she is doing at all times. 2.2.7. Attempts to trouble shoot experiments when problems are encountered. 2.3.4. Carries out experiments according to protocol so that reliable reproducible data is obtained; but can, if necessary, deviate from this; knows at all times exactly what he/she doing at all times. 2.3.6. Works on multiple experiments at the same time, and can complete these experiments within the given time frame; adept at switching tasks and keeps a clear overview of all activities. 2.3.7. Trouble shoots if problems are encountered in the experiments. 2.3.8. Is able to master new techniques quickly. Competence 3: Results analysis 3.1.4. Discusses the execution of the experiment and results.

	3.2.6. Suggests improvements to improve the execution of the research. 3.3.1. Independently carries out Results analysis according to the appropriate methods; uses statistics (if applicable). 3.3.2. Independently evaluates the obtained results based on their accuracy and reliability. Competence 4: Quality (level 2) 4.1.1. Is aware of the health and safety rules and works according to these rules. 4.2.2. Calibrates advanced equipment before beginning experiments. Competence 5: Management and Administration (level 3) 5.2.1. Encodes chemicals and samples; stores these in the correct manner. 5.3.2. Contributes to an efficiently functioning lab (tidies up, reports when reagents are nearly finished, performs minor maintenance of equipment and solves minor malfunctions). Administration 5.3.3. Manages and archives data in lab journal (aim, experiment description, alterations, results, conclusion) and if relevant, other ways of storing data so that others can use it. Competence 7: Methodology 7.2.2. Works according to plan, also under time constraints. 7.2.3. Ensures that goals are reached and if necessary, makes adjustments to activities. 7.2.4. Is flexible in changing circumstances. Competence 11: Professional Development 11.2.5. Works with integrity, adjusts to new situations, shows determination and is a motivated student.
Assessment criteria	Skills The student: - is able to answer questions concerning the methodology of different protocols; - controls if all materials are ready for use at the start of an experiment; - executes the experiment according the guidelines of the protocols; - is able to explain the underlying principle of each step in a protocol; - standardizes equipment at the start of the experiment; - solves simple problems independently; - makes sure that targets are met and that goals are reached and if necessary adapts the working activities; - anticipates changing circumstances;

	- executes experiments according to plan and, if necessary, under time pressure; - demonstrates his ability to execute multiple experiments simultaneously; - works according to safety and health regulations; - leaves his bench cleaned and tidy; - starts on time, is prepared and has an active working attitude; - shows integrity, adaptability, perseverance and is motivated. Laboratory Notebook The student: - notes the aim, hypothesis, methods, controls, safety and environmental regulations, and calculations noted in the lab journal; - keeps track of changes in the methods; - encodes and stores chemicals and samples according to the appropriate method and records this in the lab journal; - analyses results according to the appropriate method; - executes the proper error analysis. A justified conclusion is drawn. The laboratory notebook is up to in-house standards and well-presented.
Test matrix	See Assessment Form Practical on #OnderwijsOnline – General information
	BMLS10-K1
Name [exams or modular exams]	Knowledge test 1
Code [exams or modular exams]	BMLS10-K1
Exam and modular exam format(s)	Individual, written
Judgement	Mark
Minimum result	5.5
Weight factor of modular exam	1
Exam opportunities	Term 1, resit Term 2. Term 3, resit Term 4
Permitted resources	
Method of enrolment for exam / enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the exam period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is scheduled in the following teaching period. The discussion of exams taken in a resit period is scheduled at the end of the education period. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to

	discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.
Number of examiners	Two examiners for construction and evaluation. Assessment by one examiner using the correction model (theory lecturer).
Compensation possibility	
Competences and indicators	Knowledge of Module 1: Pathogenesis- disease in cells
Assessmentcriteria	Knowledge of the following cell biology topics: 1. Carcinogenesis (hallmarks of cancer, signal transduction, apoptosis, cell cycle and GTPases). 2. Post-translational modification of proteins and chaperones Cell-Cell and Cell-Matrix adhesion. 3. Wnt signaling in colon cancer development.
Test matrix	1: ~ 80% 2: ~10% 3: ~10%
	BMLS10-K2
Name [exams or modular exams]	Knowledge test 2
Code [exams or modular exams]	BMLS10-K2
Exam and modular exam format(s)	Individual, written
Judgement	Mark
Minimum result	5.5
Weight factor of modular exam	1
Exam opportunities	Term 2, resit Term 3. Term 4, resit Term 4
Permitted resources	regular calculator
Method of enrolment for exam / enrolment period	Registration for the modular exam via Alluris. The registration period is a few weeks prior to the exam period or the resits. The period is published in the SABC annual schedule on Insite-Timetables.
Discussion and review	• The annual schedule of SABC indicates when the exam periods / resit periods are and when the work can be reviewed. Review takes place in the presence of a supervisor. • The discussion of the exam is scheduled after the exam before the review of the exam. • Indicate (for an exam made in a resit period) to the examiner / course leader if you want to make use of the opportunity to discuss the exam. If there is no interest, the discussion will not take place. • Participation in the discussion of the exam is only permitted if you have taken the exam.

Number of examiners	Two examiners for construction and evaluation. Assessment by one examiner using the correction model (theory lecturer).
Compensation possibility	
Competences and indicators	Knowledge of Module 2: Fighting pathogenesis: immunology of infectious diseases and Cancer.
Assessment criteria	The student has knowledge of: - virology: structure, methods to detect viruses, viral life cycle, biosynthesis, transmission, host interaction - immunology: the immunity to viruses and bacteria, tolerance, vaccination, immunity to cancers, basic knowledge of primary and secondary immunodeficiency, basic knowledge of allergy and auto immunity
Test matrix	~50% Virology ~50% Immunology
	BMLS10-IPV
Name [exams or modular exams]	IPS
Code [exams or modular exams]	BMLS10-IPV
Exam and modular exam format(s)	Individual, IPS
Judgement	Sufficient / Insufficient
Minimum result	Sufficient
Weight factor of modular exam	0
Exam opportunities	Term 2 or term 4. There is only one opportunity per academic year for the modular exam IPS (EER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in BMLS10 counts as registration for BMLS10-IPV
Discussion and review	For questions about the assessment you can contact the examiner.
Number of examiners	Assessment by course 10 examiners based on participation and effort throughout the course.
Compensation possibility	
Competences and indicators	Competence 6: Reporting and presenting 6.2.6 In English: Is able to conduct discussions on work-related subjects. 6.3.6. In English: can interact with a degree of fluency that makes regular interaction with native speakers quite possible (CEFR Cambridge B2 level). Competence 8: Team work Performance in a group 8.1.1. Adheres to the rules. 8.1.2. Makes a valuable contribution to the group.

	8.2.3. Makes clear agreements with others and keeps to these. 8.3.1. Recognises their own role in a group; is aware of other roles in the group and works efficiently in the team structure. Works harmoniously with others. Communication Is able to communicate about their assignment with peers and lecturers applying basic rules of communication: 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.1.9. Is active in conflict resolution. 8.2.5. Takes initiative in the conversation. 8.2.8. Verbally expresses their opinion/message clearly. 8.3.9. Is skilled in conflict resolution. 8.3.10. Interacts with conversation partner/ensures the message is understood. 8.3.11. Keeps conversation on topic. 8.2.12. Is aware of intercultural differences in the professional field
Assessment criteria	The student: - has prepared the meetings by specifying the answers to the week assignments which are discussed and the assignments which are reviewed (k.o.); - can demonstrate the specified answers to the assignment to the tutor after setting a date (in writing or presentation): in all assignments all issues addressed are answered (k.o.); - fulfils his roles (chair, minute taker, etc.) (k.o.); - recognises own role and input in the group and knows the other roles in the team; adjusts own work to the work of others; - adheres to the rules agreed on (k.o.); - asks questions and shares knowledge regarding the assignment, during tutor meetings. The student verbalises clearly and audibly, maintains eye contact; - focuses on the aim of the talk; - lets others finish, interacts with his conversation partner and checks if the message is understood; - gives group and class members feedback and is open to receiving feedback; - offers a positive contribution to the group process by taking initiative and actively resolve conflicts. Group members evaluate the student's effort as positive All project assignments should be sufficient for a satisfactory.

Course unit 11: LS11 (30 study credits)

	LS11
General information	
Target group/groups	Full-time students main phase Life Science

Name of unit of study	ECU 11: Internship Life Sciences
Code of unit of study	LS11
Lecture period	P1, P2, P3, P4
ECTS credits	30 stp
Study load in hours	840 SBU
Study hours (contact hours)	There are no lessons planned, there is an obligatory peer-feedback moment. The supervising examiner has 12,5 hours for supervising and evaluation. The second examiner has 2,5 hours for evaluation.
Entry requirements for unit of study	Foundation year successfully completed. At least 50 stp have been earned in the 2nd study year and the practical assessment in the 2nd study year must be at least satisfactory. If a research minor (R15 or R30) took place prior to the internship, the research report and literature report of R30 or report of R15 must be handed in to the work placement supervisor (compulsory). If the entry requirements are satisfied, the internship may only be started after the official approval of the project handed off by the internship coordinator.
Content and organisation	
General description	The internship aims to give you work experience in an independent research project to contribute to your development as a (starting) professional. Students can complete the graduation project with a company/organization of choice. The place where the internship takes place is in general different from the place where the graduation project is done. If the place where the internship takes place is the same as the place for the graduation project, consent from the exam committee is needed.
Exit qualifications	Designing an experimental plan Experiment Results analysis Quality control Management and administration Reporting and presenting Planning and project-based working Teamwork Professional development
Professional task	Carrying out life science research
Professional products	Internship PDP and supporting professional products Research report Reflection report
Cohesion	The internship project is in line with the course units of the major. During the graduation project, the developed competencies will be individually practiced and assessed.
Mandatory participation	-
Maximum number of participants	**-**
Compensation options	**-**

Activities and/or instructional formats	The study coach guides the student in finding an internship that fits with the personal development plan of the student. The internship coordinator provides internship preparation classes that provide the student with tools to find an internship. During the main phase there is a compulsory workshop job application. The student is responsible for finding a work placement (applying for a work placement). During the internship period, a peer-feedback meeting is organized that requires active participation.
Required literature	Information on #OnderwijsOnline – SABC Internship/Stage
Required software / required materials	
Recommended literature	
Examination	
	LS11-PB
Name [exams or modular exams]	Portfolio Assessment
Code [exams or modular exams]	LS11-PB
Exam and modular exam format(s)	In writing, Oral, Individual
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Offered throughout the year. 2 opportunities per year. Portfolio deadline is the last day of the internship. If handed in late, a 0 is given for the first chance. In consultation with the internship lecturer, a new deadline is set. Resits are possible up to 2 months after the last day of the internship.
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS11 is sufficient for enrolment in LS11-PB
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by two examiners based on assessment form (Internship lecturer and 2nd assessor).
Compensation possibility	
Competences and indicators	Competence 1: Design 1.3.6. Understands and applies advanced English literature relevant to the given context. 1.3.7. Makes connections between experiments and the broader research context. 1.3.8. Adjusts the research plan accordingly based on acquired results Competence 2: Experiment

	2.2.4 (2.3.4). Carries out experiments (independently) following protocol in order to obtain reliable, reproducible data; is able to deviate from/adjust the protocol where needed; is aware of what he/she is doing at all times. 2.2.6. Attempts to work on multiple experiments at the same time (multitasking). 2.3.6. Works on multiple experiments at the same time, and can complete these experiments within the given time frame; adept at switching tasks and keeps a clear overview of all activities. Competence 3: Results analysis 3.2.5 (3.3.5) (Independently) discusses results in relation to their other experiments and compares these to published literature. 3.2.6. Suggests improvements to improve the execution of the research. 3.3.7. Suggests follow-up experiments. Competence 6: Reporting/presenting 6.2.5. Presents research to a target audience with similar knowledge background in a clear manner; applies general presentation techniques and answers questions: * there is an introduction-body-conclusion structure to the presentation; * speaks clearly and coherently; * has upright posture and hands are freely used; * makes eye contact with the audience; * makes organised and clear slides or other visual products; * verbal and visual messages complement each other; * uses visual aids in PowerPoint to support; * holds an on-topic discussion with the audience. Competence 8: Teamwork / communication 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.2.8. Verbally expresses their opinion/message clearly. 8.3.10. Interacts with conversation partner/ensures the message is understood. > 8.3.11. Keeps conversation on topic. Competence 11: Professional development Guides own competency development 11.2.1. Identifies strengths and weaknesses. 11.1.2. Works on learning aims as described in the PDP and collated competency assessment products. 11.1.3 (11.3.3). Reflects critically on own performance and learning process; learns from mistakes; (is eager to learn). 11.2.4. Formulates POP based on strength-weakness analysis.
Assessment criteria	See assessment form Portfolio & assessment internship BML, Life Sciences and Chemistry on #OnderwijsOnline - General information. All parts of the portfolio must be present in the portfolio. The portfolio, including the research report, is uploaded in the Digital Portfolio (DPF).
Test matrix	See assessment form Portfolio & assessment internship BML, Life Sciences and Chemistry on #OnderwijsOnline - General information.
	LS11-P

Name [exams or modular exams]	Practical work
Code [exams or modular exams]	LS11-P
Exam and modular exam format(s)	Practical
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	2
Exam opportunities	There is only one chance per year for the modular exam LS11-P (EER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS11 is sufficient for enrolment in LS11-P
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner (internship lecturer) based on assessment form filled in by the company supervisor
Compensation possibility	
Competences and indicators	Competence 1: Design 1.2.1. Independently identifies relevant background information required to answer the research question. 1.2.2., (1.3.3.) Independently searches for, selects and integrates information from relevant scientific sources. 1.2.4., (1.3.5.) (Independently) integrates information into a comprehensive research plan (e.g. justifying the chosen method, describing necessary controls and availability of equipment) 1.3.6. Understands and applies advanced English literature relevant to the given context. 1.3.8. Adjusts the research plan accordingly based on acquired results Competence 2: Experiment - Preparation 2.1.2. Performs calculations prior to beginning lab work. 2.1.5. Carries out the experiments within the given time.frame 2.2.1., (2.3.1.) Is able to explain the theory behind (all) steps of the experiments. 2.2.3., (2.3.3.) Ensures (independently) that all requirements are present before beginning the experiment; makes solutions. 2.2.3., (2.3.3.) (Independently) ensures that all requirements are present before beginning the experiment, makes solutions. 2.3.4. Carries out experiments following protocol in order to obtain reliable, reproducible data; is able to deviate from/adjust the protocol where needed; is aware of what he/she is doing at all times. 2.2.6. Attempts to work on multiple experiments at the same time (multitasking). 2.3.6. Works on multiple experiments at the same time, and can complete these experiments within the given time frame; adept at switching tasks and keeps a clear

	overview of all activities. 2.2.7. Attempts to trouble shoot experiments when problems are encountered. 2.3.7. Trouble shoots if problems are encountered in the experiments. Competence 3: Results analysis 3.1.2., (3.3.2.) Independently assesses the usability of results based on accuracy and reliability. 3.1.4. Discusses the execution and experimental results. 3.2.1., (3 .3.1.) Carries out results analysis with appropriate methods (independently); if applicable uses statistics. 3.2.3 Independently makes conclusions relating to the initial research question. 3.2.5 (3.3.5) (Independently) discusses results in relation to their other experiments and compares these to published literature. 3.2.6. Suggests improvements to improve the execution of the research. 3.3.7. Suggests follow-up experiments. Competence 4: Quality control 4.1.1. Is aware of and adheres to the workplace health and safety rules. 4.1.3. Uses controls to evaluate the reliability of the results. Competence 5: Management and administration 5.2.1. Codes chemicals and samples and keeps these in a correct way. 5.2.2 (5.3.2) Contributes to an efficiently functioning lab (clears up, indicates if reagents are almost finished, carries out minor maintenance on the equipment and solves minor malfunctions). 5.2.3. (5.3.3) Manages and archives data in lab journal (purpose, experiments description, results, conclusion) and if required, in other ways so that others can understand/use these. Competence 6: Reporting/presenting 6.2.5 (6.3.5). Presents research to audiences with a similar background, (6.3.5; to a diverse group) in a clear and convincing way, according to the conventional standards of presentation techniques and answers questions: * there is structure in the presentation (head-body-tail) * speaks clearly and intelligibly; * Makes eye contact with the audience and checks whether the essence of the message comes across to the target group; * makes well-structured and clear slides or other visual products; * verbal and visual message form a whole; * Uses visual aids of a presentation medium effectively to communicate the message (6.3.5; Conducts a substantive discussion with audience.) Competence 7: Planning/project-based working 7.2.1. (7.3.1) plans and organizes his experiments/minimum weekly project resulting in a long-term work plan. 7.2.2. Carries out activities according to planning; also under time pressure. 7.2.3. Ensures that aims are achieved and adapts the work if required. 7.3.4. Responds to changing circumstances; determines priorities in activities.

	Competence 8: TeamworkFunctioning in a group 8.1.1. Adheres to rules. 8.2.3. Makes clear agreements with others and keeps to these. 8.3.4 Recognises their own role in a group; is aware of other roles in the group and works efficiently in the team structure. Works harmoniously with others. Is able to communicate about their assignment with peers and lecturers applying basic rules of communication: 8.2.5. Takes initiative in the conversation. 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.2.8. Verbally expresses their opinion/message clearly. 8.1.9. Is active in conflict resolution. 8.2.10. Interacts with conversation partner.Communication Internationalisation 8.2.12. Is aware of intercultural differences in the professional field Competence 11: Professional development 11.3.5. Works with integrity, adjusts to new situations, shows determination and is a motivated employee.
Assessment criteria	See assessment form: “Practical Work: BML, Life Sciences and Chemistry” on #OnderwijsOnline - General information.
Test matrix	See assessment form “Practical Work: BML, Life Sciences and Chemistry” on #OnderwijsOnline - General information.
	LS11-V
Name [exams or modular exams]	Internship report
Code [exams or modular exams]	LS11-V
Exam and modular exam format(s)	In writing, Individual
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	Offered throughout the year. 2 opportunities per year. Report deadline is the last day of the internship. If handed in late, a 0 is given for the first chance. In consultation with the internship lecturer, a new deadline is set. Resits are possible up to 2 months after the last day of the internship.
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS11 is sufficient for enrolment in LS11-V
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Two examiners for assessment based on assessment form (Internship lecturer and 2nd assessor).

Compensation possibility	
Competences and indicators	Competence 1: Design of experimental plan 1.2.1. Identifies independently which background information is required to answer the research question. 1.2.2., (1.3.3.) Independently searches for, selects and integrates information from relevant scientific sources. 1.2.4., (1.3.5.) (Independently) integrates information into a comprehensive research plan (e.g. justifying the chosen method, describing necessary controls and availability of equipment) 1.3.6. Understands and applies advanced English literature relevant to the given context. 1.3.7. Makes connections between experiments and the broader research context. Competence 2: Experiment 2.3.1. Can justify all steps of the experiments theoretically. Competence 3: Results analysis 3.1.2., (3.3.2.) Independently assesses the usability of results based on accuracy and reliability. 3.1.4. Discusses the execution and experimental results. 3.2.1., (3 .3.1.) Carries out results analysis with appropriate methods (independently); if applicable uses statistics. 3.2.3 (3.3.3) Independently makes conclusions relating to the initial research question (if possible) and the broader research context.. 3.2.5 (3.3.5) (Independently) discusses results in relation to their other experiments and compares these to published literature. 3.2.6. Suggests improvements to improve the execution of the research. 3.3.7. Suggests follow-up experiments. Competence 4: Quality control 4.1.3. Uses controls to evaluate the reliability of the results. Competence 5: Management and administration 5.3.3. Manages and archives data in lab journal (purpose, experiments description, changes, results, conclusion, future proposals) and if applicable in other ways so that others can use these. Competence 6: Reporting and presenting 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. 6.3.1. Reports (on the research) in the form of a report/lab journal according to internationally accepted criteria (product criteria lab journal and report level 3): uses correct spelling, grammar, sentence structure and scientific style; provides clear and logical structure in more complex texts. There is cohesion between text components; structure of text is in accordance with professional standards; report has a reference list. In the text the reader is referred to sources in the reference list;

	describes results so that the reader can understand these; uses for this purpose clearly labelled figures and tables; describes all relevant data from the research in a summary that can be read independently.
Assessment criteria	See assessment form “Internship Report Assessment Form Biology and medical laboratory research, Life Sciences & Chemistry” on #OnderwijsOnline - General information.
Test matrix	See assessment form “Internship Report Assessment Form Biology and medical laboratory research, Life Sciences & Chemistry” on #OnderwijsOnline - General information.

Course unit 12: LS12 (30 study credits)

	LS12
General information	
Target group/groups	Full-time main phase Life Sciences
Name of unit of study	ECU 12: Graduation assignment Life Science
Code of unit of study	LS12
Lecture period	P1, P2, P3, P4
ECTS credits	30 stp
Study load in hours	840 SBU
Study hours (contact hours)	There are no lessons planned, the supervising examiner has 15 hours for supervising and evaluation. The 2nd examiner has 4 hours for evaluation.
Entry requirements for unit of study	Foundation year of the course successfully completed. From the second year study programme 60 stp are obtained; No more than two unsatisfactory assessment components (documents of evidence) in the 3rd year with the exception of the practical (which must be satisfactory). Research report internship (LS11) is handed in to the teacher. Portfolio is satisfactory (except research report). If a research minor (R15 or R30) took place prior to the graduation project, the research report and literature report of R30 or the report of R15 must be handed in to the work placement supervisor prior to starting (compulsory). If the entry requirements are satisfied, the internship may only be started after the official approval of the project. The graduation coordinator assesses whether the graduation project meets the standards set by the HAN. One of the requirements is that the thesis should reflect the specialization. The portfolio and the report are conditional: only if these are satisfactory can the student participate in the graduation exam (final presentation/defence). The graduation examination can only take place if the internship is successfully completed and passed.
Content and organisation	
General description	Students can complete the graduation project with a company/organization of choice. The company or organization can satisfactorily supervise the student in a professional capacity and possesses sufficient facilities to enable the completion of the graduation project at the desired level. The place where the graduation project takes place is in general different from the place where the

	internship was completed. If the place where the graduation internship takes place is the same as the place for the internship project, consent from the exam committee is needed. In the thesis the student demonstrates that he is able to carry out the necessary research and possesses the competencies required to independently undertake this research. This research can be fundamental or applied research.
Exit qualifications	Design Experimenting Results analysis Quality control Management and administration The student may choose to include in the PDP the competencies “leading/supervising" and "Advising". In addition, the student must show competence in: Reporting and presenting; Planning and project-based working; Teamwork; Professional development
Professional task	Carrying out life science research
Professional products	Graduation PDP Research plan Research report and supporting professional products Reflection report End Presentation
Cohesion	The graduation project shows cohesion with course units of the major. During the graduation project, the developed competencies will be individually practiced and assessed.
Mandatory participation	-
Maximum number of participants	**-**
Compensation options	**-**
Activities and/or instructional formats	There are no lessons/other educational activities planned during the graduation project.
Required literature	Information on #OnderwijsOnline – SABC Graduation / Afstuderen
Required software / required materials	
Recommended literature	
Examination	
	LS12-PB
Name [exams or modular exams]	Portfolio Assessment
Code [exams or modular exams]	LS12-PB
Exam and modular exam format(s)	Individual, Writing
Judgement	Satisfactory / Unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0

Exam opportunities	2 opportunities per year. Submit the portfolio no later than the last day of the graduation project. If submitted too late a 0 for chance 1. In consultation with the supervising lecturer a new deadline is set. Resit the portfolio up to two months after the last day of the graduation.
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS12 is sufficient for enrolment in LS12-PB
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner based on assessment form (Graduation project lecturer).
Compensation possibility	
Competences and indicators	Plan of approach; Competence 1: Design 1.3.1. Independently searches for, selects and processes information from relevant sources for scientific research. 1.3.2. Independently formulates on the basis of a given research assignment the research questions with associated hypotheses. 1.3.3. Independently integrates information into a comprehensive research plan (e.g. justifying the chosen method, describing necessary controls and availability of equipment). Competence 2: Experiment 2.3.1. Can justify all steps of the experiments theoretically. Competence 6: Reporting and presenting 6.3.1. Reports on the research in the form of a report/lab journal according to internationally accepted criteria (product criteria lab journal and report level 3): uses correct spelling, grammar, sentence structure and scientific style provides clear and logical structure in more complex texts. There is cohesion between text components; structure of text is in accordance with professional standards; report has a reference list. In the text the reader is referred to sources in the reference list; describes results so that the reader can understand these; uses for this purpose clearly labelled figures and tables; describes all relevant data from the research in a summary that can be read independently. Competence 7: Planning and project-based working 7.3.1. Plans and organises his project resulting in a work plan of a minimum of 4 weeks). Competence 11: Professional development - Independently gives shape to own competency development - PDP 11.2.1. Describes strengths and weaknesses.

	11.3.1. Based on the strength-weakness analysis, independently develops a PDP: Reflection report 11.1.2. Works on learning aims according to the PDP and collects evidence of competency. 11.3.2. Looks back critically (reflects) on their own actions and learning process; from mistakes; is open to learning moments.
Assessment criteria	Final PDP, approved by graduation supervisor Plan of approach, approved by graduation supervisor Report visit by graduation supervisor Report mid-term assessment meeting Mid-term assessment form practical work Final assessment form practical work Performance review report See assessment forms on #OnderwijsOnline - general information All components of the portfolio must be present and the final assessment of the portfolio must be satisfactory. The portfolio, including the research report, is uploaded in the Digital Portfolio (DPF).
Test matrix	See assessment forms on #OnderwijsOnline - general information
	LS12-P
Name [exams or modular exams]	Practical work
Code [exams or modular exams]	LS12-P
Exam and modular exam format(s)	Practical, Individual
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	For the modular exam P there is only one chance per year (EER paragraph 8.5)
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS12 is sufficient for enrolment in LS12-P
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner (Graduation project lecturer) based on assessment form filled in by the company supervisor.
Compensation possibility	
Competences and indicators	Competence 1: Design 1.2.1. Identifies independently which background information is required to answer the research question. 1.3.1. Independently searches for, selects and processes information from relevant sources for scientific research.

	1.3.2. Independently formulates sub-questions/aims with associated hypotheses based on the given research aim. 1.3.4. Adjusts the research plan on the basis of results. 1.3.5. Links own research with the overarching research project. Competence 2: Experiment 2.1.2. Performs calculations prior to beginning lab work. 2.3.6. Masters techniques quickly. 2.3.1. Can justify all steps of the experiments theoretically. 2.3.2. Independently ensures that all requirements are ready before the experiment is started; makes solutions. 2.3.3.Independently carries out experiments according to a protocol so that reliable reproducible data is obtained, but can, if necessary, deviate from this. 2.3.4. Is able to work on multiple experiments simultaneously and complete them within the proposed time frame (multitasking), can switch easily and keep an overview. 2.3.5. Solve practical problems if the experiment does not run as was anticipated (trouble shooting). Competence 3: Results analysis 3.2.4. Makes proposals for improving the execution of the research. 3.3.1. Independently carries out results analysis according appropriate methods; uses statistics (if applicable). 3.3.2. Independently assesses the usability of results based on accuracy and reliability. 3.3.3. Independently makes conclusions relating to the initial research question (if possible) and overarching research project. 3.3.4. Discusses results relative to other experiments and compares them with the results in literature. Competence 4: Quality control 4.1.1. Is aware of the safety (work) and environment rules and works accordingly. 4.1.3. Uses controls to evaluate the reliability of the results. 4.3.1. Checks the shelf-life of reagents and solutions. 4.3.2. Adheres to prescribed quality standards. Competence 5: Management and administration 5.2.1. Codes chemicals and samples and stores these in a correct way. 5.3.1. Contributes to an efficiently functioning lab (clears up, indicates if reagents are almost finished, carries out minor maintenance on the equipment and solves minor malfunctions). 5.3.2. Manages and archives data in lab journal (purpose, experiments description, changes, results, conclusion, future proposals) and if applicable in other ways so that others can use these.

	Competence 6: Reporting and presenting 6.3.2. Presents research to varying audiences in a clear and convincing way, according to the conventional standards of presentation techniques and answers questions: there is structure in the presentation (head-body-tail)speaks clearly and intelligibly; stands upright and keeps hands relaxed; makes eye contact with the public and checks whether the essence of the message comes across to the target group; makes well-structured and clear slides or other visual products; verbal and visual message form a whole; used capabilities of Powerpoint as Visual support for transferring the message; conducts a substantive discussion with audience. Competence 7: Planning and project-based working 7.2.2. Carries out activities according to planning; also under time pressure. 7.2.3. Ensures that aims are achieved and adapts the work if required. 7.3.1. Plans and organises his project resulting in a work plan of a minimum of 4 weeks). 7.3.2. Responds to changing circumstances; determines priorities in activities. Competence 8: Teamwork - Functioning in a group 8.1.1. Observes the rules. 8.1.2. Makes a clear contribution to the group. 8.2.1. Makes concrete agreements and keeps to these. 8.3.1. Recognizes own role and contribution to the group and know what other roles there are in the team; functions adequately; takes others into consideration. 8.3.3. Keeps to the aim of the discussion. Communication 8.1.6 Shows initiative to actively solve conflicts. 8.3.4. Is able to deal with conflicts. Competence 11: Professional development 11.3.2. Looks back critically (reflects) on their own actions and learning process; learns from mistakes; is open to learning moments. 11.3.3. Shows professional work attitude, adapts quickly, shows determination, and is a motivated student.
Assessment criteria	See assessment form: “Graduation Project Practical Assessment BML, Life Science and Chemistry” on #OnderwijsOnline - General information.
Test matrix	See assessment form: “Graduation Project Practical Assessment BML, Life Science and Chemistry” on #OnderwijsOnline - general information
	LS12-Pr
Name [exams or modular exams]	Oral presentation and defence
Code [exams or modular exams]	LS12-Pr
Exam and modular exam format(s)	Oral, Individual
Judgement	Grade

Minimum result	5.5
Weight factor of modular exam	1
Exam opportunities	2 opportunities per year. Resits in consultation with the internship coordinator.
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS12 is sufficient for enrolment in LS12-Pr
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by two examiners based on assessment form (Graduation project lecturer and 2nd assessor).
Compensation possibility	-
Competences and indicators	Competence 1: Design 1.3.2. Independently formulates sub-questions/aims with associated hypotheses based on the given research aim. 1.3.4. Adjusts the research plan on the basis of results. 1.3.5. Links own research with the overarching research project. Competence 2: Experiment 2.3.1. Can justify all steps of the experiments theoretically. Competence 3: Results analysis 3.1.4. Discusses the execution and experimental results. 3.2.4. Makes proposals for improving the execution of the research. 3.3.5. Makes proposals for follow-up experiments. 3.3.1. Independently carries out results analysis according appropriate methods; uses statistics (if applicable). 3.3.2. Independently assesses the usability of results based on accuracy and reliability. 3.3.3. Independently makes conclusions relating to the initial research question (if possible) and overarching research project. 3.3.4. Discusses results relative to other experiments and compares them with the results in literature. Competence 4: Quality control 4.1.3. Uses controls to evaluate the reliability of the results. Competence 6: Reporting and presenting 6.3.2. Presents research to varying audiences in a clear and convincing way, according to the conventional standards of presentation techniques and answers questions: there is structure in the presentation (head-body-tail)speaks clearly and intelligibly; stands upright and keeps hands relaxed; makes eye contact with the public and checks whether the essence of the message comes across to the target group; makes well-structured and clear slides or other visual products; verbal and visual

	message form a whole; Uses visual aids of a presentation medium effectively to communicate the message; Conducts a substantive discussion with audience. Competence 8: Teamwork – Communication 8.1.3. Maintains eye contact with conversation partner. 8.1.4. Allows others to finish speaking. 8.2.4. States his/her opinion/message clearly. 8.3.2. Interacts with discussion partner/checks if message is understood.
Assessment criteria	See assessment form " Presentation and defense Life Sciences, BML, Chemistry" on #OnderwijsOnline - General information.
Test matrix	See assessment form: " Presentation and defense Life Sciences, BML, Chemistry" on #OnderwijsOnline - General information.
	LS12-V
Name [exams or modular exams]	Graduation report
Code [exams or modular exams]	LS12-V
Exam and modular exam format(s)	In writing, Individual
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	2 opportunities per year. Submit the research report no later than the last day of the graduation project. For deadlines submitting reports regarding graduation sessions see annual timetable Applied Biosciences and Chemistry. If submitted too late a 0 for chance 1. In consultation with the supervising lecturer a new deadline is set. Resit the graduation report up to two months after the last day of the graduation.
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in ECU LS12 is sufficient for enrolment in LS12-V
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by two examiners based on assessment form (Graduation project lecturer and 2nd assessor).
Compensation possibility	
Competences and indicators	Competence 1: Design 1.2.1. Identifies independently which background information is required to answer the research question. 1.3.1. Independently searches for, selects and processes information from relevant sources for scientific research.

	1.3.2. independently formulates sub-questions/aims with associated hypotheses based on the given research aim. 1.3.5. Links own research with the overarching research project. Competence 2: Experiment 2.3.1. Can justify all steps of the experiments theoretically. Competence 3: Results analysis 3.1.4. Discusses the execution and experimental results. 3.2.4. Makes proposals for improving the execution of the research. 3.3.5. Makes proposals for follow-up experiments. 3.3.1. Independently carries out results analysis according appropriate methods; uses statistics (if applicable). 3.3.2. Independently assesses the usability of results based on accuracy and reliability. 3.3.3. Independently makes conclusions relating to the initial research question (if possible) and overarching research project. 3.3.4. Discusses results relative to other experiments and compares them with the results in literature. Competence 4: Quality control 4.1.3. Uses controls to evaluate the reliability of the results. Competence 5: Management and administration 5.3.2. Manages and archives data in lab journal (purpose, experiments description, changes, results, conclusion, future proposals) and if applicable in other ways so that others can use these. Competence 6: Reporting and presenting 6.3.1. Reports on the research in the form of a report/lab journal according to internationally accepted criteria (product criteria lab journal and report level 3): uses correct spelling, grammar, sentence structure and scientific style provides clear and logical structure in more complex texts. There is cohesion between text components; structure of text is in accordance with professional standards; report has a reference list. In the text the reader is referred to sources in the reference list; describes results so that the reader can understand these; uses for this purpose clearly labelled figures and tables; describes all relevant data from the research in a summary that can be read independently. Competence 11: Professional development 11.3.2. Looks back critically (reflects) on their own actions and learning process; learns from mistakes; is open to learning moments.
Assessment criteria	See assessment form “Graduation Research Report BML, Chemistry, Life Sciences” on #OnderwijsOnline - General information.
Test matrix	See assessment form “Graduation Research Report BML, Chemistry, Life Sciences” on #OnderwijsOnline - General information.

9.3 Minors of the degree program

In this academic year, the degree program offers the following minors:

a. M_ATBC-M-BN Bio-Nano introductie in de Bio-Nanotechnologie (30 credits) (Dutch)
b. M_ATBC-M-BBS BioBased Innovations (30 studiepunten)
c. M_ATBC-M-DD Drug Discovery (30 studiepunten)
d. M_ATBC-M-CHP Medische Diagnostiek: Cytologie en Histopathologie (30 credits) (Dutch)
e. M_ATBC-M-DMM Medische Diagnostiek: Medische Microbiologie (30 credits) (Dutch)
f. M_ATBC-M-P Scientific Research (30 studiepunten)

Units of study LS-R15 en LS-R30 – Researchminor – can be chosen as part of the minor 'Scientific Research'.

You can also choose a minor from another HAN degree program. You can find the overview of HAN minors and their entry requirements here: www.minoren-han.nl.

M_ATBC-M-BN Bio-Nano introductie in de Bio-Nanotechnologie (30 credits) (Dutch)

	M_ATBC-M-BN
General information	
Target group	Main phase students from all chemical and (bio) medical disciplines
Name of course unit	Minor Bio-Nano: Introductie in de Bio-Nanotechnologie / Minor Bio-Nano: Introduction to Bio-nanotechnology
Study unit code	M_ATBC-M-BN
Teaching term	semester 1 (NL) and 2 (ENG) (term 1-2 / 3-4)
Study credits	30 study credits
Study load in hours	840 SBU
Study hours (contact hours)	Term 3: Rostered contact hours (105 lesson periods) 78.25 clock hours: Practical: 8 lesson periods per week Tutor: 3 lesson hours periods per week Theory 'Self organization': 9 lesson periods Theory "Bioconjugation": 9 lesson periods Theory: "Analysis of nanomaterials" 7 credit hours, 1 lesson period/week. Guest lectures 3 lesson periods Term 4: Rostered contact hours (105 lesson periods) 78.25 clock hours: Practical: 8 lesson periods per week Tutor: 3 lesson hours periods per week Theory "Nanomaterials and biological interaction": Theory "Oncology and targeting of nano drugs": 9 lesson periods of theory: "Proteins as nano materials" 7 lessons, 1 lesson period/week. Guest lectures 3 lesson periods Self-study hours (341.25 hours): The student needs to plan 341.25 hours for group work and self-study. Total programmed contact time per period: Term 3: 15 lesson periods/week; 105 lesson periods/term= 78.25 hours Term 4: 15 lesson periods/week;105 lesson periods/term= 78.25 hour Time for independent work: 685.5 hours Total: 840 hours

Course entry requirements	The competencies applied in this minor, are practiced at level 2. LS6A, LS6C, LS5A, LS5B, LS5C followed. LS6B is completed. Or second year chemistry. Before starting this course unit, the student must at least have completed their foundation year (in the case of newcomers, exceptions are possible).
Content and organisation	
General description	The minor in Bio-Nanotechnology focuses on the interface between biomedical technology and chemistry, in this sense broadening and deepening. As a central theme of the minor, there is a practical that starts with the chemical manufacture of polymers and biohybrid nanoparticles. In addition, the physical properties of these particles are mapped, ultimately to study the interaction with biological systems (cells). Two double lab sessions are scheduled per week to work on the practical assignments. The theory modules “Self-organization", "Bioconjugation", “Analysis of nanomaterials", “Proteins as nanomaterials", “Biological interactions of nanomaterials" and "Monitoring and targeting of nanodrugs" are offered in the form of lectures and seminars, and have a direct connection with the practical assignments. The tutor meetings cover various weekly assignments with the ultimate goal of writing a research proposal. In this course unit, the professional task ‘performing scientific research’ in the area of (bio)nano-technology in a multidisciplinary team is a central theme. The chosen context areas are: Pharma, bioinspired and biobased. The chosen educational model is project-based education. This course unit builds on chemical, biological and medical course units from the second year. (Bio) medical students and chemistry students will collaborate using each other's input and multidisciplinary work is essential. This means that students from different specialisations will take the lead at different times and coach other students. This is reflected in the final research proposal that students will write together in a multidisciplinary team. The language of the minor Bio-Nano is Dutch in semester 1 and English in semester 2. The examinations for students who do not participate in the English variant of the programme are, if so desired, offered in Dutch and/or can be answered in Dutch. The professional products must be written in English.
Exit qualifications	Design of experimental plan Experimenting Results Analysis Quality Control Management and Administration

	Reporting and Presenting Methodology Teamwork (multidisciplinary) Professional Development
Professional tasks and products	Carrying out Life Science Research
Professional products	
Cohesion	In the minor nanotechnology, you will work on an extensive project that combines biomedical technology and chemistry.
Mandatory participation	
Maximum number of participants	15
Compensation possibilities	K1 and K2 ≥ 5.5; when calculating K1 and K2, a maximum of two of the six components may be ≤ 5.5 and all components must be at least a 4.
Activities and/or instructional formats	Supporting subject Nanotechnology and applications Self organization Bioconjugation Analysis of nanomaterials Proteins as nanomaterial Biological interaction of nanomaterials Monitoring (Oncology) and targeting of nanodrugs *Work form: Lecture* Supporting subject Nanotechnology and applications Research proposal; write a research proposal (in a group) in the field of bio-nanotechnology. *Work forms: Group assignment* Supporting subject Nanotechnology and applications Presentation; present in group a recent articles and a research proposal written in group within the field of "Nano medicines". *Work forms: Group assignment* Supporting subject Nanotechnology and applications Practical education, experiment and experience. *Work form: Lecture and practical*
Required literature	- Collection of the articles and reviews covered in the lessons (free to download from the university library)
Required software/required materials	ChemSketch (www.acdlabs.com or similar)
Recommended literature	
Examination	
	M_ATBC-M-BN-K1
Name of examination or modular examination	Theory Exam 1

Examination or modular examination code	M_ATBC-M-BN-K1
Assessment types(s):	Individual written open questions
Result	Grade
Passing grade	5.5
Weight factor of modular exams	1
Exam opportunities Permitted resources	Term 1, resit during term 2, or Term 3, resit end term 4
Method of enrolment for exam/enrolment period	Registration for the modular exam through Alluris. The registration period is opened a few weeks prior to the exam period or the resit period. The period is published in the academic calendar of the ATBC on Insite - Timetables. Insite rosters.
Discussion and review	• The exam and resit periods and inspection of exam results are indicated in the ATBC academic calendar. Review takes place in the presence of a supervisor. • Review takes place under supervision- the post-exam discussion is rostered during the following teaching period. • For exams taken during resit periods, the post-exam discussions are planned at the end of the teaching period. At the end of term 4, the post-exam discussion will be held before the start of the resit period of term 4. • Contact the examiner/course coordinator (for exams taken during a resit period) if you would like to discus the exam. • With no interest, the post-exam discussion does not take place. • Participation in the post-exam discussion is only allowed if you have taken the exam.
Number of examiners	2 Examiners for construction and evaluation. Assessment by one examiner based on the answer key (theory lecturer).
Permitted resources	
Possibilities for compensation	The average of knowledge test K1 must be ≥ 5.5. Two items in Q1 and Q2 combined may be ≤ 5.5 but ≥ 4.0.
Assessment dimensions	Knowledge of the driving forces in the self-organization of molecules and (bio)polymers in nano-and mesostructures. Knowledge of chemical modifications as well as biological systems for functionalising, modification and linking of (bio) polymers and nanoparticles for the use of these materials in drug delivery. Knowledge of commonly used analysis techniques for nanomaterials.
Assessment criteria	Part 1: Self organization The student has knowledge of - Ionic, electronic and molecular interactions in the solid, liquid and dissolved state; - the structure, formation and properties of zeolites; - gold nanoparticles and their "near infrared" properties; - the theory and physical basis behind the formation of liposomes; - critical micelle concentration; - the theoretically expected secondary and tertiary structure of (bio) polymers in aqueous environment; - Polymeric nanoparticles;

	- the theoretical physical basis behind the formation of different nanostructures from amphiphilic polymers; - natural and synthetic membranes; - polyion complexes; - binding of DNA/RNA to polymers to polyion complexen (lipofectamine); - Hydrogels and nanohydrogels. Part 2: Bioconjugation General The student has knowledge of - different administration routes of drugs in the human body; - properties of medicines and materials that are important in the design of drug carriers. (This includes: - Drug decomposition, stability, solubility, toxicity, biocompatibility); - Active targeted drug delivery (accessibility ligands and targets, labeling, different methods applied etc.). Chemistry The student has knowledge of - Maleimide linkage - (copper-free) click chemistry - Thiol-ene chemistry - Isothiocyanate linking (FITC/RITC) - Native chemical ligation - EDCI linking - Crosslinking - Biochemical: The student has knowledge of - Amino acids and homologues - Recombinant DNA techniques - Functional peptides. - Streptavidin Biotin - SATA modification Part 3: Analysis of nanomaterials The student has knowledge of - SEM/TEM - AFM/STM - Confocal microscopy - FACS - Dynamic light scattering - ITC - SEC - FFF/MALS - Zeta potential As well as the physical basis for the above techniques.
Exam matrix	~ 33% Self organization ~ 33% Bioconjugatie ~ 33% Analysis of nanomaterials

	M_ATBC-M-BN-K2
Name of examination or modular examination	Knowledge exam 2
Examination or modular examination code	M_ATBC-M-BN-K2
Assessment types(s):	Individual written open questions
Result	Grade
Passing grade	5.5
Weight factor of modular exams	1
Exam opportunities	Term 2, resit during term 3 or Term 4, and resit end of term 4
Permitted resources	
Method of enrolment for exam/enrolment period	Registration for the modular exam through Alluris. The registration period is opened a few weeks prior to the exam period or the resit period. The period is published in the academic calendar of the ATBC on Insite - Timetables. Insite rosters.
Discussion and review	• The exam and resit periods and inspection of exam results are indicated in the ATBC academic calendar. Review takes place in the presence of a supervisor. • The post-examination discussion is scheduled after the examination, but before the examination review. • Contact the examiner/course coordinator (for exams taken during a resit period) if you would like to discus the exam. • With no interest, the post-exam discussion does not take place. • Participation in the post-exam discussion is only allowed if you have taken the exam.
Number of examiners	2 Examiners for construction and evaluation. Assessment by one examiner based on the answer key (theory lecturer).
Possibilities for compensation	The average of knowledge test K2 must be ≥ 5.5. Two items in Q1 and Q2 combined may be ≤ 5.5 but ≥ 4.0.
Assessment dimensions	Knowledge of the self-organization and potential application after modification of proteins and biopolymers in nanostructures for drug delivery Knowledge of the interaction and dissemination of nanomaterials in biological systems, as well as preventing interactions. Monitoring - Monitoring (Oncology) and targeting of nanodrugs biological systems, in combination with analytical techniques on the nanomaterials, with the following fields of application: - Immunohistochemistry - Immunofluorescence - Electron microscopy - Neoplasias - Cells and tissues
Assessment criteria	Part 1: Proteins as nanomaterial The student has knowledge of: - advantages and disadvantages of the use of protein materials for drug delivery; - factors that are important in modifying and application protein materials; - synthesis methods for whole protein-based nanomaterials - virus particles as nanomaterials;

	- morphology and structure of virus particles in relation to nanomaterials; - modifications in proteins for structuring in nanomaterials; - elastin-like peptides, their biological function, (bio) synthesis and self-organization; - applicability ELP materials in drug delivery; - protein materials as functional handles in targeted drug delivery; - the activity of enzymes before and after modification; - techniques to determine the (biological) activity of proteins; -assembly methods of ELP and VLP nanomaterials - functional peptides. Part 2: Biological interaction of nanomaterials The student has knowledge of - mechanisms of cellular uptake; - the effect of PEI, PEG, Polyoxazolines and Polysulphonic acid on cell interactions; - stealth effect; - effect of size, shape and Zeta potential on cellular uptake ; - cell penetrating peptides; - lipophectamine for cell perforation; - Some literature examples of functionalized nanoparticles in cell cultures; - methods to measure biodistribution (radio labeling, fluorescence, NIR); - Biodistribution of nanoparticles; - EPR effect; - the dimensions of nanoparticles and the amount of active ingredients that fit in a nanoparticle (drug: carrier); - recent literature examples of biodistributions of functionalized nanoparticles; - nano particles as artificial organelles. Part 3: Monitoring (Oncology) and targeting of nanodrugs The student has knowledge of - structure and function of cells and organs; - microscopy: LM-CLSM-TEM/SEM. The student can describe and theoretically justify the following processes: - fixation, tissue processing, embedding and cutting; - antigens, antibodies, immunology; - resolution/microscopy; - triple labeling with appropriate dyes on sections for fluorescence and CLSM; - fluorescence; - excitation / emission.
Exam matrix	~ 33% Proteins as nanomaterials ~ 33% Biological interaction of nanomaterials ~ 33% Monitoring (Oncology) and targeting of nanodrugs
	M_ATBC-M-BN-T

Name of examination or modular examination	Theme test
Examination or modular examination code	M_ATBC-M-BN-T
Assessment types(s):	Individual written open questions
Result	Grade
Passing grade	5.5
Weight factor of modular exams	1
Exam opportunities	Term 2, resit during term 3 or Term 4, and resit end of term 4
Permitted resources	The students have access to study the selected literature (article) two weeks prior to the exam.
Method of enrolment for exam/enrolment period	Registration for the modular exam through Alluris. The application period is a The registration period is opened a few weeks prior to the exam period or the resit period. The period is published in the academic calendar of the ATBC on Insite - Timetables. Insite rosters.
Discussion and review	• The exam and resit periods and inspection of exam results are indicated in the ATBC academic calendar. Review takes place in the presence of a supervisor. • The post-examination discussion is scheduled after the examination, but before the examination review. • Contact the examiner/course coordinator (for exams taken during a resit period) if you would like to discus the exam. • With no interest, the post-exam discussion does not take place. • Participation in the post-exam discussion is only allowed if you have taken the exam.
Number of examiners	2 Examiners for construction and evaluation. Assessment by one examiner based on the answer key (theory lecturer).
Possibilities for compensation	
Assessment dimensions	Competence 1: Design 1.3.3. Independently searches for, selects and processes information from relevant sources for scientific research. 1.3.6. Understands and applies complex English literature relevant to the given context. Competence 2: Experimenting 2.1.2. Performs calculations prior to beginning lab work. 2.3.1. Can justify all steps of the experiments theoretically Competence 3: Results Analysis 3.2.2. Independently makes conclusions relating to the initial research question (if possible). 3.3.1. Independently carries out results analysis according appropriate methods; uses statistics (if applicable). Competence 4: Quality Control

	4.1.3. Uses controls, and uses these to assess the reliability of the results. Competence 10: Advising 10.2.1. Translates needs to practical requirements.
Assessment criteria	The student is able to: Read, understand and interpret recently published literature about bio-nanotechnology. That is to say: - reads and understands articles; - can read and explain the reaction diagrams and figures shown; - can indicate why certain techniques were chosen (from the theory modules); evaluate pros and cons and discuss them; - alternatives methods proposals; - make connections between data and conclusions found (relating to the theory); - assesses and justifies what the value of the published results are; - give critical commentary on the methods used and conclusion; - knows the specific terminology and can explain them. Additionally, the student has knowledge of - which factors are important in the design of a nanoparticle for a specific purpose; - can indicate what the dangers and potential of nanomaterials and nanodrugs; - can describe methods and design experiments to produce and modify proteins, peptides and enzymes. - can describe methods and design experiments to produce and modify polymeric nanomaterials; - can explain the relationship between the physical properties and biological interactions of nanomaterials; - can describe methods and design experiments to demonstrate or monitor proteins, peptides and enzymes. - can use the theory from the entire minor and translate this to relevant developments in medical science and in particular oncology;
Exam matrix	The following topics appear equally in the thematic test: - Self-organization - Bioconjugation - Analysis of nanomaterials - Proteins as nanomaterial - Biological interaction of nanomaterials - Monitoring (Oncology) and targeting of nanodrugs - all knowledge gained in practical classes (synthesis, cell biology, SEM and CLSM - All knowledge gained in the tutor meetings.
	M_ATBC-M-BN-V
Name of examination or modular examination	Research Proposal
Examination or modular examination code	M_ATBC-M-BN-V

Assessment types(s):	Written, Group
Result	Grade
Passing grade	5.5
Weight factor of modular exams	1
Exam opportunities	Term 2, resit during term 3 or Term 4, and resit end of term 4
Permitted resources	
Method of enrolment for exam/enrolment period	Participation in M_ATBC-M-BN counts as registration for M_ATBC-M-BN-V.
Discussion and review	The filled-in assessment form with any feedback is considered the discussion and review of this modular assessment.
Number of examiners	Assessment by two examiners based on assessment form.
Possibilities for compensation	
Assessment dimensions	Competence 1: Design 1.2.2., (1.3.3.) Independently searches for, selects and processes information from relevant sources for scientific research 1.3.4 Independently formulates sub-questions/aims with associated hypotheses based on the given research aim. 1.3.6. Understands and applies simple English literature relevant to the given context. 1.3.7. Links own research with the overarching research project. Competence 2: Experiment preparation 2.3.1. Can justify all steps of the experiments theoretically Competence 6: Reporting and Presenting 6.2.1. Reports their research in the form of a research report/lab journal/poster according to in-house guidelines (product criteria for lab journal and research report; level 2): - uses correct spelling, grammar, sentence structure and scientific style; - Uses a clear and logical structure in complex passages of text; - Is aware of the cohesion between the different sections of text; - The document structure conforms to guidelines used in professional practice; - The report contains a reference list. The text refers to the literature in the this reference list; - Describes results so that the reader can understand them; - Uses clearly labelled figures and tables. - Describes all relevant data in a summary. 6.3.1. Reports on the research in the form of a report/lab journal according to internationally accepted criteria (product criteria lab journal and report level 3): - uses correct spelling, grammar, sentence structure and scientific style; - Uses a clear and logical structure in complex passages of text; - Is aware of the cohesion between the different sections of text; - The document structure conforms to guidelines used in professional practice;

	- The report contains a reference list. The text refers to the literature in the this reference list; - Describes results so that the reader can understand them; - Uses clearly labelled figures and tables. - describes all relevant data from the research in a summary that can be read independently. 11.2.6. Is aware of the internationally accepted scientific code of conduct.
Assessment criteria	See assessment form for research proposal on #OnderwijsOnline under General information
Exam matrix	*See assessment form on #OnderwijsOnline under Algemene Informatie (General Information)*
	M_ATBC-M-BN-Pr
Name of examination or modular examination	Presentation
Examination or modular examination code	M_ATBC-M-BN-Pr
Assessment types(s):	Oral, Group
Result	Grade
Passing grade	5.5
Weight factor of modular exams	1
Exam opportunities	Term 2, resit during term 3 or Term 4, and resit end of term 4
Permitted resources	
Method of enrolment for exam/enrolment period	Participation in M_ATBC-M-BN counts as registration for M_ATBC-M-BN-Pr.
Discussion and review	The filled-in assessment form with any feedback is considered the discussion and review of this modular assessment.
Number of examiners	Assessment by two examiners based on assessment form (practical teacher).
Possibilities for compensation	
Assessment dimensions	Competence 1: Design of experimental plan 1.3.3. Independently searches for, selects and processes information from relevant sources for scientific research. 1.3.4. Independently formulates sub-questions/aims with associated hypotheses based on the given research aim. 1.3.6. Understands and applies simple English literature relevant to the given context. 1.3.7. Links own research with the overarching research project. Competence 2: Experiment preparation 2.1.2. Performs calculations prior to beginning lab work. Competence 3: Results Analysis

	3.1.2., (3.3.2.) Independently assesses the usability of results based on accuracy and reliability. 3.2.1., (3.3.1.) Carries out results analysis with appropriate methods (independently); if applicable uses statistics. 3.2.3., (3.3.3.) Independently makes conclusions relating to the initial research question (if possible) and overarching research project. 3.2.5., (3.3.5.) Independently discusses results relative to other experiments and compares them with the results in literature. 3.2.6. Makes proposals for improving the execution of the research. 3.3.7. Makes proposals for follow-up experiments. Competence 4: Quality Control 4.1.3. Controls used, the result of which gives an opinion on the reliability of results. Competence 6: Reporting and Presenting 6.3.5 Presents research to a diverse audience in a clear and convincing way, according to the conventional standards of presentation techniques and answers questions: there is structure in the presentation (head-body-tail); Speaks clearly and intelligibly; Stands up straight and leaves hands free; Makes eye contact with the audience and checks whether the essence of the message comes across to the target group; Makes clear and concise statements slides or other visual products; Verbal and visual message forms a whole; uses capabilities of Powerpoint as visual support for transferring the message; conducts a substantive discussion with audience. Competence 8: Team work 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.2.8. States his/her opinion/message clearly. 8.2.12. Is aware of intercultural differences in the profession Competency 11 Professional development Guides own competence development 11.1.2. Works on learning aims according to the PDP and collects evidence of competency. 11.2.6. Is aware of the internationally accepted scientific code of conduct. 11.2.7. Formulates and justifies an opinion regarding ethical aspects of the profession.
Assessment criteria	See Presentation (Research Article and Research Proposal) Assessment Form on OnderwijsOnline under Algemene Informatie (General Information)
Exam matrix	See Presentation (Research Article and Research Proposal) Assessment Form on OnderwijsOnline under Algemene Informatie (General Information)
	M_ATBC-M-BN-P

Name of examination or modular examination	Practical work
Examination or modular examination code	M_ATBC-M-BN-P
Assessment types(s):	Individual, practical
Result	Grade
Passing grade	5.5
Weight factor of modular exams	1
Exam opportunities	Terms 2 or 4 There is only one opportunity per academic year for the modular exams P (EER art. 8.5)
Permitted resources	
Method of enrolment for exam/enrolment period	Participation in M_ATBC-M-BN counts as registration for M_ATBC-M-BN-P.
Discussion and review	The filled-in assessment form with any feedback is considered the discussion and review of this modular assessment.
Number of examiners	Assessment by one examiner (practical teacher) based on the assessment form.
Possibilities for compensation	
Assessment dimensions	Competence 1: Design of experimental plan 1.3.3. Independently searches for, selects and processes information from relevant sources for scientific research. 1.3.4. Independently formulates sub-questions/aims with associated hypotheses based on the given research aim. 1.3.5. Independently integrates information into a comprehensive research plan (e.g. justifying the chosen method, describing necessary controls and availability of equipment). 1.3.6. Understands and applies complex English literature relevant to the given context. Competence 2: Experiment preparation 2.1.2. Performs calculations prior to beginning lab work. 2.1.5. Carries out the experiments within the stated time 2.2.1., (2.3.1.) Can justify (all) the basic steps of the experiments theoretically 2.2.3., (2.3.3.) Ensures (independently) that all requirements are ready before the experiment is started; makes solutions 2.2.4., (2.3.4.) Carries out experiments according to protocol so that reliable reproducible data is obtained; but can, if necessary, deviate from this; knows at all times exactly what he/she does. 2.2.6. Attempts running concurrent experiments (multitasking) Is able to work on multiple experiments simultaneously and complete them within the proposed time frame (multitasking), can switch easily and keep an overview. 2.2.7. Attempts to trouble shoot experiments when problems are encountered. 2.3.7. Solve practical problems if the experiment does not run as anticipated (trouble shooting). Competence 3: Results Analysis 3.1.2., (3.3.2.) Independently assesses the usability of results based on accuracy and reliability. 3.2.1., (3.3.1.) Carries out results analysis with

	appropriate methods (independently); if applicable uses statistics. 3.2.3., (3.3.3.) Independently makes conclusions relating to the initial research question (if possible) and overarching research project. 3.2.5., (3.3.5.) Independently discusses results relative to other experiments and compares them with the results in literature. 3.2.6. Makes proposals for improving the execution of the research. 3.3.7. Makes proposals for follow-up experiments. Competence 4: Quality Control 4.1.1. Is aware of and adheres to the workplace health and safety rules. 4.1.3. Uses controls, and uses these to assess the reliability of the results. Competence 5: Management and Administration 5.2.1. Codes chemicals and samples and stores these in a correct way 5.2.2. Contributes to an efficiently functioning lab (clears up, indicates if reagents are almost finished, carries out minor maintenance on the equipment) 5.2.3. Manages and archives data in lab journal (aim, experiments description, results, conclusion) and if required, in other ways so that others can understand these. Competence 6: Reporting 6.2.1. Reports on his research in the form of a report / lab journal in accordance with internationally applicable rules (product criteria: lab journal and report level 2): uses correct spelling, grammar, sentence structure and scientific style; adds a clear and logical structure to more complex text parts; the structure of the text is in accordance with the guidelines used in the field; report includes a bibliography. In the text is referenced to sources in bibliography; describes results so that the reader can understand them; uses clearly labeled graphics and tables; describes all relevant data in a summary 6.3.1. Reports on his research in the form of a report / lab journal in accordance with internationally applicable rules (product criteria: lab journal and report level 3): Uses correct spelling, grammar, sentence structure and scientific style; adds a clear and logical structure to more complex texts There is coherence between text parts; is aware of coherence between text parts; structure of text is in accordance with guidelines used in the field; report includes a literature list. The text refers to sources in the reference list; describes results so that the reader can understand them; uses clearly labeled images and tables for this purpose; describes all relevant data from a study in a summary that can be read independently. Competence 7: Planning/project-based working

	7.2.1. (7.3.1) Plans and organizes his experiments resulting in a work plan that covers a minimum of 4 lessons (plans and organizes his project resulting in a work plan of a minimum of 4 weeks) 7.2.2. Works according to plan, also under time constraints. 7.2.3. Ensures that aims are achieved and adapts the work if required. 7.3.4. Responds to changing circumstances; determines priorities in activities.
Assessment criteria	See Practical Assessment Form on OnderwijsOnline under Algemene Informatie (General Information)
Exam matrix	See Practical Assessment Form on OnderwijsOnline under Algemene Informatie (General Information)
	M_ ATBC-M-BN-PA
Name of examination or modular examination	Portfolio Assessment
Examination or modular examination code	M_ATBC-M-BN-PA
Assessment types(s):	Oral, Individual
Result	Grade
Passing grade	5.5
Weight factor of modular exams	1
Exam opportunities	Term 2, resit during term 3, or in term 4, resit end of term 4.
Permitted resources	
Method of enrolment for exam/enrolment period	Participation in M_ATBC-M-BN counts as registration for M_ATBC-M-BN-Pa.
Discussion and review	The filled-in assessment form with any feedback is considered the discussion and review of this modular assessment.
Number of examiners	Assessment by two examiners based on assessment form.
Possibilities for compensation	
Assessment dimensions	Competence 1: Design 1.3.6. Understands and applies simple English literature relevant to the given context. 1.3.7. Links own research with the overarching research project. Competence 2: Experiment preparation 2.3.1. Can justify all steps of the experiments theoretically Competence 3: Results Analysis 3.2.3., (3.3.3.) Independently makes conclusions relating to the initial research question (if possible) and overarching research project. 3.2.5 (3.3.5) Independently discusses results relative to other experiments and compares them with the results in literature. 3.2.6. Makes proposals for improving the execution of the research. 3.3.7. Makes proposals for follow-up experiments. Competence 6: Reporting and Presenting

	6.1.5. Presents research to audience members of the same background according to standards of presentation techniques and answers questions: Applies correct spelling and grammar; describes results so that the reader can understand them; uses clearly labeled pictures and tables; there is structure to the presentation (introduction-body-conclusion); speaks clearly and intelligibly; stands up straight and leaves hands free; makes eye contact with audience; creates clear and orderly slides or other visual products. 6.3.1. Reports on his research in the form of a report / lab journal in accordance with internationally applicable rules (product criteria: lab journal and report level 3): uses correct spelling, grammar, sentence structure and scientific style; adds a clear and logical structure to more complex texts There is coherence between text parts; is aware of coherence between text parts; structure of text is in accordance with guidelines used in the field; report includes a literature list. Text refers to sources in bibliography; describes results so reader can understand; uses clearly labeled images and tables; describes all relevant data in a summary that can be read independently. Competence 8: Team work 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.1.9. Shows initiative to actively solve conflicts. 8.2.5. Takes initiative in the conversation. 8.2.8. States his/her opinion/message clearly. 8.2.12. Is aware of intercultural differences in the profession 8.3.9. Is able to deal with conflicts 8.3.10. Interacts with discussion partner/checks if message is understood. 8.3.11. Keeps to the aim of the conversation. Competency 11 Professional development Guides own competency development 11.2.1. Describes strengths and weaknesses. 11.3.3. Looks back critically (reflects) on their own actions and learning process; learns from mistakes; is open to learning moments.
Assessment criteria	See Portfolio Assessment Form on OnderwijsOnline under Algemene Informatie (General Information)
Exam matrix	See Portfolio Assessment Form on OnderwijsOnline under Algemene Informatie (General Information)
	M_ATBC-M-BN-IPV
Name of examination or modular examination	IPS
Examination or modular examination code	M_ATBC-M-BN-IPV
Assessment types(s):	Oral, Individual
Result	Satisfactory/Unsatisfactory

Passing grade	Satisfactory
Weight factor of modular exams	0
Exam opportunities	Terms 2 or 4 Participation in modular exam IPV is only possible once per academic year (EER art. 8.5).
Permitted resources	
Method of enrolment for exam/enrolment period	Participation in M_ATBC-M-BN counts as registration for M_ATBC-M-BN-IPV.
Discussion and review	For questions about the assessment, please contact the examiner.
Number of examiners	One examiner (tutor) for the assessment based on participation and effort.
Possibilities for compensation	
Assessment dimensions	Competence 8: Team work Functioning in a group 8.1.1. Adheres to rules. 8.1.2. Makes a clear contribution to the group. 8.2.3. Makes concrete agreements and keeps to these 8.3.4. Recognizes own role and contribution to the group and know what other roles there are in the team; functions adequately; takes others into consideration. Communication Communicates in an open and clear manner with colleagues and supervisors according to basic communication guidelines: 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.1.9. Is active in conflict resolution. 8.2.5. Takes initiative in the conversation. 8.2.8. States his/her opinion/message clearly. 8.3.9. Is able to deal with conflicts. 8.3.10. Interacts with discussion partner/checks if message is understood. 8.3.11. Keeps to the aim of the conversation. Internationalisation 8.2.12. Is aware of intercultural differences in the profession Competency 11 Professional development 11.3.3. Looks back critically (reflects) on their own actions and learning process; learns from mistakes; is open to learning moments. 11.3.5. Acts with integrity, adapts quickly, shows determination, and is a motivated employee.
Assessment criteria	The student: - the student has prepared for the meeting by completing the assignment to be discussed, and also completed the required reading for the following assignment to be discussed; - Is able to show weekly assignments to the tutor (according to agreement, in writing or as a presentation); all required aspects are complete in all assignments; - fulfils their designated roles (Chair, secretary etc.);

	- the student adheres to the rules agreed upon; - Asks questions and shares knowledge regarding the assignment during tutorials; verbalizes these clearly and audibly, maintains eye contact; - Gives others opportunity to speak; - The student offers feedback to group and class members and is open to receiving feedback;

M_ATBC-M-BBS BioBased Innovations (30 studiepunten)

	M_ATBC-M-BBS
General information	
Target group/groups	Full-time students main phase - Life Sciences (LS), Biology and Medical Laboratory Research (BML), Chemistry Full time students - Industrial Product Design (IPD) Full time students - Architecture Similar courses at other Universities of Applied Science
Name of unit of study	Minor Biobased Innovations
Code of unit of study	M_ATBC-M-BBs
Lecture period	Semester 1: period 1 and 2 (Sep-Jan) Semester 2: period 3 and 4 (Feb-Jul)
ECTS credits	30 EC
Study load in hours	840 SBU
Study hours (contact hours)	Planned lesson/contact hours: - Introduction: 10-15 hours theory/guest lectures, excursion/workshop 8 hours and 60-70 hours self-study - Module multidisciplinary approach: 20 contact hours and 8 hours self-study - Specialization module: 10-15 hours theory/guest lectures, 40-60 hours workshop/practical, 80-100 hours self-study - Scheduled time for project period is 14 weeks with 100-110 contact hours with supervisors/experts/project team and 440-460 hours of practical work/self-study/writing of products Total hours: 840 hours (30 EC)
Entry requirements for unit of study	Propaedeutical phase should be completed (first study year). In total at least 60 credits from the main phase should be earned and IPS from all courses in the 1st and 2nd year must be completed. The requirements above are applicable for students from all studies (including IPD & Architecture). In addition, for BML/LS/Chemistry students: • BML/LS: BM5B/LS5B and BM6B/LS6B must be completed (sufficient). • Chemistry: the practical assessments (including reports) in the 2nd study year must be at least satisfactory.
Content and organisation	

General description	The minor Biobased Innovations gives an insight on the different aspects of the biobased economy and the opportunities of biomass as raw material. The program consists of: 1. A theoretical introduction, 2. A specialization module (Biobased design (ATBC-M-BBS-BD) or Biorefinery (ATBC-M-BBS-BR). They will get specialized knowledge about the biobased aspects of their own discipline (such as biorefinery and fermentation for chemistry and biology students, and biobased design for students architecture and industrial product design). The students will be graded individually. 3. Project: students will work in a project on developing biobased, circular and innovative products or processes together with companies and with students with various (technical) backgrounds. Each student will cover his/her area of expertise within the project. At the same time, they will open up their horizon and learn to collaborate in a multidisciplinary team. Project consists of: a. Research Plan b. Practical execution c. Report d. Presentation The language of instruction is English. The exams for students that do not participate in the English variant of the study program, if desired, are provided in Dutch or can be answered in Dutch.
Exit qualifications	Designing an experimental plan Experimenting/developing Results analysis Quality control Management and administration Reporting and presenting Planning and project-based working Working in a team
Professional task	Carrying out scientific research and/or designing.
Professional products	Poster presentation Plan of Approach (including literature study) Research report Presentation
Cohesion	Biomass (waste and/or sidestreams) is used as a basis for food, food supplements, chemicals, materials, transport fuels, electricity and heat. Because of this broad range of applications, professionals are needed who can work together in multidisciplinary teams. That is why the School of Applied Bioscience and Chemistry (via HAN BioCentre) developed the minor in collaboration with de HAN School of Built Environment and Automotive & Engineering. It builds on the skills acquired in the first and second year by students from the studies chemistry, life sciences, biology and

	medical laboratory research, industrial product design and architecture.
Mandatory participation	Presence during at least 90% of the working days during the project period is mandatory in order to get a sufficient mark for the practical performance. Presence is obliged during the workshops of the “Multidisciplinair Approach Module”.
Maximum number of participants	16. Maximum 8 students from ATBC.
Compensation options	No compensation for exams or products. If amount of working days is not reached, the project time can be extended.
Activities and/or instructional formats	In about 12 of the 20 weeks practical research and/or development will be performed (central research project). *Work form: practical*. The research project is preceded by a written plan of approach (including literature study) and concluded with a report and presentation. *Work form: tutorial and self-study*. Prior to the project the student will gain knowledge during the introductory, multidisciplinary and specialization modules. *Work forms: combined theory lectures/work groups/excursions/practicals/workshops*
Required literature	None
Required software / required materials	*CES Edupack software*
Recommended literature	*Biorefineries and chemical processes, Ed. Jhuma Sadhukhan, Kok Siew Ng en Elias Martinez H., Wiley, ISBN 9781119990864*
Examination	
	M_ATBC-M-BBS-T
Name [exams or modular exams]	Theoretical exam
Code [exams or modular exams]	M_ATBC-M-BBS-T
Exam and modular exam format(s)	Individual, Written
Judgement	Mark
Minimum result	5,5
Weight factor of modular exam	2
Exam opportunities	Halfway semester 1 and halfway semester 2; see course manual and schedule for the exact date. Resit via consultation with the minor coordinator.
Permitted resources	Calculator (non- graphical).

Method of enrolment for exam / enrolment period	Participation to M_ATBC-M-BBS counts as registration for theoretical test M_ATBC-M-BBS-T. Registration for the resit via consultation with the minor coordinator.
Discussion and review	• The discussion and review of the exam are scheduled by the examiner. • Indicate (for an exam made in a resit period) to the examiner if you want to make use of the opportunity to discuss the exam. If there is no interest, the follow-up discussion will not take place. • Participation in the discussion is only permitted if you have taken the exam.
Number of examiners	Two examiners for construction and evaluation. Assessment by one examiner using the correction model (theory lecturer).
Compensation possibility	none
Competences and indicators	-
Assessment criteria	The student: (1) is able to give a definition of sustainable development; including global, European and Dutch view on this topic; (2) can explain the general principles of the biobased economy; (3) has basic knowledge on circular economy; circular vs linear, production processes, logistic chains; (4) is able to give a definition of life cycle analysis (LCA); including basic knowledge of the contents of this cycle; (5) has basic knowledge on legislation and regulations on sustainable development;
Test Matrix	Assessment criteria 1 and 2 contributes between 20-30% and all other assessment criteria contribute between 10 and 20% of the total.
	M_ATBC-M-BBS_MA
Name [exams or modular exams]	Module Multidisciplinair Approach
Code [exams or modular exams]	M_ATBC-M-BR-BBS_MA
Exam and modular exam format(s)	Oral, Individual
Judgement	Satisfactory/unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	Participation in modular exam MA is only possible once per semester.
Permitted resources	N/A
Method of enrolment for exam / enrolment period	Participation in OWE M_ATBC-M-BBS counts as registration for M_ATBC-M-BR_MA
Discussion and review	Presence and active participation in four (4) workshops/practicals is required.

Number of examiners	One examiner for the assessment based on participation and effort.
Compensation possibility	-
Competences and indicators	**Competence 7: Methodology** 7.1.3. Plans study activities. 7.2.2. Works according to plan, also under time constraints. 7.2.3. Ensures that goals are reached and if necessary, makes adjustments to activities. 7.2.4. Is flexible in changing circumstances. **Competence 8: Team Work** Functioning in a group 8.1.1. Adheres to rules. 8.1.2. Makes a valuable contribution to the group. 8.2.4. Recognises their own role in a group and is aware of other roles in the group. Works harmoniously with others. **Communication** Is able to communicate about their assignment with peers and lecturers applying basic rules of communication. 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.2.5. Takes initiative in the conversation. 8.2.5. Verbally expresses their opinion/message clearly. 8.2.10. Interacts with conversation partner. 8.2.12. Is aware of intercultural differences in the professional field **Competence 10: Advising** 10.2.1. Translates needs to practical requirements. **Competence 11: Professional Development** 11.2.5. Works with integrity, adjusts to new situations, shows determination and is a motivated student.
Assessment criteria	The student: -the student is present during all 4 workshops/practicals -the student has prepared for the workshop/practical by reading the assignment and answering the preparative questions -the student shows active participation by asking questions -the student shares knowledge regarding the discipline in case
Test matrix	All assessment criteria should be satisfactory. Student should be present during all 4 workshops/practicals
	M_ATBC-M-BBS-BD
Name [exams or modular exams]	Biobased Design
Code [exams or modular exams]	M_ATBC-M-BBS-BD
Exam and modular exam format(s)	Individual, Written (Poster) and Assessment
Judgement	Mark
Minimum result	5,5
Weight factor of modular exam	4

Exam opportunities	2 attempts per year. First attempt approximately halfway of semester. See course manual for exact date. Second attempt/resit in agreement with examiner.
Permitted resources	-
Method of enrolment for exam / enrolment period	Participation to M_ATBC-M-BBS counts as registration for theoretical test M_ATBC-M-BBS-BD. Registration for the resit via the minor coordinator.
Discussion and review	Returning the completed assessment form to the student with any remarks serves as review and discussion of this modular exam..
Number of examiners	Assessment by two examiners based on the assessment form.
Compensation possibility	-
Competences and indicators	**Reporting and presenting** Competence 6.2.1. Reports their research in the form of a research report/lab journal/poster according to in-house guidelines (product criteria for lab journal and research report; level 2): • uses correct spelling, grammar, sentence structure and scientific style; • uses a clear and logical structure in complex passages of text; • is aware of the cohesion between the different sections of text; • the document structure conforms to guidelines used in professional practice; • the report contains a reference list. The text references to the literature in this list; • describes results so the reader can understand, uses clearly labelled figures and tables; Competence 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. Competence 6.2.4. In English, uses written tasks appropriate to the professional practice to communicate straightforward ideas as defined by CEFR B1 Level Writing **In the context of biobased design.**
Assessment criteria	Consult the evaluation form: 'Biobased design Assignment' on #OnderwijsOnline – General information.
Test Matrix	Consult the evaluation form: 'Biobased design Assignment' on #OnderwijsOnline – General information.
	M_ATBC-M-BBS_BR
Name [exams or modular exams]	Biorefinery

Code [exams or modular exams]	M-ATBC-M-BBS_BR
Exam and modular exam format(s)	Individual, Written (Poster) and Assessment
Judgement	mark
Minimum result	5.5
Weight factor of modular exam	4
Exam opportunities	2 attempts per year. First attempt approximately halfway of semester. See course manual for exact date. Second attempt/resit in agreement with examiner.
Permitted resources	-
Method of enrolment for exam / enrolment period	Participation to M_ATBC-M-BBS counts as registration for M_ATBC-M-BBS-BR.
Discussion and review	The filled-in assessment form with any remarks is considered the discussion and review of this modular exam.
Number of examiners	Assessment by two examiners based on the assessment form.
Compensation possibility	-
Competences and indicators	**Reporting and presenting** Competence 6.2.1. Reports their research in the form of a research report/lab journal/poster according to in-house (HLO) guidelines (product criteria for lab journal and research report; level 2): • uses correct spelling, grammar, sentence structure and scientific style; • uses a clear and logical structure in complex passages of text; • is aware of the cohesion between the different sections of text; • the document structure conforms to guidelines used in professional practice; • the report contains a reference list. The text references to the literature in this list; • describes results so the reader can understand, uses clearly labelled figures and tables; Competence 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. Competence 6.2.4. In English, uses written tasks appropriate to the professional practice to communicate straightforward ideas as defined by CEFR B1 Level Writing **In the context of biorefinery and fermentation technology.**
Assessment criteria	Consult the evaluation form: 'BioRefinery Assignment' on #OnderwijsOnline – General information.
Test Matrix	Consult the evaluation form: 'BioRefinery Assignment' on #OnderwijsOnline – General information.

	M_ATBC-M-BBS-RP
Name [exams or modular exams]	Research Plan
Code [exams or modular exams]	M-ATBC-M-BBS-RP
Exam and modular exam format(s)	Written plan, Group*. *) Students are graded individually based on their contribution in the project.
Judgement	Mark
Minimum result	5.5
Weight factor of modular exam	4
Exam opportunities	2 attempts per year. Hand in first attempt approximately halfway of the semester. See course manual for exact date. If submitted too late, a 0 is given for the first chance. Second attempt/resit 1 to 4 weeks after first attempt. See course manual for exact date. A sufficient research plan is mandatory for execution of the project.
Permitted resources	-
Method of enrolment for exam / enrolment period	Participation to M_ATBC-M-BBS counts as registration for M_ATBC-M-BBS-RP.
Discussion and review	The completed assessment form will be returned to the student. On request additional remarks can be given by the examiner.
Number of examiners	Assessment by one examiner based on the assessment form.
Compensation possibility	None
Competences and indicators	**Competence 1 Design of experimental setup** 1.3.3. Independently searches for, selects and integrates information from relevant scientific sources. 1.3.4. Independently forms intermediate research questions and related hypothesis based on the given research question. 1.3.5. Independently integrates information into a comprehensive research plan (e.g. justifying the chosen method, describing necessary controls and availability of equipment) 1.3.8. Adjusts the research plan accordingly based on acquired results. 1.3.6. Understands and applies advanced English literature relevant to the given context. **Competence 2 Experimenting** 2.1.2. Performs calculations prior to beginning practical work. 2.3.1. Is able to explain the theory behind all steps of the experiments. 2.3.3. Independently ensures that all requirements are present before beginning the experiment. **Competence 4 Quality control** 4.1.1. Is aware of the health and safety rules and works according to these rules. 4.1.3. Uses controls, and uses these to assess the reliability of the results. **Competence 6 Reporting and presenting** 6.3.1. Reports their research in the form of a research report/lab journal/poster according to international guidelines (product criteria for lab journal and research report; level 3

	➢ uses correct spelling, grammar, sentence structure and scientific style; ➢ uses a clear and logical structure in complex passages of text. There is cohesions between the different sections of text; ➢ the document structure conforms to guidelines used in professional practise; ➢ the report contains a reference list. The text references to the literature in this list; ➢ describes results so the reader can understand, uses clearly labelled figures and tables; ➢ all relevant data is described in a summary that is independent to the report. . 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. 6.2.4. In English, uses written tasks appropriate to the professional practise to communicate straightforward ideas as defined by CEFR B1 Level Writing **Competence 7 Methodology** 7.3.1. Plans and organises activities in a work plan covering a duration of at least 4 weeks.
Assessment criteria	Consult the assessment form: 'Biobased Innovation Research Plan' on #OnderwijsOnline – General information.
Test Matrix	Consult the assessment form: 'Biobased Innovation Research Plan' on #OnderwijsOnline – General information.
	M_ATBC-M-BBS-Pr
Name [exams or modular exams]	Presentation
Code [exams or modular exams]	M_ATBC-M-BBS-Pr
Exam and modular exam format(s)	Oral, Individual
Judgement	Mark
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	2 attempts per year . The first attempt approximately at the end of the semester. See course manual for exact date. Second attempt/resit 1 to 4 weeks after first attempt. See course manual for exact date.
Permitted resources	-
Method of enrolment for exam / enrolment period	Participation in OWE M_ATBC-M-BBS counts as registration for M_ATBC-M-BBS-Pr
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by two examiners based on assessment form.
Compensation possibility	-

Competences and indicators	**Competence 1: Designing** 1.2.4. Forms intermediate research questions and related a hypothesis based on the given research question. 1.3.7. Makes connections between experiments and the broader research context. 1.3.8. Adjusts the research plan accordingly based on acquired results. **Competence 2: Experimenting** 2.3.1. Is able to explain the theory behind all steps of the experiments. **Competence 3: Analyzing Results** 3.1.4. Discusses the execution of the experiment and results. 3.2.3. Independently makes conclusions relating to the initial research question (if possible). 3.2.5. Relates results with results from their other experiments and also to data in published literature. 3.3.1. Independently carries out results analysis according to the appropriate methods; uses statistics (if applicable). **Competence 6: Reporting and Presenting** 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. 6.3.5. Presents research to a target audience with similar knowledge background in a clear and persuasive manner; applies general presentation techniques and answers questions: there is an introduction-body-conclusion structure to the presentation; speaks clearly and coherently; has upright posture and hands are freely used; makes eye contact with the audience; makes organized and clear slides or other visual products; verbal and visual messages complement each other; Uses visual aids in PowerPoint to support; holds an on-topic discussion with the audience. 6.2.4. In English, uses written tasks appropriate to the professional practise to communicate straightforward ideas as defined by CEFR B1 Level Writing **Competence 8: Team work** 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.2.8. Verbally expresses their opinion/message clearly. 8.2.10. Interacts with conversation partner. 8.3.11. Keeps conversation on topic.
Assessment criteria	Consult the assessment form: ‘Biobased Innovations - Presentation’ on #OnderwijsOnline.

Test matrix	Consult the assessment form: 'Biobased Innovations - Presentation' on #OnderwijsOnline
	M_ATBC-M-BBS-R
Name [exams or modular exams]	Report
Code [exams or modular exams]	M_ATBC-M-BBS-R
Exam and modular exam format(s)	Written report, Group*. *) Students are graded individually based on their contribution in the project.
Judgement	Mark
Minimum result	5,5
Weight factor of modular exam	4
Exam opportunities	2 attempts per year. Hand in at the latest 2 weeks after the last day of the minor. If submitted too late, a 0 is given for the first chance. Resit at the latest two months after the last day of the minor.
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in OWE M_ATBC-M-BBS counts as registration for M_ATBC-M-BBS-R
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by two examiners based on assessment form.
Compensation possibility	
Competences and indicators	**Competence 1: Designing** 1.2.1. Independently identifies relevant background information required to answer the research. 1.3.3. Independently searches for, selects and integrates information from relevant scientific sources. 1.3.4. Independently forms intermediate research questions and related hypothesis based on the given research question. 1.3.6. Understands and applies advanced English literature relevant to the given context. 1.3.7. Makes connections between experiments and the broader research context. **Competence 2: Experimenting** 2.3.1. Is able to explain the theory behind all steps of the experiments. **Competence 3: Analyzing Results** 3.3.1. Independently carries out results analysis according to the appropriate methods; uses statistics (if applicable). *Validation* 3.3.2. Independently evaluates the obtained results based on their accuracy and reliability.

	Conclusion and discussion 3.1.4. Discusses the execution of the experiment and results. 3.2.3. Independently makes conclusions relating to the initial research question (if possible) 3.2.5. Relates results with results from their other experiments and also to data in published literature. 3.2.6. Suggests improvements to improve the execution of the research. 3.3.7. Suggests follow-up experiments. **Competence 4: Quality Control** 4.1.3. Uses controls, and uses these to assess the reliability of the results. **Competence 5: Management and administration** 5.3.3. Manages and archives data in a lab journal or other logbook (aim, experiment description, alterations, results, conclusion) and if relevant, other ways of storing data so that others can use it. **Competence 6: Reporting and Presenting** 6.3.1. Reports their research in the form of a research report according to international guidelines (product criteria for lab journal and research report; level 2). - uses correct spelling, grammar, sentence structure and scientific style; - uses a clear and logical structure in complex passages of text. There is cohesion between the different sections of text; - the documents structure conforms to guidelines used in professional practice; - the report contains a reference list. The text references to the literature in this list; describes results so the reader can understand; - uses clearly labelled figures and tables; all relevant data is described in a summary that is independent to the report. 6.2.4. In English, uses written tasks appropriate to the professional practise to communicate straightforward ideas as defined by CEFR B1 Level Writing
Assessment criteria	Consult the evaluation form: 'Biobased Innovations – Project Report on #OnderwijsOnline.
Test matrix	Consult the evaluation form: 'Biobased Innovations - Project Report' on #OnderwijsOnline.
	M_ATBC-M-BBS-PP
Name [exams or modular exams]	Practical performance
Code [exams or modular exams]	M_ATBC-M-BBS-PP

Exam and modular exam format(s)	Practical, Individual
Judgement	Mark
Minimum result	5,5
Weight factor of modular exam	5
Exam opportunities	There is only one opportunity per year for the modular exam PP (EER paragraph 8.5)
Permitted resources	-
Method of enrolment for exam / enrolment period	Participation in OWE M_ATBC-M-BBS counts as registration for M_ATBC-M-BBS-PP
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as review and discussion of this modular exam.
Number of examiners	Assessment by one examiner based on assessment form.
Compensation possibility	-
Competences and indicators	**Competence 1: Designing** 1.2.1. Independently identifies relevant background information required to answer the research question. 1.3.3. Independently searches for, selects and integrates information from relevant scientific sources. 1.3.5. Independently integrates information into a comprehensive research plan (e.g. justifying the chosen method, describing necessary controls and availability of equipment) 1.3.8. Adjusts the research plan accordingly based on acquired results. **Competence 2: Experimenting** *Preparation* 2.1.2. Performs calculations prior to beginning lab work. 2.1.5. Carries out the experiment within the given time. 2.3.1. Is able to explain the theory behind all steps of the experiments. 2.3.3. Independently ensures that all requirements are present before beginning the experiment, makes solutions. *Execution* 2.2.4. Carries out experiments according to the protocol in order to obtain reliable, reproducible data; is aware of what he/she is doing at all times. 2.2.6. Attempts to work on multiple experiments at the same time (multitasking). 2.2.7. Attempts to trouble shoot experiments when problems are encountered. 2.3.7. Trouble shoots if problems are encountered in the experiments. **Competence 3: Analyzing Results**

	3.1.4. Discusses the execution of the experiment and results. 3.3.1. Independently carries out results analysis according to the appropriate methods; uses statistics (if applicable). 3.2.3. Independently makes conclusions relating to the initial research question (if possible). 3.2.5. Relates results with results from their other experiments and also to data in published literature. 3.2.6. Suggests improvements to improve the execution of the research. 3.3.2. Independently evaluates the obtained results based on their accuracy and reliability. **Competence 4: Quality Control** 4.1.1. Is aware of the health and safety rules and works according to these rules. 4.1.3. Uses controls, and uses these to assess the reliability of the results. 4.2.2. Uses advanced tools and equipment in a correct manner. **Competence 5: Management and administration** 5.2.1. Encodes chemicals and samples; stores these in the correct manner. 5.2.2. Contributes to an efficiently functioning lab or workshop. 5.3.3. Manages and archives data in lab journal or logbook (aim, experiment description, alterations, results, conclusion) and if relevant, other ways of storing data so that others can use it. **Competence 6: Reporting and Presenting** 6.3.1. Reports their research in the form of a research report/lab journal/poster according to international guidelines (product criteria for lab journal and research report; level 2): - uses correct spelling, grammar, sentence structure and scientific style; - uses a clear and logical structure in complex passages of text. There is cohesion between the different sections of text; - the documents structure conforms to guidelines used in professional practice; - the report contains a reference list. The text references to the literature in this list; - describes results so the reader can understand; uses clearly labelled figures and tables; all relevant data is described in a summary that is independent to the report. **Competence 7: Working in a planned and project-based manner** 7.2.1. Plans and organizes activities in a work plan that covers a duration of at least 4 practical lessons. 7.2.2. Works according to plan, also under time constraints. 7.2.3. Ensures that goals are reached and if necessary, makes adjustments to activities.

	7.3.4. Is flexible in changing circumstances; determines priorities in the work. **Competence 8: Team work** *Functioning in a group* 8.1.1. Adheres to rules. 8.2.3. Makes clear agreements with others and keeps to these. 8.2.4. Recognizes their own role in a group and is aware of other roles in the group. Works harmoniously with others. *Communication* Is able to communicate about their assignment with peers and lecturers applying basic rules of communication: 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Gives others opportunity to speak. 8.1.9. Is active in conflict resolution. 8.2.5. Takes initiative in the conversation. 8.2.8. Verbally expresses their opinion/message clearly. 8.2.10. Interacts with conversation partner. **Competence 11: Professional development** 11.3.5. Works with integrity, adjusts to new situations, shows determination and is a motivated employee.
Assessment criteria	Consult the evaluation form: 'Biobased Innovations - Practical performance' on #OnderwijsOnline.
Test matrix	Consult the evaluation form: 'Biobased Innovations - Practical performance' on #OnderwijsOnline.

M_ATBC-M-DD Drug Discovery (30 studiepunten)

	M_ATBC-M-DD
Algemene informatie	
Doelgroep	Hoofdfase studenten uit alle chemische en (bio) medische richtingen
Naam onderwijseenheid	Minor Drug Discovery: Introductie in de Drug Discovery
Code onderwijseenheid	M_ATBC-M-DD
Onderwijsperiode	semester 2 (periode 3-4)
Studiepunten	30 stp
Studielast in uren	840 SBU
Onderwijstijd (contacturen)	Periode 3: Week 1-5 Het drug discovery proces bestaat uit 5 te onderscheiden fasen. De eerste 5 weken wordt per week een fase belicht. Gestreefd wordt naar de volgende opbouw per week: • ca 15 geroosterde lesuren; 15 klokuur: (ca 11,25 klokuren) • droge werkopdracht per fase welke in groepsverband (multidisciplinair) wordt uitgewerkt; zelfstudie en zelf roosteren (27 klokuren) • werkbezoek bedrijf (2 lesuren), 1.5 klokuur • tutor 3 lesuren (2,25 klokuur) per week om werkopdracht te bespreken

	Totaal geprogrammeerde contacttijd week 1-5: 20 lesuren p/week;100 lesuren = klokuren 75, Geprogrammeerde onderwijstijd voor zelfwerkzaamheid: 135 klokuren Totaal: 210 klokuren Theorieonderdelen: “Target identificatie en validatie”: 15 lesuren (incl gastcolleges) “Assay development”: 15 lesuren (incl gastcolleges) “HTS en compound libraries/eigenschappen” 15 lesuren. (incl gastcolleges) “Hit en lead optimalisatie”: 15 lesuren (incl gastcolleges) “Pre development fase, 15 lesuren (incl gastcolleges) Vanaf week 6-20 wordt de opzet Praktijklessen waarin gestreefd wordt om in groepsverband aan reguliere opdrachten vanuit het werkveld te werken. 22,5 klokuren per week verdeeld. • Tutor: 2 lesuren per week (1,5 klokuur) • Zelfstudie uren (292,5 klokuren): Student dient zelf en in groepsverband 292,5 uur aan zelf- en groepsstudiewerkzaamheden te roosteren. Totaal geprogrammeerde contacttijd week 6-20: 30 lesuren p/week;450 lesuren = klokuren 337,75, Geprogrammeerde onderwijstijd voor zelfwerkzaamheid: 292,5 klokuren Totaal: 630 klokuren Totaal: 840 klokuren
Ingangseisen onderwijseenheid	Voor aanvang aan deze OWE dient de student minimaal zijn/haar propedeuse behaald te hebben (Bij instromers uitzonderingen mogelijk). De competenties die in deze minor aan de orde zijn, zijn op niveau 2 geoefend. Tweede jaar chemie gevolgd waarbij C8T en C8P of C6T en C6P behaald. Ofwel tweede jaar BML gevolgd waarbij BM6B is behaald. Hetzelfde geldt voor de overeenkomstige OWEs uit Chemistry en LS. Studenten van andere laboratoriumopleidingen kunnen zich ook aanmelden. Deze externe studenten worden eerst uitgenodigd voor een intake gesprek.
Inhoud en organisatie	
Algemene omschrijving	De minor Drug Discovery richt zich op de interface tussen biomoleculaire technologie en chemie, en is in deze zin dan ook verbredend en verdiepend. De opbouw is dat in de eerste weken de theoretische basis wordt gelegd van het drug discovery proces. Per week wordt een fase behandeld die een vergelijkbare opbouw zal hebben; theorie, gastcolleges, werkbezoek en een droge opdracht (simulatieopdracht)

	waarin je oefent met de theorie van die week. De tutorbijeenkomsten behandelen deze fasen aan de hand van opdrachten. De volgende 5 fasen worden onderscheiden; Target identificatie en validatie: “Assay development”: “HTS en compound libraries/eigenschappen “Hit en lead optimalisatie”: “Pre development fase, In week 6 start het praktijkgedeelte en zal doorlopen tot en met week 20. In deze fase wordt gestreefd om in groepsverband aan reguliere opdrachten vanuit het werkveld te werken. In de tutorbijeenkomsten bespreken we wekelijks de voortgang van het project met als einddoel een presentatie van een onderzoeksresulaten. In deze OWE staat de beroepstaak “het uitvoeren van een natuurweten-schappelijk onderzoek” op het gebied van de biomoleculaire technologie en chemie in een multidisciplinair team centraal. Het gekozen contextgebied is medicijnontwikkeling. Het gekozen onderwijsmodel is projectonderwijs. Deze OWE bouwt voort op chemische, biologische en biomoleculaire courses uit het tweede jaar. Zodoende zullen (bio)moleculaire studenten en chemie studenten elkaars input nodig hebben en is multidisciplinair samenwerken een must. Dat wil zeggen dat studenten uit verschillende richtingen op verschillende momenten het initiatief dienen te nemen en andere studenten dienen te begeleiden. Dit komt tot uiting in het uiteindelijke onderzoeksvoorstel (PVA) dat studenten in multidisciplinair teamverband dienen te schrijven. De voertaal van de minor Drug Discovery is Engels. De tentamens voor studenten die niet deelnemen aan de Engelse variant van de opleiding worden desgewenst in het Nederlands aangeboden en / of kunnen in het Nederlands worden beantwoord. De beroepsproducten moeten in het Engels worden gemaakt.
Eindkwalificaties	Ontwerpen Experimenteren Resultaten analyseren Kwaliteitsbeheer Beheer en administratie Rapporteren en presenteren Planmatig en projectmatig werken Samenwerken (multidisciplinair) Sturen professionele ontwikkeling
Beroepstaak, beroepstaken	Uitvoeren van natuurwetenschappelijk onderzoek
Beroepsproducten	Plan van aanpak, (poster)presentatie
Samenhang	In de minor Drug Discovery wordt gestreefd te werken aan reguliere opdrachten uit het bedrijfsleven (multidisciplinair) waarbij bio-moleculaire technologie en chemie samen komen.
Deelnameplicht onderwijs	Deelname aan praktijk en projectgroep/tutor is verplicht.

Maximaal aantal deelnemers	20 (HAN + AVANS samen)
Compensatie mogelijkheden	geen compensatie
Activiteiten en/of werkvormen	Ondersteunend vakken Drug Discovery en activiteiten/toepassingen Theorie • Target identificatie en validatie • “Assay development • “HTS en compound libraries/eigenschappen • “Hit en lead optimalisatie • “Pre development fase, *Werkvorm: hoorcollege* Casus uitwerken (simulatie/droge opdracht) en werkbesprekingen *Werkvorm: tutor en groepsopdracht / zelfstudie* Werkbezoek bedrijven Plan van aanpak schrijven voor onderzoek aan bedrijfsopdracht *Werkvorm: groepsopdracht* Praktijk onderwijs (uitvoeren praktijkopdracht), experimenteren en zelf ervaren. *Werkvorm: praktijk*
Verplichte literatuur	Drug Discovery and Development. Technology in Transition. Eds. H.P. Rang
Verplichte Software / verplicht materiaal	ChemSketch (www.acdlabs.com; of vergelijkbaar) LabArchives
Aanbevolen literatuur	
Tentaminering	
	M_ATBC-M-DD-K
Naam (deel)tentamen	Kennistoets
Code (deel)tentamen	M_ATBC-M-DD-K
Vorm(en) (deel)tentamen	Individueel, Schriftelijk, Open vragen
Oordeel	Cijfer
Minimaal oordeel	5,5
Weging deeltentamen	1
Tentamenmomenten Toegestane hulpmiddelen	Periode 3, herkansing periode 4
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Aanmelden voor het deeltentamen via Alluris. De aanmeldingstermijn is een aantal weken voorafgaand aan die toetsperiode of de herkansingsperiode. De termijn staat aangegeven in het jaarrooster van de Academie ATBC op Insite-roosters.
Nabespreking en inzage	• In het ATBC jaarrooster is aangegeven wanneer de tentamenperiodes zijn en wanneer het gemaakte werk ingezien kan worden. Inzage gebeurt

	in aanwezigheid van een surveillant. • De nabespreking van het tentamen wordt ingeroosterd in de volgende onderwijsperiode. Nabespreking van tentamens gemaakt in een herkansingsperiode worden ingeroosterd aan het eind van de onderwijsperiode. • Geef bij de examinator/coursetrekker aan of je gebruik wilt maken van de mogelijkheid om het tentamen na te bespreken. Als er geen belangstelling is, gaat de nabespreking niet door. • Deelname aan de nabespreking is alleen toegestaan als je het tentamen hebt gemaakt.
Aantal examinatoren	Twee examinatoren voor de constructie en evaluatie. Beoordeling door één examinator op basis van antwoordmodel (theoriedocent).
Toegestane hulpmiddelen	
Compensatiemogelijkheden	
Beoordelingsdimensies	Target identificatie en validatie": Kennis van het proces van moleculair target identificatie en validatie van functie en effect. "Assay development": kennis van verschillen in assay technieken met hun voor en nadelen. "HTS en compound libraries/eigenschappen" Begrip van verschillende benaderingen in HTS en welke soorten stoffenbibliotheken daarbij horen. Kennis van drug-like en hit-like eigenschappen van verbindingen. "Hit en lead optimalisatie": Het proces van hit en lead optimalisatie, met daarbij aandacht voor de multidimensionale kant van deze optimalisatie zoals bv. metabolisme, toxiciteit, nieuwheid, PK, ADME etc. "Pre development fase, kennis omtrent de patenten (IP), safety, scale-up strategien, quality assurance
Beoordelingscriteria	Onderdeel 1: Target identificatie en validatie De student heeft kennis van en inzicht in het proces en de benodigde technologieën om nieuwe biologische targets (eiwitten, DNA, RNA) voor ziektebeelden te identificeren en te valideren. Onderdeel 2: Assay development De student heeft kennis van en inzicht in het proces van en de benodigde technologieën om robuuste assays te generen om activatie of remming van biologische targets te kunnen meten. Onderdeel 3: HTS en compound libraries/eigenschappen De student heeft kennis van en inzicht in het proces en de technologieën nodig voor het uitvoeren van high throughput screenen(HTS). Daarnaast heeft de student inzicht in de benodigde eigenschappen van chemische stoffen welke nodig zijn om verdere optimalisatie mogelijk te maken. Verder heeft de student kennis van verschillende typen van stoffenbibliotheken die ingezet worden in screeningscampagnes. De student kent het proces van actives naar confirmed hit. Onderdeel 4. Hit en lead optimalisatie": De student heeft kennis van en inzicht in het proces van confirmed hit naar lead compound en van lead compound naar development

	kandidaat. Hij weet welke parameters essentieel zijn in dit proces en kan multidimensionaal hiermee omgaan. Onderdeel 5 “Pre development fase De student heeft kennis van en inzicht in de activiteiten die na selectie development kandidaat uitgevoerd moeten worden, voordat een kandidaat stof ook daadwerkelijk de klinische fase in gaat.
Toetsmatrijs	~20% Target identificatie en validatie ~20% Assay development ~20%“HTS en compound libraries/eigenschappen ~20%“Hit en lead optimalisatie: ~20% Pre development fase,
	M_ATBC-M-DD-V
Naam (deel)tentamen	Onderzoeksvoorstel (Plan van aanpak)
Code (deel)tentamen	M_ATBC-M-DD-V
Vorm(en) (deel)tentamen	Groep, Schriftelijk
Oordeel	Cijfer
Minimaal oordeel	5,5
Weging deeltentamen	1
Tentamenmomenten	Periode 3, herkansing periode 4
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Deelname aan OWE M_ATBC-M-DD geldt als aanmelding voor M_ATBC-M-DD-V.
Nabespreking en inzage	Het aan de student teruggeven van het ingevulde beoordelingsformulier en eventueel opmerkingen op het formulier of in het beroepsproduct geldt als inzage en nabespreking van dit deeltentamen.
Aantal examinatoren	Beoordeling door twee examinatoren op basis van beoordelingsformulier.
Compensatiemogelijkheden	
Beoordelingsdimensies	Competentie 1: Ontwerpen 1.3.3. Zoekt, selecteert en verwerkt (zelfstandig) informatie uit relevante bronnen voor natuurwetenschappelijk onderzoek. 1.3.4.Formuleert op basis van gegeven onderzoeksvraag zelfstandig deelvragen met bijbehorende hypotheses. 1.3.6. Begrijpt complexe Engelstalige literatuur in de context van de module en past deze toe. 1.3.7. Legt verbanden van eigen onderzoek met overkoepelend project. Competentie 2: Experimenteren voorbereiden 2.3.1. Kan alle stappen van de experimenten theoretisch verantwoorden. Competentie 6: Rapporteren en presenteren 6.3.1. Rapporteert over zijn onderzoek in vorm van een verslag/labjournaal volgens internationaal geldende regels (productcriteria labjournaal en verslag (niveau 3):

	- hanteert correcte spelling, grammatica, zinsbouw en wetenschappelijke stijl; - brengt helder en logische structuur aan in complexere teksten; - is zich bewust van samenhang tussen tekstonderdelen; - opbouw van tekst is conform in het werkveld gebruikte richtlijnen; - rapport omvat een literatuurlijst. In de tekst wordt verwezen naar bronnen in literatuurlijst; - beschrijft resultaten zodat de lezer deze begrijpen kan; - gebruikt hiervoor duidelijke gelabelde afbeeldingen en tabellen; - beschrijft alle relevante gegevens in een samenvatting die als zelfstandig geheel gelezen kan worden.
Beoordelingscriteria	Zie beoordelingsformulier voor onderzoeksvoorstel op #OnderwijsOnline bij Algemene Informatie.
Toetsmatrijs	Zie beoordelingsformulier voor onderzoeksvoorstel op #OnderwijsOnline bij Algemene Informatie.
	M_ ATBC-M-BN-PA
Naam (deel)tentamen	Presentatie en assessment
Code (deel)tentamen	M_ATBC-M-DD-PA
Vorm(en) (deel)tentamen	Individueel, mondeling
Oordeel	Cijfer
Minimaal oordeel	5,5
Weging deeltentamen	1
Tentamenmomenten	Periode 4, herkansing eind periode 4
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Deelname aan OWE M_ATBC-M-DD geldt als aanmelding voor M_ATBC-M-DD-PA.
Nabespreking en inzage	Het aan de student teruggeven van het ingevulde beoordelingsformulier en eventueel opmerkingen op het formulier of in het beroepsproduct geldt als inzage en nabespreking van dit deeltentamen.
Aantal examinatoren	Beoordeling door twee examinatoren op basis van beoordelingsformulier.
Compensatiemogelijkheden	
Beoordelingsdimensies	Competentie 1: Ontwerpen van experimentele opzet 1.3.3. Zoekt, selecteert en verwerkt zelfstandig informatie uit relevante bronnen voor natuurwetenschappelijk onderzoek. 1.3.4. Formuleert op basis van gegeven onderzoeksvraag zelfstandig deelvragen met bijbehorende hypotheses. 1.3.6. Begrijpt complexe Engelstalige literatuur in de context van de module en past deze toe. 1.3.7. Legt verbanden van eigen onderzoek met overkoepelend project. Competentie 2: Experimenteren Voorbereiding 2.1.2. Maakt voorberekeningen. Competentie 3: Resultaten analyseren

	3.2.1. (3.3.1) Voert (zelfstandig) op de juiste wijze volgens de geschikte methoden de analyse van de resultaten uit; i.v.t. maakt hiervoor gebruik van statistiek. 3.1.2. (3.3.2) Doet (zelfstandig) uitspraak over de bruikbaarheid van de behaalde resultaten op basis van nauwkeurigheid en betrouwbaarheid. 3.3.3. Trekt zelfstandig conclusie m.b.t. de onderzoeksvraagstelling (als mogelijk) (en overkoepelend project). 3.2.5. (3.3.5) Bediscussieert (zelfstandig) resultaten in relatie met andere deelexperimenten en vergelijkt (legt verbanden) met literatuurwaarden. 3.2.6. Maakt verbetervoorstellen voor de uitvoering van het onderzoek. 3.3.7. Maakt voorstellen voor vervolgexperimenten. Competentie 4: Kwaliteitsbeheer 4.1.3. Gebruikt controles, waarvan het resultaat een uitspraak doet over de betrouwbaarheid van de resultaten. Competentie 6: Rapporteren en presenteren 6.3.1. Rapporteert over zijn onderzoek in vorm van een verslag/labjournaal volgens internationaal geldende regels (productcriteria labjournaal en verslag niveau 3):hanteert correcte spelling, grammatica, zinsbouw en wetenschappelijke stijl; brengt helder en logische structuur aan in complexere teksten. Er is sprake van samenhang tussen tekstonderdelen; is zich bewust van samenhang tussen tekstonderdelen; opbouw van tekst is conform in het werkveld gebruikte richtlijnen; rapport omvat een literatuurlijst. In de tekst wordt verwezen naar bronnen in literatuurlijst; beschrijft resultaten zodat de lezer deze begrijpen kan; gebruikt hiervoor duidelijke gelabelde afbeeldingen en tabellen; beschrijft alle relevante gegevens in een samenvatting die als zelfstandig geheel gelezen kan worden. 6.3.5. Presenteert onderzoek aan diverse groep toehoorders op heldere en overtuigende wijze volgens de normen van presentatietechnieken en beantwoord vragen: Er zit structuur in de presentatie (kop-romp-staart); Spreekt duidelijk en verstaanbaar; Staat rechtop en laat de handen vrij; Maakt oogcontact met het publiek en controleert of essentie van boodschap bij doelgroep overkomt; Maakt overzichtelijke en duidelijke slides of andere visuele producten; Verbale en visuele boodschap vormen een geheel; Gebruikt mogelijkheden van PowerPoint als visuele ondersteuning voor het overbrengen van de boodschap; Gaat inhoudelijke discussie met publiek aan. Competentie 8: Samenwerken 8.1.6. Houdt oogcontact met gesprekspartner. 8.1.7. Laat anderen uitpraten. 8.2.5. Neemt initiatief voor gesprek. 8.2.8. Brengt zijn haar mening/boodschap helder onder woorden.

	8.3.10. Sluit aan bij gesprekspartner/toetst of boodschap is overgekomen. 8.3.11. Houdt gespreksdoel in het oog. 8.2.12. Is zich bewust van interculturele verschillen in het werkveld Competentie 11 Sturen professionele ontwikkeling Geeft eigen competentieontwikkeling vorm 11.2.1. Benoemt zijn sterke en zwakke kanten. 11.1.2. Werkt aan leerdoelen volgens POP en verzamelt competentiebewijzen 11.2.6. Is zich bewust van de internationaal geaccepteerde wetenschappelijke gedragscode. 11.2.7. Formuleert en beargumenteert een mening met betrekking tot ethische aspecten van het beroepenveld. 11.3.3. Kijkt kritisch terug (reflecteert) op eigen handelingen en leerproces; leert van zijn fouten; staat open voor leermomenten.
Beoordelingscriteria	Zie beoordelingsformulier voor presentatie en assessment op #OnderwijsOnline bij Algemene Informatie.
Toetsmatrijs	Zie beoordelingsformulier voor presentatie en assessment op #OnderwijsOnline bij Algemene Informatie.
	M_ATBC-M-DD-P
Naam (deel)tentamen	Praktische werkzaamheden
Code (deel)tentamen	M_ATBC-M-DD-P
Vorm(en) (deel)tentamen	Individueel, Praktijk
Oordeel	cijfer
Minimaal oordeel	5,5
Weging deeltentamen	2
Tentamenmomenten	Periode 4. Voor deelname aan deeltentamen P is er maar één kans per studiejaar (OER paragraaf 8.5)
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Deelname aan OWE M_ATBC-M-DD geldt als aanmelding voor M_ATBC-M-DD-P.
Nabespreking en inzage	Het aan de student teruggeven van het ingevulde beoordelingsformulier en eventueel opmerkingen op het formulier of in het beroepsproduct geldt als inzage en nabespreking van dit deeltentamen.
Aantal examinatoren	Beoordeling door twee examinatoren op basis van beoordelingsformulier.
Compensatiemogelijkheden	
Beoordelingsdimensies	Competentie 1: Ontwerpen van experimentele opzet 1.3.3. Zoekt, selecteert en verwerkt zelfstandig informatie uit relevante bronnen voor natuurwetenschappelijk onderzoek. 1.3.4. Formuleert op basis van gegeven onderzoeksvraag zelfstandig deelvragen met bijbehorende hypotheses. 1.3.5. Integreert informatie zelfstandig om tot een beargumenteerd (b.v. geschiktheid methode en beschikbaarheid apparatuur) onderzoeksplan te komen.

	1.3.6 Begrijpt complexe Engelstalige literatuur in de context van de module en past deze toe. Competentie 2: Experimenteren 2.1.2. Maakt voorberekeningen. 2.1.5. Voert de experimenten binnen de gestelde tijd uit. 2.2.1., (2.3.1.) Kan de basis (alle) stappen van de experimenten theoretisch verantwoorden. 2.2.3., (2.3.3.) Zorgt (zelfstandig) ervoor dat alle benodigdheden klaar staan voordat met het experiment begonnen wordt; maakt oplossingen. 2.2.4., (2.3.4.) Voert experimenten volgens protocol uit zodat betrouwbare reproduceerbare data wordt verkregen, (maar kan hiervan afwijken indien nodig); weet te allen tijde exact wat hij/zij doet. 2.2.6. Maakt een begin met het tegelijkertijd uitvoeren van meerdere experimenten (multitasking) 2.3.6. werkt aan meerdere experimenten tegelijkertijd en kan deze uitvoeren binnen de gestelde tijd, kan makkelijk switchen en behoudt overzicht. 2.2.7. Doet een poging om problemen op te lossen als het experiment niet loopt zoals was voorzien (trouble shooting) 2.3.7. lost praktische problemen op als het experiment niet loopt zoals was voorzien (trouble shooting). Competentie 3: Resultaten analyseren 3.1.2., (3.3.2.) Doet (zelfstandig) uitspraak over de bruikbaarheid van de behaalde resultaten op basis van nauwkeurigheid en betrouwbaarheid. 3.2.1., (3.3.1.) Voert (zelfstandig) op de juiste wijze volgens de geschikte methoden de analyse van de resultaten uit; i.v.t. maakt hiervoor gebruik van statistiek. 3.2.3., (3.3.3.) Trekt zelfstandig conclusie m.b.t. de onderzoeksvraagstelling (als mogelijk) (en overkoepelend project). 3.2.5., (3.3.5.) Bediscussieert (zelfstandig) resultaten in relatie met andere deelexperimenten en vergelijkt met literatuurwaarden. 3.2.6. Maakt verbetervoorstellen voor de uitvoering van het onderzoek. 3.3.7. Maakt voorstellen voor vervolgexperimenten. Competentie 4: Kwaliteitsbeheer 4.1.1. Stelt zich op de hoogte van de veiligheids (arbo)- en milieuregels en werkt volgens deze regels. 4.1.3. Gebruikt controles, waarvan het resultaat een uitspraak doet over de betrouwbaarheid van de resultaten. 4.3.4. Controleert de houdbaarheid van reagentia en oplossingen. Competentie 5: Beheer en administratie 5.2.1. Codeert chemicaliën en monsters en bewaart deze op correcte wijze. 5.2.2. Draagt bij aan een efficiënt functionerend lab (ruimt op, signaleert als reagentia bijna op zijn, pleegt klein onderhoud aan de apparatuur).

	5.2.3. Beheert en archiveert gegevens in labjournaal (doel, experimenten- beschrijving, resultaten, conclusie) en i.v.t. op andere manieren zodat anderen deze kunnen begrijpen. Competentie 6: Rapporteren en presenteren 6.3.1. Rapporteert over zijn onderzoek in vorm van een verslag/labjournaal volgens internationaal geldende regels (productcriteria labjournaal en verslag niveau 3):hanteert correcte spelling, grammatica, zinsbouw en wetenschappelijke stijl; brengt helder en logische structuur aan in complexere teksten. Er is sprake van samenhang tussen tekstonderdelen; is zich bewust van samenhang tussen tekstonderdelen; opbouw van tekst is conform in het werkveld gebruikte richtlijnen; rapport omvat een literatuurlijst. In de tekst wordt verwezen naar bronnen in literatuurlijst; beschrijft resultaten zodat de lezer deze begrijpen kan; gebruikt hiervoor duidelijke gelabelde afbeeldingen en tabellen; beschrijft alle relevante gegevens in een samenvatting die als zelfstandig geheel gelezen kan worden Competentie 7: Planmatig/projectmatig werken 7.2.1., (7.3.1) Plant en organiseert zijn experimenten resulterend in een werkplan dat minimaal 4 praktijklessen bestrijkt (Plant en organiseert zijn project resulterend in een werkplan van minimaal 4 weken). 7.2.2. Voert werkzaamheden volgens planning uit; ook onder tijdsdruk. 7.2.3. Ziet erop toe dat doelen worden behaald en stuurt werkzaamheden eventueel bij. 7.3.4. Speelt in op wijzigende omstandigheden; bepaalt prioriteiten in werkzaamheden. Competentie 8: Samenwerken 8.1.9. Toont initiatief conflicten actief op te lossen. 8.2.12. Is zich bewust van interculturele verschillen in het werkveld. 8.3.9. Weet goed met conflicten om te gaan Competentie 11: Sturen professionele ontwikkeling 11.2.5. Handelt integer, past zich snel aan, toont doorzettingsvermogen en is gemotiveerde student.
Beoordelingscriteria	Zie beoordelingsformulier voor Praktijk op #OnderwijsOnline bij Algemene Informatie.
Toetsmatrijs	Zie beoordelingsformulier voor Praktijk op #OnderwijsOnline bij Algemene Informatie.

M_ATBC-M-CHP Medische Diagnostiek: Cytologie en Histopathologie (30 credits) (Dutch)

	M_ATBC-M-CHP
Algemene informatie	
Doelgroep	Voltijd studenten hoofdfase Biologie en Medisch Laboratoriumonderzoek, niveau 3
Naam onderwijseenheid	Minor Medische diagnostiek: cytologie en histopathologie / Minor Medical diagnostics: cytology and histopathology
Code onderwijseenheid	M_ATBC-M-CHP

Onderwijsperiode	Periode 1-2
Studiepunten	30 stp
Studielast in uren	840 SBU
Onderwijstijd (contacturen)	Geprogrammeerde contacttijd: 25 lesuren p/week; 350 lesuren totaal = 262 klokuren. Geprogrammeerde onderwijstijd voor zelfwerkzaamheid: 578 klokuren. Totaal: 840 klokuren.
Ingangseisen onderwijseenheid	De competenties die in deze Minor aan de orde zijn, zijn op niveau 2 geoefend. OWE BM5 of BM6B praktijk is met een voldoende afgesloten en BM6A1/2 en C zijn gevolgd. Voor aanvang aan deze OWE dient de student minimaal zijn/haar propedeuse behaald te hebben (Bij deelnemers aan de verkorte route uitzonderingen mogelijk).
Inhoud en organisatie	
Algemene omschrijving	De bestudering van genetische, biochemische, functionele en vooral de cytohistopathologische aspecten van ziekte en de cytohistotechniek staan centraal in deze minor. Ook is er aandacht voor moleculair biologische technieken en immunologische technieken en is er aandacht voor onderzoeksvaardigheden om voorbereid te zijn en te kunnen participeren in onderzoeken op het gebied van cytohistopathologie. De minor sluit goed aan bij diagnostische-, innovatieve- en researchdisciplines. De voertaal van deze minor is Nederlands.
Eindkwalificaties	Ontwerpen van experimentele opzet Experimenteren Analyseren onderzoeksresultaten Rapporteren / presenteren Planmatig en projectmatig werken Beheer en administratie Samenwerken Sturen professionele ontwikkeling
Beroepstaak, beroepstaken	Uitvoeren van natuurwetenschappelijk onderzoek
Beroepsproducten	Literatuurverslag, Onderzoeksverslag
Samenhang	Deze OWE is het vervolg op de ontwikkelde competenties en kennis uit OWE BM5 (A,B en C) en BM6 (A, B en C), met name BM6. Binnen deze minor cytohistopathologie vindt een verbreding en verdieping plaats van de theoretische kennis en de praktische vaardigheden op het gebied van de cytohistopathologie. Ook is er aandacht voor moleculair biologische technieken en immunologische technieken en is er aandacht voor onderzoeksvaardigheden. De minor sluit goed aan bij diagnostische-, innovatieve- en researchdisciplines.

Deelnameplicht onderwijs	Voor beoordeling praktijk (P) is aanwezigheid bij de praktijklessen verplicht. Voor beoordeling van IPV is aanwezigheid bij de tutorlessen verplicht.
Maximaal aantal deelnemers	16 studenten
Compensatie mogelijkheden	
Activiteiten en/of werkvormen	**Ondersteunend vak Cyto/histotechniek** *Werkwijze: hoorcollege/praktijk/tutor* Informatie en details zie onderwijsonline **Ondersteunend vak Algemene pathologie** *Werkwijze: gecombineerd hoor-/werkcollege* Informatie en details zie onderwijsonline **Ondersteunend vak Speciële Cytohistopathologie** *Werkwijze: gecombineerd hoor-/werkcollege/tutor* Informatie en details zie onderwijsonline **Ondersteunend vak Moleculaire diagnostiek en moleculaire technieken** *Werkwijze: hoorcollege / werkcollege/tutor* Informatie en details zie onderwijsonline **Ondersteunend vak Cytologie** *Werkwijze: praktijk/tutor* Informatie en details zie onderwijsonline
Verplichte literatuur	- Junqueira's, Basic Histology Text and Atlas, 14th edition - © McGraw-Hill Education, 2016 - Grauw, M. de, red., (2001). Gynaecologische cytologie. Leusden: Vereniging Analisten Pathologie. ISBN: 9789080558847 - Bancroft, J.D., & M. Gamble, e.d. (2013). Theory and practice of histological techniques , (seventh edition or later). New York, NY: Elsevier Health Sciences. ISBN: 9780702042263 - Rubin, R., Strayer, D.S., (2007) Rubin's Pathology: Clinicopathologic Foundations of Medicine (Fifth Edition or later) Philadelphia PD: Lippincott Williams and Wilkins. ISBN: 9780781795166
Verplichte Software / verplicht materiaal	
Aanbevolen literatuur	- Van Pelt-Verkuijl, E., Van Leeuwen, W.B. (2013). Moleculaire diagnostiek, (Heron reeks), 2e druk. Utrecht, Syntax media. ISBN: 978907742395 - Reece et al., **Campbell Biology**. San Fransisco, CA: Pearson Education Inc.

	- Murphy K., Janeway's Immunobiology, New York NY: Garland Science - Alberts, B. Taylor & Francis, Molecular Biology of the cell
Tentaminering	
	M_ATBC-M-CHP-T1
Naam (deel)tentamen	Thematoets 1
Code (deel)tentamen	M_ATBC-M-CHP-T1
Vorm(en) (deel)tentamen	Individueel, Schriftelijk, Open vragen
Oordeel	Cijfer
Minimaal oordeel	5,5
Weging deeltentamen	1
Tentamenmomenten	Periode 1, herkansing periode 2
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Aanmelden voor het deeltentamen via Alluris. De aanmeldingstermijn is een aantal weken voorafgaand aan die toetsperiode of de herkansingsperiode. De termijn staat aangegeven in het jaarrooster van de Academie ATBC op Insite-roosters.
Nabespreking en inzage	• In het ATBC jaarrooster is aangegeven wanneer de tentamenperiodes zijn en wanneer het gemaakte werk ingezien kan worden. Inzage gebeurt in aanwezigheid van een surveillant. • De nabespreking van het tentamen wordt ingeroosterd in de volgende onderwijsperiode. Nabespreking van tentamens gemaakt in een herkansingsperiode worden ingeroosterd aan het eind van de onderwijsperiode. • Geef bij de examinator/coursetrekker aan of je gebruik wilt maken van de mogelijkheid om het tentamen na te bespreken. Als er geen belangstelling is, gaat de nabespreking niet door. • Deelname aan de nabespreking is alleen toegestaan als je het tentamen hebt gemaakt.
Aantal examinatoren	Twee examinatoren voor de constructie en evaluatie. Beoordeling door één examinator op basis van antwoordmodel (theoriedocent).
Compensatiemogelijkheden	
Beoordelingsdimensies	Competentie 1: Ontwerpen 1.3.3. Zoekt, selecteert en verwerkt zelfstandig informatie uit relevante bronnen voor natuurwetenschappelijk onderzoek. Competentie 2: Experimenteren 2.1.2. Maakt voorberekeningen. 2.3.1. Kan alle stappen van de experimenten theoretisch verantwoorden.

	Competentie 3: Resultaten analyseren 3.3.1. Voert zelfstandig op de juiste wijze volgens de geschikte methoden de analyse van de resultaten uit; i.v.t. maakt hiervoor gebruik van statistiek. 3.2.3. Trekt zelfstandig conclusie m.b.t. de onderzoeksvraagstelling (als mogelijk).
Beoordelingscriteria	De student kan behandelde weefsels tekenen, benoemen en verklaren: De student kan de volgende processen beschrijven en theoretisch verantwoorden: - Fixatie, tissue processing, inbedden en snijden - Deparaffineren en rehydratie, kleuren van weefsels - Ontstekingen (acuut/chronisch en cyclo behandeling De student - kan de basisstappen van een protocol voor een kleuring of weefselbehandeling uitleggen en de student kan beargumenteren of een onbekend protocol geschikt is voor het aantonen of bewerken van weefsels Verdere informatie en details zie onderwijsonline
Toetsmatrijs	De context-onderwerpen zijn representatief verdeeld over de toets: -50% Cyto/histo-techniek-Microscopie ~25% Alg. /Spec. Pathologie ~25% Moleculaire diagnostiek en moleculaire technieken
	M_ATBC-M-CHP-T2
Naam (deel)tentamen	Thematoets 2
Code (deel)tentamen	M_ATBC-M-CHP-T2
Vorm(en) (deel)tentamen	Individueel Schriftelijk Open vragen
Oordeel	Cijfer
Minimaal oordeel	5,5
Weging deeltentamen	1
Tentamenmomenten	Periode 2, herkansing periode 3
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Aanmelden voor het deeltentamen via Alluris. De aanmeldingstermijn is een aantal weken voorafgaand aan die toetsperiode of de herkansingsperiode. De termijn staat aangegeven in het jaarrooster van de Academie ATBC op Insite-roosters.
Nabespreking en inzage	• In het ATBC jaarrooster is aangegeven wanneer de tentamenperiodes zijn en wanneer het gemaakte werk ingezien kan worden. Inzage gebeurt in aanwezigheid van een surveillant. • De nabespreking van het tentamen wordt ingeroosterd na het tentamen, maar voor de inzage van het tentamen. • Geef bij de examinator/coursetrekker aan of je gebruik wilt maken van de mogelijkheid om het tentamen na te bespreken. Als er geen belangstelling is, gaat de nabespreking niet door.

	• Deelname aan de nabespreking is alleen toegestaan als je het tentamen hebt gemaakt.
Aantal examinatoren	Twee examinatoren voor de constructie en evaluatie. Beoordeling door één examinator op basis van antwoordmodel (theoriedocent).
Compensatiemogelijkheden	
Beoordelingsdimensies	Competentie 1: Ontwerpen 1.3.3. Zoekt, selecteert en verwerkt zelfstandig informatie uit relevante bronnen voor natuurwetenschappelijk onderzoek. Competentie 2: Experimenteren 2.1.2. Maakt voorberekeningen. 2.3.1. Kan alle stappen van de experimenten theoretisch verantwoorden. Competentie 3: Resultaten analyseren 3.3.1. Voert zelfstandig op de juiste wijze volgens de geschikte methoden de analyse van de resultaten uit; i.v.t. maakt hiervoor gebruik van statistiek. 3.2.3. Trekt zelfstandig conclusie m.b.t. de onderzoeksvraagstelling (als mogelijk). Verdere informatie en details zie onderwijsonline
Beoordelingscriteria	De student kan behandelde weefsels tekenen, benoemen en verklaren: De student kan de volgende processen beschrijven en theoretisch verantwoorden: - fixatie, tissue processing, inbedden en snijden; - deparaffineren en rehydratie, kleuren van weefsels; - fysische fixatie en kleuren van weefsels; - antigenen- antilichamen, immunologie en enzymhistochemie. - ISH en speciale technieken zoals SEM-EDX-CLSM; De student: - kan de basisstappen van een protocol voor een kleuring of weefselbehandeling uitleggen en beargumenteren of een onbekend protocol geschikt is voor het aantonen of bewerken van weefsels; - kan de controles benoemen en uitleggen Verdere informatie en details zie onderwijsonline
Toetsmatrijs	De context-onderwerpen zijn representatief verdeeld over de toets: ~50% Cyto/histo-techniek-Microscopie ~25% Alg. /Spec. Pathologie ~25% Moleculaire diagnostiek en moleculaire technieken
	M_ATBC-M-CHP-K1
Naam (deel)tentamen	Kennistoets 1
Code (deel)tentamen	M_ATBC-M-CHP-K1
Vorm(en) (deel)tentamen	Individueel, Schriftelijk, Multiple Choice

Oordeel	Cijfer
Minimaal oordeel	5,5
Weging deeltentamen	1
Tentamenmomenten	Periode 1, herkansing periode 2
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Aanmelden voor het deeltentamen via Alluris. De aanmeldingstermijn is een aantal weken voorafgaand aan die toetsperiode of de herkansingsperiode. De termijn staat aangegeven in het jaarrooster van de Academie ATBC op Insite-roosters.
Nabespreking en inzage	• In het ATBC jaarrooster is aangegeven wanneer de tentamenperiodes zijn en wanneer het gemaakte werk ingezien kan worden. Inzage gebeurt in aanwezigheid van een surveillant. • De nabespreking van het tentamen wordt ingeroosterd in de volgende onderwijsperiode. Nabespreking van tentamens gemaakt in een herkansingsperiode worden ingeroosterd aan het eind van de onderwijsperiode. • Geef bij de examinator/coursetrekker aan of je gebruik wilt maken van de mogelijkheid om het tentamen na te bespreken. Als er geen belangstelling is, gaat de nabespreking niet door. • Deelname aan de nabespreking is alleen toegestaan als je het tentamen hebt gemaakt.
Aantal examinatoren	Twee examinatoren voor de constructie en evaluatie. Beoordeling door één examinator op basis van antwoordmodel (theoriedocent).
Compensatiemogelijkheden	
Beoordelingsdimensies	In de context van de onderdelen die behandeld zijn zoals vermeld op onderwijsonline zoals: -Risico management, veiligheid en kwaliteitscontrole in de histopathologie -Fixatie, Uitsnijkamer, Tissue processing, Microtomie en kleuringen -Immuunpathologie waaronder Celdood, schade en ontstekingen -(kwantitatieve) PCR, Multiplex PCR, Sequencing, Southern Blot en NGS
Beoordelingscriteria	De student heeft kennis van behandelde organen, weefsels en cellen De student heeft kennis van de volgende processen: - fixatie, tissue processing, inbedden en snijden; - deparaffineren en rehydratie, kleuren van weefsels; De student heeft kennis van de behandelde moleculaire stof mbt -DNA, RNA isolatie en analyse -Primers, probes en labels -Kwaliteit en controles bij PCR-technieken; -Toepassingsgebieden en verschillende bio-informatica tools; -Over huidige en toekomstige ontwikkelingen

	Verdere informatie en details zie onderwijsonline
Toetsmatrijs	De context-onderwerpen zijn representatief verdeeld over de toets: ~50% Cyto/histo-techniek-Microscopie ~50% Alg. /Spec. Pathologie Moleculaire diagnostiek en moleculaire technieken
	M_ATBC-M-CHP-K2
Naam (deel)tentamen	Kennistoets 2
Code (deel)tentamen	M_ATBC-M-CHP-K2
Vorm(en) (deel)tentamen	Individueel, Schriftelijk, Multiple Choice
Oordeel	Cijfer
Minimaal oordeel	5,5
Weging deeltentamen	1
Tentamenmomenten	Periode 2, herkansing periode 3.
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Aanmelden voor het deeltentamen via Alluris. De aanmeldingstermijn is een aantal weken voorafgaand aan die toetsperiode of de herkansingsperiode. De termijn staat aangegeven in het jaarrooster van de Academie ATBC op Insite-roosters.
Nabespreking en inzage	• In het ATBC jaarrooster is aangegeven wanneer de tentamenperiodes zijn en wanneer het gemaakte werk ingezien kan worden. Inzage gebeurt in aanwezigheid van een surveillant. • De nabespreking van het tentamen wordt ingeroosterd na het tentamen, maar voor de inzage van het tentamen. • Geef bij de examinator/coursetrekker aan of je gebruik wilt maken van de mogelijkheid om het tentamen na te bespreken. Als er geen belangstelling is, gaat de nabespreking niet door. • Deelname aan de nabespreking is alleen toegestaan als je het tentamen hebt gemaakt.
Aantal examinatoren	Twee examinatoren voor de constructie en evaluatie. Beoordeling door één examinator op basis van antwoordmodel (theoriedocent).
Compensatiemogelijkheden	
Beoordelingsdimensies	In de context van de onderdelen die behandeld zijn zoals vermeld op onderwijsonline zoals: -Veiligheid en kwaliteitscontrole in de histopathologie -Fixatie, Uitsnijkamer, Tissue processing, Microtomie en kleuringen -Immuunpathologie en cyclofosfamide -Antigenen- antilichamen, immunologie en enzymhistochemie. -ISH en speciale technieken zoals SEM-EDX-CLSM;
Beoordelingscriteria	De student heeft kennis van behandelde organen, weefsels en cellen De student kan de volgende processen beschrijven en theoretisch verantwoorden:

	- fixatie, tissue processing, inbedden en snijden; - deparaffineren en rehydratie, kleuren van weefsels; -Antigenen- antilichamen, immunologie en enzymhistochemie. -ISH en speciale technieken zoals SEM-EDX-CLSM; De student: - kan de basisstappen van een protocol voor een kleuring of weefselbehandeling uitleggen en beargumenteren of een onbekend protocol geschikt is voor het aantonen of bewerken van weefsels; Verdere informatie en details zie onderwijsonline
Toetsmatrijs	De context-onderwerpen zijn representatief verdeeld over de toets: ~50% Cyto/histo-techniek-Microscopie ~25% Alg. /Spec. Pathologie ~25% Moleculaire diagnostiek en moleculaire technieken
	M_ATBC-M-CHP-Ph1
Naam (deel)tentamen	Praktijk histotechniek 1
Code (deel)tentamen	M_ATBC-M-CHP-Ph1
Vorm(en) (deel)tentamen	Individueel, Praktijk
Oordeel	Cijfer
Minimaal oordeel	5,5
Weging deeltentamen	1
Tentamenmomenten	Periode 1. Voor deelname aan deeltentamen Ph1 is er maar één kans per studiejaar (OER paragraaf 8.5)
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Deelname aan OWE M_ATBC-M-CHP geldt als aanmelding voor M_ATBC-M-CHP-Ph1
Nabespreking en inzage	Het aan de student teruggeven van het ingevulde beoordelingsformulier en eventueel opmerkingen op het formulier of in het beroepsproduct geldt als inzage en nabespreking van dit deeltentamen.
Aantal examinatoren	Beoordeling door twee examinatoren op basis van beoordelingsformulier (Praktijkdocenten).
Compensatiemogelijkheden	
Beoordelingsdimensies	Competentie 1: Ontwerpen van experimentele opzet 1.3.3. Zoekt, selecteert en verwerkt zelfstandig informatie uit relevante bronnen voor natuurwetenschappelijk onderzoek. 1.3.5. Integreert informatie zelfstandig om tot een beargumenteerd (b.v. geschiktheid methode en beschikbaarheid apparatuur) onderzoeksplan te komen. 1.3.6. Begrijpt complexe Engelstalige literatuur in de context van de module en past deze toe.

	Competentie 2: Experimenteren 2.1.2. Maakt voorberekeningen. 2.2.7. Doet een poging om problemen op te lossen als het experiment niet loopt zoals was voorzien (trouble shooting). 2.3.1. Kan alle stappen van de experimenten theoretisch verantwoorden. 2.3.3. Zorgt er zelfstandig voor dat alle benodigdheden klaar staan voordat met het experiment begonnen wordt; maakt oplossingen. 2.3.4. Voert experimenten zelfstandig volgens protocol uit zodat betrouwbare reproduceerbare data wordt verkregen, maar kan hiervan afwijken indien nodig; weet te allen tijde exact wat hij/zij doet. 2.3.6. Werkt aan meerdere experimenten tegelijkertijd en kan deze uitvoeren binnen de gestelde tijd, kan makkelijk switchen en behoudt overzicht. 2.3.8. Maakt zich technieken snel eigen. Competentie 3: Resultaten analyseren 3.1.2. Doet uitspraak over de bruikbaarheid van de behaalde resultaten op basis van nauwkeurigheid en betrouwbaarheid. 3.1.4. Bediscussieert de uitvoering en de resultaten van het experiment. 3.2.5. Bediscussieert resultaten in relatie met andere deelexperimenten en vergelijkt met literatuurwaarden. 3.3.1. Voert zelfstandig op de juiste wijze volgens de geschikte methoden de analyse van de resultaten uit; i.v.t. maakt hiervoor gebruik van statistiek. Competentie 4: Kwaliteitsbeheer 4.1.1. Stelt zich op de hoogte van de veiligheids (Arbo)- en milieuregels en werkt volgens deze regels. 4.1.2. IJkt simpele apparatuur (pH meters, pipetten) gaat correct om met materialen en apparatuur. 4.1.3 Gebruikt controles, waarvan het resultaat een uitspraak doet over de betrouwbaarheid van de resultaten. 4.3.5 Houdt zich aan de voorgeschreven kwaliteitsvoorschriften. Competentie 5: Beheer en administratie 5.2.1. Codeert chemicaliën en monsters en bewaart deze op correcte wijze. 5.2.2. Draagt bij aan een efficiënt functionerende lab (ruimt op, signaleert als reagentia bijna op zijn, pleegt klein onderhoud aan de apparatuur). 5.2.3. Beheert en archiveert gegevens in labjournaal (doel, experimenten-beschrijving, resultaten, conclusie) en i.v.t. op andere manieren zodat anderen deze kunnen begrijpen. Competentie 6: Rapporteren

	6.3.1. Rapporteert (over zijn onderzoek) in vorm van een verslag/labjournaal/ volgens internationaal geldende regels (productcriteria labjournaal en verslag niveau 3): - hanteert correcte spelling, grammatica, zinsbouw en wetenschappelijke stijl; - brengt helder en logische structuur aan in complexere teksten. Er is sprake van samenhang tussen tekstonderdelen; - is zich bewust van samenhang tussentekstonderdelen; - opbouw van tekst is conform in het werkveld gebruikte richtlijnen; - rapport omvat een literatuurlijst. In de tekst wordt verwezen naar bronnen in literatuurlijst; - beschrijft resultaten zodat de lezer deze begrijpen kan; - gebruikt hiervoor duidelijke gelabelde afbeeldingen en tabellen; - beschrijft alle relevante gegevens in een samenvatting die als zelfstandig geheel gelezen kan worden. Competentie 7: Planmatig en projectmatig werken 7.2.1. Plant en organiseert zijn experimenten resulterend in een werkplan dat minimaal 4 praktijklessen bestrijkt. 7.2.2. Voert werkzaamheden volgens planning uit; ook onder tijdsdruk. 7.2.3. Ziet erop toe dat doelen worden behaald en stuurt werkzaamheden eventueel bij. 7.2.4. Speelt in op wijzigende omstandigheden. 7.3.1. Plant en organiseert zijn project resulterend in een werkplan van minimaal 4 weken. Competentie 10: Adviseren 10.2.2. Adviseert over methode nadat meerdere alternatieven zijn getest en presenteert onderbouwde keuze. Competentie 11: Sturen professionele ontwikkeling 11.2.5. Handelt integer, past zich snel aan, toont doorzettingsvermogen en is gemotiveerde student.
Beoordelingscriteria	Zie beoordelingsformulier “Praktijk” op #OnderwijsOnline bij Algemene Informatie. Tijdens de praktijk zal een onderzoeksverslag worden geschreven en is er aandacht voor verdieping van de meer complexere histologische technieken, zie hiervoor beoordelingsformulier online “verslag stage” Hierbij vormt de beoordeling kleuringen en snijden etc. inclusief eventuele eindopdracht = eindcijfer praktijk. De beoordeling vragen algemeen of workflow immunologie of vragen cryotechnieken = eindcijfer theorie.

	De beoordeling snelheid, motivatie en inzet = eindcijfer planning. De beoordeling labjournaal op diepgang, details en netheid = eindcijfer labjournaal.
Toetsmatrijs	Zie beoordelingsformulier “Praktijk” op #OnderwijsOnline - algemene informatie
	M_ATBC-M-CHP-Ph2
Naam (deel)tentamen	Praktijk histotechniek 2
Code (deel)tentamen	M_ATBC-M-CHP-Ph2
Vorm(en) (deel)tentamen	Individueel, Praktijk
Oordeel	Cijfer
Minimaal oordeel	5,5
Weging deeltentamen	1
Tentamenmomenten	Periode 2. Voor deelname aan deeltentamen Ph2 is er maar één kans per studiejaar (OER paragraaf 8.5)
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Deelname aan OWE M_ATBC-M-CHP geldt als aanmelding voor M_ATBC-M-CHP-Ph2
Nabespreking en inzage	Het aan de student teruggeven van het ingevulde beoordelingsformulier en eventueel opmerkingen op het formulier of in het beroepsproduct geldt als inzage en nabespreking van dit deeltentamen.
Aantal examinatoren	Beoordeling door twee examinatoren op basis van beoordelingsformulier (Praktijkdocenten).
Compensatiemogelijkheden	
Beoordelingsdimensies	Competentie 1: Ontwerpen van experimentele opzet 1.3.3. Zoekt, selecteert en verwerkt zelfstandig informatie uit relevante bronnen voor natuurwetenschappelijk onderzoek. 1.3.5. Integreert informatie zelfstandig om tot een beargumenteerd (b.v. geschiktheid methode en beschikbaarheid apparatuur) onderzoeksplan te komen. 1.3.6. Begrijpt complexe Engelstalige literatuur in de context van de module en past deze toe. Competentie 2: Experimenteren 2.1.2. Maakt voorberekeningen. 2.2.7. Doet een poging om problemen op te lossen als het experiment niet loopt zoals was voorzien (trouble shooting). 2.3.1. Kan alle stappen van de experimenten theoretisch verantwoorden. 2.3.3. Zorgt er zelfstandig voor dat alle benodigdheden klaar staan voordat met het experiment begonnen wordt; maakt oplossingen. 2.3.4. Voert experimenten zelfstandig volgens protocol uit zodat betrouwbare reproduceerbare data wordt verkregen, maar kan

	hiervan afwijken indien nodig; weet te allen tijde exact wat hij/zij doet. 2.3.6. Werkt aan meerdere experimenten tegelijkertijd en kan deze uitvoeren binnen de gestelde tijd, kan makkelijk switchen en behoudt overzicht. 2.3.8. Maakt zich technieken snel eigen. Competentie 3: Resultaten analyseren 3.1.2. Doet uitspraak over de bruikbaarheid van de behaalde resultaten op basis van nauwkeurigheid en betrouwbaarheid. 3.1.4. Bediscussieert de uitvoering en de resultaten van het experiment. 3.2.5. Bediscussieert resultaten in relatie met andere deelexperimenten en vergelijkt met literatuurwaarden. 3.3.1. Voert zelfstandig op de juiste wijze volgens de geschikte methoden de analyse van de resultaten uit; i.v.t. maakt hiervoor gebruik van statistiek. Competentie 4: Kwaliteitsbeheer 4.1.1. Stelt zich op de hoogte van de veiligheids (Arbo)- en milieuregels en werkt volgens deze regels. 4.1.2. IJkt simpele apparatuur (pH meters, pipetten). 4.1.3 Gebruikt controles, waarvan het resultaat een uitspraak doet over de betrouwbaarheid van de resultaten. 4.3.5 Houdt zich aan de voorgeschreven kwaliteitsvoorschriften. Competentie 5: Beheer en administratie 5.2.1. Codeert chemicaliën en monsters en bewaart deze op correcte wijze. 5.2.2. Draagt bij aan een efficiënt functionerende lab (ruimt op, signaleert als reagentia bijna op zijn, pleegt klein onderhoud aan de apparatuur). 5.2.3. Beheert en archiveert gegevens in labjournaal (doel, experimenten-beschrijving, resultaten, conclusie) en i.v.t. op andere manieren zodat anderen deze kunnen begrijpen. Competentie 6: Rapporteren 6.3.1. Rapporteert over zijn onderzoek in vorm van een verslag/labjournaal volgens internationaal geldende regels (productcriteria labjournaal en verslag niveau 3):hanteert correcte spelling, grammatica, zinsbouw en wetenschappelijke stijl; brengt helder en logische structuur aan in complexere teksten. Er is sprake van samenhang tussen tekstonderdelen; is zich bewust van samenhang tussentekstonderdelen; opbouw van tekst is conform in het werkveld gebruikte richtlijnen; rapport omvat een literatuurlijst. In de tekst wordt verwezen naar bronnen in literatuurlijst; beschrijft resultaten zodat de lezer deze begrijpen kan; gebruikt hiervoor duidelijke gelabelde afbeeldingen en tabellen;

	beschrijft alle relevante gegevens in een samenvatting die als zelfstandig geheel gelezen kan worden. 6.2.3. Is bekend met internationale wetenschappelijke en academische schrijfstijlen en past deze toe. Competentie 7: Planmatig en projectmatig werken 7.2.1. Plant en organiseert zijn experimenten resulterend in een werkplan dat minimaal 4 praktijklessen bestrijkt. 7.2.2. Voert werkzaamheden volgens planning uit; ook onder tijdsdruk. 7.2.3. Ziet erop toe dat doelen worden behaald en stuurt werkzaamheden eventueel bij. 7.2.4. Speelt in op wijzigende omstandigheden. 7.3.1. Plant en organiseert zijn project resulterend in een werkplan van minimaal 4 weken. Competentie 10: Adviseren 10.2.2. Adviseert over methode nadat meerdere alternatieven zijn getest en presenteert onderbouwde keuze. Competentie 11: Sturen professionele ontwikkeling 11.2.5. Handelt integer, past zich snel aan, toont doorzettingsvermogen en is gemotiveerde student.
Beoordelingscriteria	Zie beoordelingsformulier “Praktijk”. op #OnderwijsOnline bij Algemene Informatie. Tijdens de praktijk zal een onderzoeksverslag worden geschreven en is er aandacht voor verdieping van de meer complexere histologische technieken, zie hiervoor beoordelingsformulier online “verslag stage”. Hierbij vormt de beoordeling kleuringen en snijden etc. inclusief eventuele eindopdracht = eindcijfer praktijk. De beoordeling vragen algemeen of workflow immunologie of vragen cryotechnieken = eindcijfer theorie. De beoordeling snelheid, motivatie en inzet = eindcijfer planning. De beoordeling labjournaal op diepgang, details en netheid = eindcijfer labjournaal.
Toetsmatrijs	Zie beoordelingsformulier “Praktijk” op #OnderwijsOnline - algemene informatie
	M_ATBC-M-CHP-L
Naam (deel)tentamen	Literatuurverslag
Code (deel)tentamen	M_ATBC-M-CHP-L
Vorm(en) (deel)tentamen	Individueel, Schriftelijk
Oordeel	Cijfer
Minimaal oordeel	5,5

Weging deeltentamen	1
Tentamenmomenten	Periode 1, herkansing periode 2
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Deelname aan OWE M_ATBC-M-CHP geldt als aanmelding voor M_ATBC-M-CHP-L
Nabespreking en inzage	Het aan de student teruggeven van het ingevulde beoordelingsformulier en eventueel opmerkingen op het formulier of in het beroepsproduct geldt als inzage en nabespreking van dit deeltentamen.
Aantal examinatoren	Beoordeling door één examinator op basis van beoordelingsformulier (Praktijkdocent).
Compensatiemogelijkheden	
Beoordelingsdimensies	Competentie 1: Ontwerpen 1.2.1. Identificeert zelfstandig welke achtergrondinformatie benodigd is om de onderzoeksvraag te beantwoorden. 1.2.2., (1.3.3.) Zoekt, selecteert en verwerkt (zelfstandig) informatie uit relevante bronnen voor natuurwetenschappelijk onderzoek. 1.3.6. Begrijpt complexe Engelstalige literatuur in de context van de module en past deze toe. 1.3.7. Legt verbanden van eigen onderzoek met overkoepelend project. Competentie 3: Resultaten analyseren 3.3.3. Trekt zelfstandig conclusie m.b.t. de onderzoeksvraagstelling (als mogelijk) en overkoepelend project. 3.3.7. Maakt voorstellen voor vervolgexperimenten. Competentie 6: Rapporteren en presenteren 6.2.1. Rapporteert (over zijn onderzoek) in vorm van een verslag/labjournaal/poster volgens in opleiding geldende regels (productcriteria labjournaal en verslag niveau 2): hanteert correcte spelling, grammatica,zinsbouw en wetenschappelijke stijl; brengt helder en logische structuur aan in complexere teksten; is zich bewust van samenhang tussen tekstonderdelen; opbouw van tekst is conform in het werkveld gebruikte richtlijnen; rapport omvat een literatuurlijst. In de tekst wordt verwezen naar bronnen in literatuurlijst; beschrijft resultaten zodat de lezer deze begrijpen kan; gebruikt hiervoor duidelijke gelabelde afbeeldingen en tabellen; beschrijft alle relevante gegevens in een samenvatting. 6.3.1. Rapporteert over zijn onderzoek in vorm van een verslag/labjournaal volgens internationaal geldende regels (productcriteria labjournaal en verslag niveau 3):hanteert correcte spelling, grammatica, zinsbouw en wetenschappelijke stijl; brengt helder en logische structuur aan in complexere teksten. Er is sprake van samenhang tussen tekstonderdelen;

	is zich bewust van samenhang tussen tekstonderdelen; opbouw van tekst is conform in het werkveld gebruikte richtlijnen; rapport omvat een literatuurlijst. In de tekst wordt verwezen naar bronnen in literatuurlijst; beschrijft resultaten zodat de lezer deze begrijpen kan; gebruikt hiervoor duidelijke gelabelde afbeeldingen en tabellen; beschrijft alle relevante gegevens in een samenvatting die als zelfstandig geheel gelezen kan worden. 6.2.3. Is bekend met internationale wetenschappelijke en academische schrijfstijlen en past deze toe.
Beoordelingscriteria	Zie beoordelingsformulier “Literatuurverslag Minor CHP” op #OnderwijsOnline - Algemene Informatie.
Toetsmatrijs	Zie beoordelingsformulier “Literatuurverslag Minor CHP” op #OnderwijsOnline - algemene informatie
	M_ATBC-M-CHP-V
Naam (deel)tentamen	Onderzoeksverslag
Code (deel)tentamen	M_ATBC-M-CHP-V
Vorm(en) (deel)tentamen	Schriftelijk, Individueel
Oordeel	Cijfer
Minimaal oordeel	5,5
Weging deeltentamen	1
Tentamenmomenten	Periode 2, herkansing periode 3.
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Deelname aan OWE M_ATBC-M-CHP geldt als aanmelding voor M_ATBC-M-CHP-V
Nabespreking en inzage	Het aan de student teruggeven van het ingevulde beoordelingsformulier en eventueel opmerkingen op het formulier of in het beroepsproduct geldt als inzage en nabespreking van dit deeltentamen.
Aantal examinatoren	Beoordeling door één examinator op basis van beoordelingsformulier (Praktijkdocent).
Compensatiemogelijkheden	
Beoordelingsdimensies	Competentie 1: Ontwerpen 1.3.3. Zoekt, selecteert en verwerkt zelfstandig informatie uit relevante bronnen voor natuurwetenschappelijk onderzoek. 1.3.6. Begrijpt complexe Engelstalige literatuur in de context van de module en past deze toe. 1.3.7. Legt verbanden van eigen onderzoek met overkoepelend project. Competentie 2: Experimenteren 2.3.1. Kan alle stappen van de experimenten theoretisch verantwoorden.

	Competentie 3: Resultaten analyseren 3.1.4. Bediscussieert de uitvoering en de resultaten van het experiment. 3.2.6. Maakt verbetervoorstellen voor de uitvoering van het onderzoek. 3.3.1. Voert zelfstandig op de juiste wijze volgens de geschikte methoden de analyse van de resultaten uit; i.v.t. maakt hiervoor gebruik van statistiek. 3.3.2. Doet zelfstandig uitspraak over de bruikbaarheid van de behaalde resultaten op basis van nauwkeurigheid en betrouwbaarheid. 3.3.3. Trekt zelfstandig conclusie m.b.t. de onderzoeksvraagstelling (als mogelijk) en overkoepelend project. 3.3.5. Bediscussieert zelfstandig resultaten in relatie met andere deelexperimenten en legt verbanden met literatuurwaarden. 3.3.7. Maakt voorstellen voor vervolgexperimenten. Competentie 4: Kwaliteitsbeheer 4.1.3. Gebruikt controles, waarvan het resultaat een uitspraak doet over de betrouwbaarheid van de resultaten. Competentie 5: Beheer en administratie 5.3.3. Beheert en archiveert gegevens in labjournaal (doel, experimentenbeschrijving, wijzigingen, resultaten, conclusie, voorgesteld vervolg) en i.v.t. op andere manieren zodat anderen deze kunnen gebruiken. Competentie 6: Rapporteren en presenteren 6.3.1. Rapporteert over zijn onderzoek in vorm van een verslag/labjournaal volgens internationaal geldende regels (productcriteria labjournaal en verslag niveau 3): hanteert correcte spelling, grammatica, zinsbouw en wetenschappelijke stijl; brengt helder en logische structuur aan in complexere teksten. Er is sprake van samenhang tussen tekstonderdelen; is zich bewust van samenhang tussen tekstonderdelen; opbouw van tekst is conform in het werkveld gebruikte richtlijnen; rapport omvat een literatuurlijst. In de tekst wordt verwezen naar bronnen in literatuurlijst; beschrijft resultaten zodat de lezer deze begrijpen kan; gebruikt hiervoor duidelijke gelabelde afbeeldingen en tabellen; beschrijft alle relevante gegevens in een samenvatting die als zelfstandig geheel gelezen kan worden. 6.2.3. Is bekend met internationale wetenschappelijke en academische schrijfstijlen en past deze toe.
Beoordelingscriteria	Zie beoordelingsformulier “Onderzoeksverslag Minor CHP” op #OnderwijsOnline bij Algemene Informatie.
Toetsmatrijs	Zie beoordelingsformulier “Onderzoeksverslag Minor CHP” op #OnderwijsOnline bij Algemene Informatie.

	M_ATBC-M-CHP-Pc1
Naam (deel)tentamen	Praktijktoets cytodiagnostiek 1
Code (deel)tentamen	M_ATBC-M-CHP-Pc1
Vorm(en) (deel)tentamen	Individueel, Schriftelijk, Praktijk
Oordeel	Cijfer
Minimaal oordeel	5,5
Weging deeltentamen	1
Tentamenmomenten	Periode 1, herkansing periode 2
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Deelname aan OWE M_ATBC-M-CHP geldt als aanmelding voor M_ATBC-M-CHP-Pc1
Nabespreking en inzage	Het aan de student teruggeven van het ingevulde beoordelingsformulier en eventueel opmerkingen op het formulier of in het beroepsproduct geldt als inzage en nabespreking van dit deeltentamen.
Aantal examinatoren	Beoordeling door één examinator op basis van beoordelingsformulier (Praktijkdocent).
Compensatiemogelijkheden	
Beoordelingsdimensies	Competentie 2: Experimenteren 2.2.7. Doet een poging om problemen op te lossen als het experiment niet loopt zoals was voorzien (trouble shooting). 2.3.1. Kan alle stappen van de experimenten theoretisch verantwoorden. 2.3.3. Zorgt er zelfstandig voor dat alle benodigdheden klaar staan voordat met het experiment begonnen wordt; maakt oplossingen. 2.3.4. Voert experimenten (microscoperen) zelfstandig volgens protocol uit zodat betrouwbare reproduceerbare data wordt verkregen, maar kan hiervan afwijken indien nodig; weet te allen tijde exact wat hij/zij doet. 2.3.8. Maakt zich technieken snel eigen. Competentie 3: Resultaten analyseren 3.1.2. Doet uitspraak over de bruikbaarheid van de behaalde resultaten op basis van nauwkeurigheid en betrouwbaarheid. 3.2.5. Bediscussieert resultaten in relatie met andere deelexperimenten en vergelijkt met literatuurwaarden. 3.3.1. Voert zelfstandig op de juiste wijze volgens de geschikte methoden de analyse van de resultaten uit; i.t.v. maakt hiervoor gebruik van statistiek. Competentie 4: Kwaliteitsbeheer 4.1.1. Stelt zich op de hoogte van de veiligheids- (Arbo) en milieuregels en werkt volgens deze regels. 4.1.2. IJkt simpele apparatuur (pH meters, pipetten).

	4.1.3 Gebruikt controles, waarvan het resultaat een uitspraak doet over de betrouwbaarheid van de resultaten. Competentie 5: Beheer en administratie 5.2.1. Codeert chemicaliën en monsters en bewaart deze op correcte wijze. 5.2.2. Draagt bij aan een efficiënt functionerende lab (ruimt op, signaleert als reagentia bijna op zijn, pleegt klein onderhoud aan de apparatuur). 5.2.3. Beheert en archiveert gegevens in labjournaal (doel, experimenten-beschrijving, resultaten, conclusie) en i.v.t. op andere manieren zodat anderen deze kunnen begrijpen. Competentie 6: Rapporteren 6.2.1. Rapporteert (over zijn onderzoek) in vorm van een verslag/labjournaal/poster volgens in opleiding geldende regels (productcriteria labjournaal en verslag niveau 2): hanteert correcte spelling, grammatica, zinsbouw en wetenschappelijke stijl; brengt helder en logische structuur aan in complexere teksten; is zich bewust van samenhang tussentekstonderdelen; opbouw van tekst is conform in het werkveld gebruikte richtlijnen; rapport omvat een literatuurlijst. In de tekst wordt verwezen naar bronnen in literatuurlijst; beschrijft resultaten zodat de lezer deze begrijpen kan; gebruikt hiervoor duidelijke gelabelde afbeeldingen en tabellen; beschrijft alle relevante gegevens in een samenvatting. Competentie 7: Planmatig en projectmatig werken 7.2.2. Voert werkzaamheden volgens planning uit; ook onder tijdsdruk. 7.2.3. Ziet erop toe dat doelen worden behaald en stuurt werkzaamheden eventueel bij. 7.2.4. Speelt in op wijzigende omstandigheden. In de context van: cytodiagnostiek
Beoordelingscriteria	Cytodiagnostiek: de gynaecologische cytodiagnostiek De student kan de behandelde processen beschrijven en theoretisch verantwoorden. Verdere informatie en details zie onderwijsonline
Toetsmatrijs	Het praktijktentamen m.b.v. microscoop bestaat uit 10 ongestipte preparaten en wordt afgenomen gedurende twee en half klokuren (15 min. per prep.). De antwoorden dienen te bestaan uit diagnose, KOPAC-codering en PAP-Class.
	M_ATBC-M-CHP-Pc2
Naam (deel)tentamen	Praktijktoets cytodiagnostiek 2

Code (deel)tentamen	M_ATBC-M-CHP-Pc2
Vorm(en) (deel)tentamen	Individueel, Schriftelijk, Praktijk
Oordeel	Cijfer
Minimaal oordeel	5,5
Weging deeltentamen	1
Tentamenmomenten	Periode 2, herkansing periode 3.
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Deelname aan OWE M_ATBC-M-CHP geldt als aanmelding voor M_ATBC-M-CHP-Pc2
Nabespreking en inzage	Het aan de student teruggeven van het ingevulde beoordelingsformulier en eventueel opmerkingen op het formulier of in het beroepsproduct geldt als inzage en nabespreking van dit deeltentamen.
Aantal examinatoren	Beoordeling door één examinator op basis van beoordelingsformulier (Praktijkdocent).
Compensatiemogelijkheden	
Beoordelingsdimensies	Competentie 2: Experimenteren 2.2.7. Doet een poging om problemen op te lossen als het experiment niet loopt zoals was voorzien (trouble shooting). 2.3.1. Kan alle stappen van de experimenten theoretisch verantwoorden. 2.3.3. Zorgt er zelfstandig voor dat alle benodigdheden klaar staan voordat met het experiment begonnen wordt; maakt oplossingen. 2.3.4. Voert experimenten (microscoperen) zelfstandig volgens protocol uit zodat betrouwbare reproduceerbare data wordt verkregen, maar kan hiervan afwijken indien nodig; weet te allen tijde exact wat hij/zij doet. 2.3.8. Maakt zich technieken snel eigen. Competentie 3: Resultaten analyseren 3.1.2. Doet uitspraak over de bruikbaarheid van de behaalde resultaten op basis van nauwkeurigheid en betrouwbaarheid. 3.2.5. Bediscussieert resultaten in relatie met andere deelexperimenten en vergelijkt met literatuurwaarden. 3.3.1. Voert zelfstandig op de juiste wijze volgens de geschikte methoden de analyse van de resultaten uit; i.v.t. maakt hiervoor gebruik van statistiek. Competentie 4: Kwaliteitsbeheer 4.1.1. Stelt zich op de hoogte van de veiligheids (Arbo)- en milieuregels en werkt volgens deze regels. 4.1.2. IJkt simpele apparatuur (pH meters, pipetten). 4.1.3. Gebruikt controles, waarvan het resultaat een uitspraak doet over de betrouwbaarheid van de resultaten. Competentie 5: Beheer en administratie

	5.2.1. Codeert chemicaliën en monsters en bewaart deze op correcte wijze. 5.2.2. Draagt bij aan een efficiënt functionerende lab (ruimt op, signaleert als reagentia bijna op zijn, pleegt klein onderhoud aan de apparatuur). 5.2.3. Beheert en archiveert gegevens in labjournaal (doel, experimenten-beschrijving, resultaten, conclusie) en i.v.t. op andere manieren zodat anderen deze kunnen begrijpen. Competentie 6: Rapporteren 6.2.1. Rapporteert (over zijn onderzoek) in vorm van een verslag/labjournaal/poster volgens in opleiding geldende regels (productcriteria labjournaal en verslag niveau 2): hanteert correcte spelling, grammatica, zinsbouw en wetenschappelijke stijl; brengt helder en logische structuur aanin complexere teksten; is zich bewust van samenhang tussen tekstonderdelen; opbouw van tekst is conform in het werkveld gebruikte richtlijnen; rapport omvat een literatuurlijst. In de tekst wordt verwezen naar bronnen in literatuurlijst; beschrijft resultaten zodat de lezer deze begrijpen kan; gebruikt hiervoor duidelijke gelabelde afbeeldingen en tabellen; beschrijft alle relevante gegevens in een samenvatting. Competentie 7: Planmatig en projectmatig werken 7.2.2. Voert werkzaamheden volgens planning uit; ook onder tijdsdruk. 7.2.3. Ziet erop toe dat doelen worden behaald en stuurt werkzaamheden eventueel bij. 7.2.4. Speelt in op wijzigende omstandigheden. In de context van: cytodiagnostiek
Beoordelingscriteria	Cytodiagnostiek I en II: de gynaecologische cytodiagnostiek De student kan de behandelde processen beschrijven en theoretisch verantwoorden. Verdere informatie en details zie onderwijsonline
Toetsmatrijs	Het praktijktentamen m.b.v. microscoop bestaat uit 10 ongestipte preparaten en wordt afgenomen gedurende twee en half klokuren (15 min. per prep.). De antwoorden dienen te bestaan uit diagnose, KOPAC-codering en PAP-Class.
	M_ATBC-M-CHP-Tc1
Naam (deel)tentamen	Theorietoets cytodiagnostiek 1
Code (deel)tentamen	M_ATBC-M-CHP-Tc1
Vorm(en) (deel)tentamen	Individueel, Schriftelijk
Oordeel	Cijfer
Minimaal oordeel	5,5
Weging deeltentamen	1
Tentamenmomenten	Periode 1, herkansing periode 2

Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Aanmelden voor het deeltentamen via Alluris. De aanmeldingstermijn is een aantal weken voorafgaand aan die toetsperiode of de herkansingsperiode. De termijn staat aangegeven in het jaarrooster van de Academie ATBC op Insite-roosters.
Nabespreking en inzage	• In het ATBC jaarrooster is aangegeven wanneer de tentamenperiodes zijn en wanneer het gemaakte werk ingezien kan worden. Inzage gebeurt in aanwezigheid van een surveillant. • De nabespreking van het tentamen wordt ingeroosterd in de volgende onderwijsperiode. Nabespreking van tentamens gemaakt in een herkansingsperiode worden ingeroosterd aan het eind van de onderwijsperiode. • Geef bij de examinator/coursetrekker aan of je gebruik wilt maken van de mogelijkheid om het tentamen na te bespreken. Als er geen belangstelling is, gaat de nabespreking niet door. • Deelname aan de nabespreking is alleen toegestaan als je het tentamen hebt gemaakt.
Aantal examinatoren	Beoordeling door één examinator op basis van antwoordmodel (Praktijkdocent).
Compensatiemogelijkheden	
Beoordelingsdimensies	Competentie 1: Ontwerpen 1.3.3. Zoekt, selecteert en verwerkt zelfstandig informatie uit relevante bronnen voor natuurwetenschappelijk onderzoek. Competentie 2: Experimenteren 2.1.2. Maakt voorberekeningen. 2.3.1. Kan alle stappen van de experimenten theoretisch verantwoorden. Competentie 3: Resultaten analyseren 3.2.3. Trekt zelfstandig conclusie m.b.t. de onderzoeksvraagstelling (als mogelijk). 3.3.1. Voert zelfstandig op de juiste wijze volgens de geschikte methoden de analyse van de resultaten uit; i.v.t. maakt hiervoor gebruik van statistiek. Competentie 4: Kwaliteitsbeheer 4.1.1. Stelt zich op de hoogte van de veiligheids (Arbo)- en milieuregels en werkt volgens deze regels. 4.1.3. Gebruikt controles, waarvan het resultaat een uitspraak doet over de betrouwbaarheid van de resultaten. Competentie 7: Planmatig en projectmatig werken 7.1.1. Plant en organiseert zijn activiteiten resulterend in een werkplan. 7.2.1. Plant en organiseert zijn experimenten resulterend in een werkplan dat minimaal 4 praktijklessen bestrijkt. Competentie 10: Adviseren

	10.2.1. Vertaalt wensen naar praktische eisen. In de context van: cytodiagnostiek
Beoordelingscriteria	Cytodiagnostiek: de gynaecologische cytodiagnostiek De student kan de behandelde processen beschrijven en theoretisch verantwoorden. Verdere informatie en details zie onderwijsonline
Toetsmatrijs	De context-onderwerpen zijn representatief verdeeld over de toets en betreffen de gynaecologische cytodiagnostiek 100%.
	M_ATBC-M-CHP-Tc2
Naam (deel)tentamen	Theorietoets cytodiagnostiek 2
Code (deel)tentamen	M_ATBC-M-CHP-Tc2
Vorm(en) (deel)tentamen	Individueel, Schriftelijk
Oordeel	Cijfer
Minimaal oordeel	5,5
Weging deeltentamen	1
Tentamenmomenten	Periode 2, herkansing periode 3.
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Aanmelden voor het deeltentamen via Alluris. De aanmeldingstermijn is een aantal weken voorafgaand aan die toetsperiode of de herkansingsperiode. De termijn staat aangegeven in het jaarrooster van de Academie ATBC op Insite-roosters.
Nabespreking en inzage	• In het ATBC jaarrooster is aangegeven wanneer de tentamenperiodes zijn en wanneer het gemaakte werk ingezien kan worden. Inzage gebeurt in aanwezigheid van een surveillant. • De nabespreking van het tentamen wordt ingeroosterd na het tentamen, maar voor de inzage van het tentamen. • Geef bij de examinator/coursetrekker aan of je gebruik wilt maken van de mogelijkheid om het tentamen na te bespreken. Als er geen belangstelling is, gaat de nabespreking niet door. • Deelname aan de nabespreking is alleen toegestaan als je het tentamen hebt gemaakt.
Aantal examinatoren	Beoordeling door één examinator op basis van antwoordmodel (theoriedocent).
Compensatiemogelijkheden	
Beoordelingsdimensies	Competentie 1: Ontwerpen 1.3.3. Zoekt, selecteert en verwerkt zelfstandig informatie uit relevante bronnen voor natuurwetenschappelijk onderzoek. Competentie 2: Experimenteren 2.1.2. Maakt voorberekeningen. 2.3.1. Kan alle stappen van de experimenten theoretisch verantwoorden. Competentie 3: Resultaten analyseren 3.2.3. Trekt zelfstandig conclusie m.b.t. de

	onderzoeksvraagstelling (als mogelijk). 3.3.1. Voert zelfstandig op de juiste wijze volgens de geschikte methoden de analyse van de resultaten uit; i.v.t. maakt hiervoor gebruik van statistiek. Competentie 4: Kwaliteitsbeheer 4.1.1. Stelt zich op de hoogte van de veiligheids (Arbo)- en milieuregels en werkt volgens deze regels. 4.1.3. Gebruikt controles, waarvan het resultaat een uitspraak doet over de betrouwbaarheid van de resultaten. Competentie 7: Planmatig en projectmatig werken 7.1.1. Plant en organiseert zijn activiteiten resulterend in een werkplan. 7.2.1. Plant en organiseert zijn experimenten resulterend in een werkplan dat minimaal 4 praktijklessen bestrijkt. Competentie 10: Adviseren 10.2.1. Vertaalt wensen naar praktische eisen. In de context van: cytodiagnostiek
Beoordelingscriteria	Cytodiagnostiek I en II: de gynaecologische cytodiagnostiek De student kan de behandelde processen beschrijven en theoretisch verantwoorden. Verdere informatie en details zie onderwijsonline
Toetsmatrijs	De context-onderwerpen zijn representatief verdeeld over de toets en betreffen de gynaecologische cytodiagnostiek 100%
	M_ATBC-M-CHP-IPV
Naam (deel)tentamen	IPV
Code (deel)tentamen	M_ATBC-M-CHP-IPV
Vorm(en) (deel)tentamen	Individueel, Mondeling
Oordeel	Voldaan/Niet voldaan
Minimaal oordeel	Voldaan
Weging deeltentamen	0
Tentamenmomenten	Periode 2. Voor deelname aan deeltentamen IPV is er maar één kans per studiejaar (OER paragraaf 8.5)
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Deelname aan OWE M_ATBC-M-CHP geldt als aanmelding voor M_ATBC-M-CHP-IPV
Nabespreking en inzage	Voor vragen over de beoordeling kan contact opgenomen worden met de examinator.
Aantal examinatoren	Beoordeling door één examinator op basis van deelname en inzet (Tutor).
Compensatiemogelijkheden	
Beoordelingsdimensies	Competentie 8: Samenwerken

	Functioneren in een groep 8.1.1. Houdt zich aan regels. 8.1.2. Heeft een duidelijk inbreng in de groep. 8.2.3. Maakt concrete afspraken en houdt zich hieraan. 8.3.4. Herkent eigen rol en inbreng in de groep en weet welke andere rollen er in het team zijn; gaat hiermee adequaat om; stemt werkzaamheden met anderen af. Communicatie Communiceert open en helder met collega's en begeleiders volgens basisregel voor communicatie: 8.1.6. Houdt oogcontact met gesprekspartner. 8.1.7. Laat andere uitpraten. 8.1.9. Toont initiatief actief conflicten op te lossen. 8.2.5. Neemt initiatief voor gesprek. 8.2.8. Brengt zijn haar mening/boodschap helder onder woorden. 8.3.9. Weet goed met conflicten om te gaan. 8.3.10. Sluit aan bij gesprekspartner/toetst of boodschap is overgekomen. 8.3.11. Houdt gespreksdoel in het oog. Internationalisering 8.2.12. Is zich bewust van interculturele verschillen in het werkveld
Beoordelingscriteria	De student: - is minimaal 80% van de volledige bijeenkomsten aanwezig (k.o.); - heeft zich voorbereid op de vergadering door het uitwerken van de weekopdracht die nabesproken wordt en het doorlezen van de weekopdracht die voorgesproken wordt (k.o.); - kan de uitwerking van zijn weekopdrachten volgens afspraak aan de tutor laten zien (in schrift of presentatie); in alle opdrachten zijn alle gevraagde aspecten uitgewerkt (k.o.); - voert zijn rollen (voorzitter, notulist, etc.) uit (k.o.); - herkent eigen rol en inbreng in de groep en weet welke andere rollen er in het team zijn; gaat hiermee adequaat om; stemt werkzaamheden met anderen af; - houdt zich aan de afgesproken regels (k.o.); - stelt vragen en deelt kennis met betrekking tot de opdracht tijdens tutorvergaderingen; verwoordt deze helder en verstaanbaar, houdt oogcontact; - houdt het gespreksdoel in het oog; - laat anderen uitpraten, sluit aan bij de gesprekspartner en toetst of de boodschap is overgekomen; - geeft groeps- en klasgenoten feedback en staat open voor feedback; - levert een positieve bijdrage aan het groepsproces door initiatief te nemen en eventuele conflicten actief op te lossen.

M_ATBC-M-DMM Medische Diagnostiek: Medische Microbiologie (30 credits) (Dutch)

	M_ATBC-M-DMM

Algemene informatie	
Doelgroep	Voltijd studenten hoofdfase Biologie en Medisch laboratorium onderzoek
Naam onderwijseenheid	Minor Medische diagnostiek: medische microbiologie / Minor Medical diagnostics: medical microbiology
Code onderwijseenheid	M_ATBC-M-DMM
Onderwijsperiode	Periode 1 en 2 (semester 1)
Studiepunten	30 stp
Studielast in uren	840 SBU
Onderwijstijd (contacturen)	Geprogrammeerde contacttijd: ongeveer 20 lesuren per week; 140 lesuren per periode; 280 lesuren gehele OWE (2 perioden) = = 210 klokuren gehele OWE (2 perioden) Geprogrammeerde onderwijstijd voor zelfwerkzaamheid: 630 klokuren Totaal: 840 klokuren
Ingangseisen onderwijseenheid	De competenties die in deze Minor aan de orde zijn, zijn op niveau 2 geoefend. OWE BM6B is met een voldoende afgesloten en BM6A1/2 en C zijn gevolgd. Voor aanvang aan deze OWE dient de student minimaal zijn/haar propedeuse behaald te hebben (Bij deelnemers aan de verkorte route zijn uitzonderingen mogelijk).
Inhoud en organisatie	
Algemene omschrijving	Tijdens de minor vindt een verbreding en verdieping plaats van de theoretische kennis en van de praktische vaardigheden op het gebied van de medisch microbiologische diagnostiek. Daarbij is er ook aandacht voor serologische technieken en voor moleculair biologische technieken. De nadruk in deze OWE ligt op het zelfstandig uitvoeren van diagnostisch onderzoek, waarbij gebruik wordt gemaakt van een verscheidenheid aan technieken en waarbij een beroep wordt gedaan op een gedegen kennis van dit vakgebied. De voertaal van deze minor is Nederlands.
Eindkwalificaties	Ontwerpen Experimenteren Resultaten analyseren Kwaliteitsbeheer Beheer en administratie Rapporteren en presenteren Planmatig en projectmatig werken Adviseren Samenwerken Sturen professionele ontwikkeling
Beroepstaak, beroepstaken	Uitvoeren van natuurwetenschappelijk onderzoek
Beroepsproducten	Literatuurverslag Onderzoeksverslag

	Presentatie
Samenhang	Deze OWE is het vervolg op de ontwikkelde competenties en kennis uit OWE BM5 (A,B en C) en BM6 (A, B en C), met name BM6. Deze minor moet gevolgd zijn voorafgaand de stage medische microbiologie diagnostiek.
Deelnameplicht onderwijs	Voor beoordeling praktijk (P) is aanwezigheid bij de praktijklessen verplicht. Voor beoordeling van IPV is aanwezigheid bij de tutorlessen verplicht.
Maximaal aantal deelnemers	Minimaal 6, maximaal 15
Compensatie mogelijkheden	-
Activiteiten en/of werkvormen	Ondersteunend vak Virologie Algemene virologie Kenmerken, ziektebeelden, pathogenese, laboratoriumdiagnostiek, en immunisatie van belangrijke en actuele virusinfecties Antivirale middelen en hun werkingsmechanisme *Werkwijze: hoor/werkcollege* Ondersteunend vak Parasitologie Algemene Parasitologie Inheemse en uitheems parasitaire infecties Laboratoriumdiagnostiek Antiparasitaire middelen en hun werkingsmechanismen *Werkwijze: hoor/werkcollege* Ondersteunend vak Antimicrobiële middelen Antimicrobiële middelen en hun werking Antibiotica resistentie *Werkwijze: hoor/werkcollege* Ondersteunend vak Moleculaire diagnostiek PCR, Real time PCR, multiplex-PCR en sequencing Technieken gebruikt tbv de moleculaire diagnostiek Moleculaire diagnostiek in de medische microbiologie Toepassen van bio-informatica tools *Werkwijze: hoorcollege/werkcollege* Ondersteunend vak hygiëne Infectiepreventie en ziekenhuishygiëne *Werkwijze: hoorcollege/werkcollege* Ondersteunend vak Kwaliteitszorg Kwaliteitszorg van het laboratorium *Werkwijze: hoorcollege/werkcollege*

	Ondersteunend vak Mycologie Algemene Mycologie Schimmelinfecties Antifungale therapie en resistentie Laboratoriumdiagnostiek *Werkwijze: hoor/werkcollege* Ondersteunend vak Systematische bacteriologie Algemene bacteriologie Taxonomie en nomenclatuur Gram-positieve kokken en staven Gram-negatieve kokken en staven Spirillen en overigen Bacteriële infecties Gevoeligheidsbepaling, te verwachten gevoeligheidspatroon, de gebruikelijke antibiotica die voor therapie worden toegepast en resistentieproblematiek Laboratoriumdiagnostiek *Werkwijze: hoor / werkcollege* Ondersteunend vak Tractus diagnostiek Infecties per orgaansysteem, met in begrip van (beknopte) symptomatologie, beloop en complicaties antimicrobiële behandeling *Werkwijze: hoorcollege / werkcollege* Ondersteunend vak Praktijk medische microbiologie Macroscopische en microscopische morfologie van micro organismen Basistechnieken determinatie en antimicrobiële gevoeligheden Moleculaire diagnostiek Tractus diagnostiek *Werkwijze: praktijk met ondersteuning van expert* Ondersteunend vak qPCR project Moleculaire diagnostiek van infectieziekten *Werkwijze: praktijk en hoor/werkcollege*
Verplichte literatuur	Laatste versie van: - Bacteriologie voor laboratorium en kliniek deel 1; - Knecht en Doornbos Bacteriologie voor laboratorium en kliniek deel 2; - Mutsaers, Jansen ea Koneman's Color Atlas and Textbook of Diagnostic Microbiology; - Procop ea Medische Parasitologie; PoldermanMoleculaire diagnostiek; Van Pelt
Verplichte Software / verplicht materiaal	
Aanbevolen literatuur	

Tentaminering	
	M_ATBC-M-DMM-K1
Naam (deel)tentamen	Kennistoets 1
Code (deel)tentamen	M_ATBC-M-DMM-K1
Vorm(en) (deel)tentamen	Schriftelijk, Individueel, Open vragen
Oordeel	Cijfer
Minimaal oordeel	5,5
Weging deeltentamen	1
Tentamenmomenten	Periode 1, periode 2.
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Aanmelden voor het deeltentamen via Alluris. De aanmeldingstermijn is een aantal weken voorafgaand aan die toetsperiode of de herkansingsperiode. De termijn staat aangegeven in het jaarrooster van de Academie ATBC op Insite-roosters.
Nabespreking en inzage	• In het ATBC jaarrooster is aangegeven wanneer de tentamenperiodes zijn en wanneer het gemaakte werk ingezien kan worden. Inzage gebeurt in aanwezigheid van een surveillant. • De nabespreking van het tentamen wordt ingeroosterd in de volgende onderwijsperiode. Nabespreking van tentamens gemaakt in een herkansingsperiode worden ingeroosterd aan het eind van de onderwijsperiode. • Geef bij de examinator/coursetrekker aan of je gebruik wilt maken van de mogelijkheid om het tentamen na te bespreken. Als er geen belangstelling is, gaat de nabespreking niet door. • Deelname aan de nabespreking is alleen toegestaan als je het tentamen hebt gemaakt.
Aantal examinatoren	Twee examinatoren voor de constructie en evaluatie. Beoordeling door één examinator op basis van antwoordmodel (coursetrekker).
Compensatiemogelijkheden	
Beoordelingsdimensies	In de context van: Risico management en kwaliteitscontrole in de microbiologie Antimicrobiële middelen Infectiepreventie en ziekenhuishygiëne Kwaliteitszorg Algemene en specifieke Parasitologie Algemene en specifieke Virologie Moleculaire diagnostiek Medisch microbiologische diagnostiek
Beoordelingscriteria	In de context van: Risico management en kwaliteitscontrole in de microbiologie Antimicrobiële middelen Infectiepreventie en ziekenhuishygiëne Kwaliteitszorg Algemene en specifieke Parasitologie Algemene en specifieke Virologie

	Moleculaire diagnostiek Medisch microbiologische diagnostiek
Toetsmatrijs	De contextonderwerpen zijn representatief verdeeld over de toets: antimicrobiële middelen ca 25% parasitologie ca 15% virologie ca 25% moleculaire diagnostiek ca 20% kwaliteit ca. 5% infectiepreventie en ziekenhuis hygiëne ca 10%
	M_ATBC-M-DMM-P1 / M_ATBC-M-DMM-P2
Naam (deel)tentamen	Praktijk 1 / Praktijk 2
Code (deel)tentamen	M_ATBC-M-DMM-P1 / M_ATBC-M-DMM-P2
Vorm(en) (deel)tentamen	Individueel Praktijk
Oordeel	Cijfer
Minimaal oordeel	5,5
Weging deeltentamen	1
Tentamenmomenten	P1 in Periode 1, P2 in periode 2. Voor deelname aan deeltentamens P1 en P2 is er maar één kans per studiejaar (OER paragraaf 8.5)
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Deelname aan OWE M_ATBC-M-DMM geldt als aanmelding voor M_ATBC-M-DMM-P1 / M_ATBC-M-DMM-P2.
Nabespreking en inzage	Het aan de student teruggeven van het ingevulde beoordelingsformulier en eventueel opmerkingen op het formulier of in het beroepsproduct geldt als inzage en nabespreking van dit deeltentamen.
Aantal examinatoren	Twee examinatoren voor de constructie en evaluatie van de praktijktoets (Coursetrekker / Praktijkdocent). Eén examinator voor de beoordeling van de praktijktoets op basis van antwoordmodel en twee examinatoren voor de beoordeling van de praktijk op basis van beoordelingsformulier (Praktijkdocenten).
Compensatiemogelijkheden	
Beoordelingsdimensies	Competentie 2: Experimenteren 2.1.2. Maakt voorberekeningen. 2.2.7. Doet een poging om problemen op te lossen als het experiment niet loopt zoals was voorzien (trouble shooting). 2.3.1. Kan alle stappen van de experimenten theoretisch verantwoorden. 2.3.3. Zorgt er zelfstandig voor dat alle benodigdheden klaar staan voordat met het experiment begonnen wordt; maakt oplossingen. 2.3.4. Voert experimenten zelfstandig volgens protocol uit zodat betrouwbare reproduceerbare data wordt verkregen, maar kan hiervan afwijken indien nodig; weet te allen tijde exact wat hij/zij doet. 2.3.6. Werkt aan meerdere

	experimenten tegelijkertijd en kan deze uitvoeren binnen de gestelde tijd, kan makkelijk switchen en behoudt overzicht. 2.3.8. Maakt zich technieken snel eigen. Competentie 3: Resultaten analyseren 3.1.2. Doet uitspraak over de bruikbaarheid van de behaalde resultaten op basis van nauwkeurigheid en betrouwbaarheid. 3.1.4. Bediscussieert de uitvoering en de resultaten van het experiment. 3.2.5. Bediscussieert resultaten in relatie met andere deelexperimenten en vergelijkt met literatuurwaarden. 3.3.1. Voert zelfstandig op de juiste wijze volgens de geschikte methoden de analyse van de resultaten uit; i.v.t. maakt hiervoor gebruik van statistiek. Competentie 4: Kwaliteitsbeheer 4.1.1. Stelt zich op de hoogte van de veiligheids (Arbo)- en milieuregels en werkt volgens deze regels. 4.1.2. IJkt simpele apparatuur (pH meters, pipetten). 4.1.3. Gebruikt controles, waarvan het resultaat een uitspraak doet over de betrouwbaarheid van de resultaten. 4.3.5. Houdt zich aan de voorgeschreven kwaliteitsvoorschriften. Competentie 5: Beheer en administratie 5.2.1. Codeert chemicaliën en monsters en bewaart deze op correcte wijze. 5.2.2. Draagt bij aan een efficiënt functionerende lab (ruimt op, signaleert als reagentia bijna op zijn, pleegt klein onderhoud aan de apparatuur). 5.2.3. beheert en archiveert gegevens in labjournaal (doel, experimentenbeschrijving, resultaten, conclusie) en i.v.t. op andere manieren zodat anderen deze kunnen begrijpen. Competentie 6: Rapporteren 6.2.1. Rapporteert (over zijn onderzoek) in vorm van een verslag/labjournaal/poster volgens in opleiding geldende regels (productcriteria labjournaal en verslag niveau 2): - hanteert correcte spelling, grammatica, zinsbouw en wetenschappelijke stijl; - brengt helder en logische structuur aan in complexere teksten; - is zich bewust van samenhang tussen tekstonderdelen; opbouw van tekst is conform in het werkveld gebruikte richtlijnen; - rapport omvat een literatuurlijst. In de tekst wordt verwezen naar bronnen in literatuurlijst;

	- beschrijft resultaten zodat de lezer deze begrijpen kan; - gebruikt hiervoor duidelijke gelabelde afbeeldingen en tabellen; - beschrijft alle relevante gegevens in een samenvatting. Competentie 7: Planmatig en projectmatig werken 7.2.1. Plant en organiseert zijn experimenten resulterend in een werkplan dat minimaal 4 praktijklessen bestrijkt. 7.2.2. Voert werkzaamheden volgens planning uit; ook onder tijdsdruk. 7.2.3. Ziet erop toe dat doelen worden behaald en stuurt werkzaamheden eventueel bij. 7.2.4. Speelt in op wijzigende omstandigheden. 7.3.1. Plant en organiseert zijn project resulterend in een werkplan van minimaal 4 weken. Competentie 11: Sturen professionele ontwikkeling 11.2.5. Handelt integer, past zich snel aan, toont doorzettingsvermogen en is gemotiveerde student. In de context van: Bacteriologie Macroscopische en Microscopische morfologie Basistechnieken determinatie resistentie Parasitologie Bloedparasieten Intestinale parasieten Moleculaire technieken Microscopie en concentratietechnieken Moleculaire diagnostiek
Beoordelingscriteria	Beoordeling Praktijk Niveau 3 (zie beoordelingsformulier) op #OnderwijsOnline bij Algemene Informatie. Praktijktoets: Bestaat uit toets over 2 dagen waarbij kennis, vaardigheden en inzicht worden getoetst met betrekking tot: - bacteriologie; basistechnieken, macroscopische en microscopische morfologie, antimicrobiële gevoeligheden; - parasitologie; microscopische morfologie; Cijfer P is het gemiddelde van Beoordeling praktijk (Weging deeltentamen 1) en Praktijktoets (Weging deeltentamen 3). Het gemiddelde van P moet voldoende zijn.
Toetsmatrijs	Zie beoordeling Praktijk Niveau 3 (zie beoordelingsformulier) op #OnderwijsOnline bij Algemene Informatie.
	M_ATBC-M-DMM-IPV1 / M_ATBC-M-DMM-IPV2
Naam (deel)tentamen	IPV 1 / IPV 2
Code (deel)tentamen	M_ATBC-M-DMM-IPV1 / M_ATBC-M-DMM-IPV2
Vorm(en) (deel)tentamen	Individueel, Mondeling

Oordeel	Voldaan/Niet voldaan
Minimaal oordeel	Voldaan
Weging deeltentamen	0
Tentamenmomenten	Periode 1 of periode 2. Voor deelname aan de deeltentamens IPV 1 en IPV 2 is er maar één kans per studiejaar (OER paragraaf 8.5)
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Deelname aan OWE M_ATBC-M-DMM geldt als aanmelding voor M_ATBC-M-DMM-IPV1 / M_ATBC-M-DMM-IPV2.
Nabespreking en inzage	Voor vragen over de beoordeling kan contact opgenomen worden met de examinator.
Aantal examinatoren	Beoordeling door één examinator op basis van deelname en inzet (Tutor).
Compensatiemogelijkheden	
Beoordelingsdimensies	Competentie 8: Samenwerken Functioneren in een groep 8.1.1. Houdt zich aan regels. 8.1.2. Heeft een duidelijk inbreng in de groep. 8.2.3. Maakt concrete afspraken en houdt zich hieraan. 8.3.4. Herkent eigen rol en inbreng in de groep en weet welke andere rollen er in het team zijn; gaat hiermee adequaat om; stemt werkzaamheden met anderen af. Communicatie Communiceert open en helder met collega's en begeleiders volgens basisregel voor communicatie. 8.1.6. Houdt oogcontact met gesprekspartner. 8.1.7. Laat anderen uitpraten. 8.1.9. Toont initiatief conflicten actief op te lossen. 8.2.5. Neemt initiatief voor gesprek. 8.2.8. Brengt zijn haar mening/boodschap helder onder woorden. 8.3.9. Weet goed met conflicten om te gaan. 8.3.10. Sluit aan bij gesprekspartner/toetst of boodschap is overgekomen. 8.3.11. Houdt gespreksdoel in het oog.
Beoordelingscriteria	De student: - heeft zich voorbereid op de vergadering door het uitwerken van de weekopdracht die nabesproken wordt en het doorlezen van de weekopdracht die voorgesproken wordt (k.o.); - kan de uitwerking van zijn weekopdrachten volgens afspraak aan de tutor laten zien (in schrift of presentatie); in alle opdrachten zijn alle gevraagde aspecten uitgewerkt (k.o.); - voert zijn rollen (voorzitter, notulist, etc.) uit (k.o.); - herkent eigen rol en inbreng in de groep en weet welke andere rollen er in het team zijn; gaat hiermee adequaat om; stemt werkzaamheden met anderen af; - houdt zich aan de afgesproken regels (k.o.); - stelt vragen en deelt kennis met betrekking tot de opdracht tijdens tutorvergaderingen; verwoordt deze helder en verstaanbaar, houdt oogcontact; - houdt het gespreksdoel in het oog;

	- laat anderen uitpraten, sluit aan bij de gesprekspartner en toetst of de boodschap is overgekomen; - geeft groeps- en klasgenoten opmerkingen en staat open voor opmerkingen; - levert een positieve bijdrage aan het groepsproces door initiatief te nemen en eventuele conflicten actief op te lossen.
	M_ATBC-M-DMM-K2
Naam (deel)tentamen	Kennistoets 2
Code (deel)tentamen	M_ATBC-M-DMM-K2
Vorm(en) (deel)tentamen	Individueel, Schriftelijk, Open vragen
Oordeel	Cijfer
Minimaal oordeel	5,5
Weging deeltentamen	1
Tentamenmomenten	Periode 2, en periode 3
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Aanmelden voor het deeltentamen via Alluris. De aanmeldingstermijn is een aantal weken voorafgaand aan die toetsperiode of de herkansingsperiode. De termijn staat aangegeven in het jaarrooster van de Academie ATBC op Insite-roosters.
Nabespreking en inzage	• In het ATBC jaarrooster is aangegeven wanneer de tentamenperiodes zijn en wanneer het gemaakte werk ingezien kan worden. Inzage gebeurt in aanwezigheid van een surveillant. • De nabespreking van het tentamen wordt ingeroosterd na het tentamen, maar voor de inzage van het tentamen. • Geef bij de examinator/coursetrekker aan of je gebruik wilt maken van de mogelijkheid om het tentamen na te bespreken. Als er geen belangstelling is, gaat de nabespreking niet door. • Deelname aan de nabespreking is alleen toegestaan als je het tentamen hebt gemaakt..
Aantal examinatoren	Twee examinatoren voor de constructie en evaluatie. Beoordeling door één examinator op basis van antwoordmodel (coursetrekker).
Compensatiemogelijkheden	
Beoordelingsdimensies	In de context van: Mycologie: Algemene Mycologie Schimmelinfecties Antifungale therapie en resistentie Laboratoriumdiagnostiek Systematische bacteriologie Algemene bacteriologie Taxonomie en nomenclatuur Gram-positieve kokken en staven Gram-negatieve kokken en staven Spirillen en overigen

	Bacteriële infecties Gevoeligheidsbepaling, te verwachten gevoeligheidspatroon, de gebruikelijke antibiotica die voor therapie worden toegepast en resistentieproblematiek Laboratoriumdiagnostiek Tractus diagnostiek: Infecties per orgaansysteem, met in begrip van (beknopte) symptomatologie, beloop en complicaties antimicrobiële behandeling
Beoordelingscriteria	In de context van: Mycologie: Algemene mycologie Schimmelinfecties Antifungale therapie en resistentie Laboratoriumdiagnostiek Systematische bacteriologie Algemene bacteriologie Taxonomie en nomenclatuur Gram-positieve kokken en staven Gram-negatieve kokken en staven Spirillen en overigen Bacteriële infecties Gevoeligheidsbepaling, te verwachten gevoeligheidspatroon, de gebruikelijke antibiotica die voor therapie worden toegepast en resistentieproblematiek Laboratoriumdiagnostiek Tractus diagnostiek: Infecties per orgaansysteem, met in begrip van (beknopte) symptomatologie, beloop en complicaties antimicrobiële behandeling
Toetsmatrijs	De context-onderwerpen zijn representatief verdeeld over de toets. Tractus diagnostiek ca 45% mycologie 10% Systematische bacteriologie ca 45% De toetsmatrijs wordt door de docenten tijdens de lessen verder gespecificeerd.
	M_ATBC-M-DMM-L
Naam (deel)tentamen	Literatuurverslag
Code (deel)tentamen	M_ATBC-M-DMM-L
Vorm(en) (deel)tentamen	Individueel, Schriftelijk

Oordeel	Cijfer
Minimaal oordeel	5,5
Weging deeltentamen	1
Tentamenmomenten	Periode 1 of periode 2
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Deelname aan OWE M_ATBC-M-DMM geldt als aanmelding voor M_ATBC-M-DMM-L.
Nabespreking en inzage	Het ingevulde beoordelingsformulier en eventueel opmerkingen op het formulier of in het beroepsproduct geldt als inzage en nabespreking van dit deeltentamen
Aantal examinatoren	Beoordeling door één examinator op basis van beoordelingsformulier (tutor).
Compensatiemogelijkheden	**-**
Beoordelingsdimensies	Competentie 1: Ontwerpen 1.2.1. identificeert zelfstandig welke achtergrondinformatie benodigd is om de onderzoeksvraag te beantwoorden. 1.2.2., (1.3.3.) Zoekt, selecteert en verwerkt (zelfstandig) informatie uit relevante bronnen voor natuurwetenschappelijk onderzoek. 1.3.6. Begrijpt complexe Engelstalige literatuur in de context van de module en past deze toe. 1.3.7. Legt verbanden van eigen onderzoek met overkoepelend project. Competentie 3: Resultaten analyseren 3.3.3. Trekt zelfstandig conclusie m.b.t. de onderzoeksvraagstelling (als mogelijk) en overkoepelend project. 3.3.7. Maakt voorstellen voor vervolgexperimenten. Competentie 6: Rapporteren en presenteren 6.2.1. Rapporteert (over zijn onderzoek) in vorm van een verslag/labjournaal/poster volgens in opleiding geldende regels (productcriteria labjournaal en verslag niveau 2):hanteert correcte spelling, grammatica, zinsbouw en wetenschappelijke stijl;brengt helder en logische structuur aan in complexere teksten;is zich bewust van samenhang tussen tekstonderdelen;opbouw van tekst is conform in het werkveld gebruikte richtlijnen;rapport omvat een literatuurlijst. In de tekst wordt verwezen naar bronnen in literatuurlijst;beschrijft resultaten zodat de lezer deze begrijpen kan; gebruikt hiervoor duidelijke gelabelde afbeeldingen en tabellen;beschrijft alle relevante gegevens in een samenvatting. 6.3.1. Rapporteert over zijn onderzoek in vorm van een verslag/labjournaal volgens internationaal geldende regels (productcriteria labjournaal en verslag niveau 3):hanteert correcte spelling, grammatica, zinsbouw en wetenschappelijke stijl;brengt helder en logische structuur aan in complexere teksten. Er is sprake van samenhang tussen tekstonderdelen;is zich bewust

	van samenhang tussen tekstonderdelen;opbouw van tekst is conform in het werkveld gebruikte richtlijnen;rapport omvat een literatuurlijst. In de tekst wordt verwezen naar bronnen in literatuurlijst;beschrijft resultaten zodat de lezer deze begrijpen kan; gebruikt hiervoor duidelijke gelabelde afbeeldingen en tabellen; beschrijft alle relevante gegevens in een samenvatting die als zelfstandig geheel gelezen kan worden.
Beoordelingscriteria	Zie beoordelingsformulier Literatuurverslag niveau 2 op #OnderwijsOnline bij Algemene Informatie.
Toetsmatrijs	Zie beoordelingsformulier Literatuurverslag niveau 2 op #OnderwijsOnline bij Algemene Informatie.
	M_ATBC-M-DMM-V
Naam (deel)tentamen	Onderzoeksverslag
Code (deel)tentamen	M_ATBC-M-DMM-V
Vorm(en) (deel)tentamen	Schriftelijk, Groep
Oordeel	Cijfer
Minimaal oordeel	5,5
Weging deeltentamen	1
Tentamenmomenten	Periode 2
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Deelname aan OWE M_ATBC-M-DMM geldt als aanmelding voor M_ATBC-M-DMM-V.
Nabespreking en inzage	Het ingevulde beoordelingsformulier en eventueel opmerkingen op het formulier of in het beroepsproduct geldt als inzage en nabespreking van dit deeltentamen
Aantal examinatoren	Beoordeling door één examinator op basis van beoordelingsformulier (tutor).
Compensatiemogelijkheden	**-**
Beoordelingsdimensies	Competentie 6: Rapporteren en presenteren 6.2.3. Is bekend met internationale wetenschappelijke en academische schrijfstijlen en past deze toe 6.3.1. Rapporteert over zijn onderzoek in vorm van een verslag/labjournaal volgens internationaal geldende regels (productcriteria labjournaal en verslag niveau 3):hanteert correcte spelling, grammatica, zinsbouw en wetenschappelijke stijl; brengt helder en logische structuur aan in complexere teksten. Er is sprake van samenhang tussen tekstonderdelen; is zich bewust van samenhang tussen tekstonderdelen; opbouw van tekst is conform in het werkveld gebruikte richtlijnen; rapport omvat een literatuurlijst. In de tekst wordt verwezen naar bronnen in literatuurlijst; beschrijft resultaten zodat de lezer deze begrijpen kan; gebruikt hiervoor duidelijke gelabelde afbeeldingen en tabellen; beschrijft alle relevante gegevens in een samenvatting die als zelfstandig geheel gelezen kan worden. 6.3.5.Presenteert onderzoek aan diverse groep toehoorders op heldere en overtuigende wijze volgens de normen van

	presentatietechnieken en beantwoord vragen: er zit structuur in de presentatie (kop-romp-staart); spreekt duidelijk en verstaanbaar; staat rechtop en laat de handen vrij; maakt oogcontact met het publiek en controleert of essentie van boodschap bij doelgroep overkomt; maakt overzichtelijke en duidelijke slides of andere visuele producten; verbale en visuele boodschap vormen een geheel; gebruikt mogelijkheden van PowerPoint als visuele ondersteuning voor het overbrengen van de boodschap; gaat inhoudelijke discussie met publiek aan. Competentie 10: Adviseren 10.2.2. adviseert over methode nadat meerdere alternatieven zijn getest en presenteert onderbouwde keuze. In de context van: moleculaire diagnostiek van infectieziekten
Beoordelingscriteria	Zie beoordelingsformulier onderzoeksverslag niveau 2. Voor beoordelingsformulier zie #OnderwijsOnline bij Algemene Informatie.
Toetsmatrijs	Zie beoordelingsformulier onderzoeksverslag niveau 2 op #OnderwijsOnline bij Algemene Informatie.
	M_ATBC-M-DMM-Pr
Naam (deel)tentamen	Presentatie
Code (deel)tentamen	M_ATBC-M-DMM-Pr
Vorm(en) (deel)tentamen	Mondeling, Groep
Oordeel	Cijfer
Minimaal oordeel	5,5
Weging deeltentamen	1
Tentamenmomenten	Periode 2
Toegestane hulpmiddelen	
Wijze van aanmelden voor tentamen / aanmeldingstermijn	Deelname aan OWE M_ATBC-M-DMM geldt als aanmelding voor M_ATBC-M-DMM-Pr.
Nabespreking en inzage	Het ingevulde beoordelingsformulier en eventueel opmerkingen op het formulier of in het beroepsproduct geldt als inzage en nabespreking van dit deeltentamen
Aantal examinatoren	Beoordeling door twee examinatoren op basis van beoordelingsformulier (tutor).
Compensatiemogelijkheden	
Beoordelingsdimensies	Competentie 6: Rapporteren en presenteren 6.3.1. Rapporteert over zijn onderzoek in vorm van een verslag/labjournaal volgens internationaal geldende regels (productcriteria labjournaal en verslag niveau 3):hanteert correcte spelling, grammatica, zinsbouw en wetenschappelijke stijl; brengt helder en logische structuur aan in complexere teksten. Er is sprake van samenhang tussen tekstonderdelen; is zich bewust van samenhang tussen tekstonderdelen; opbouw

	van tekst is conform in het werkveld gebruikte richtlijnen; rapport omvat een literatuurlijst. In de tekst wordt verwezen naar bronnen in literatuurlijst; beschrijft resultaten zodat de lezer deze begrijpen kan; gebruikt hiervoor duidelijke gelabelde afbeeldingen en tabellen; beschrijft alle relevante gegevens in een samenvatting die als zelfstandig geheel gelezen kan worden. 6.3.4. Presenteert onderzoek aan diverse groep toehoorders op heldere en overtuigende wijze volgens de normen van presentatietechnieken en beantwoord vragen: er zit structuur in de presentatie (kop-romp-staart);spreekt duidelijk en verstaanbaar; staat rechtop en laat de handen vrij; maakt oogcontact met het publiek en controleert of essentie van boodschap bij doelgroep overkomt; maakt overzichtelijke en duidelijke slides of andere visuele producten; verbale en visuele boodschap vormen een geheel; gebruikt mogelijkheden van PowerPoint als visuele ondersteuning voor het overbrengen van de boodschap; gaat inhoudelijke discussie met publiek aan. Competentie 10: Adviseren 10.2.2. adviseert over methode nadat meerdere alternatieven zijn getest en presenteert onderbouwde keuze.
Beoordelingscriteria	Zie beoordelingsformulier presentatie niveau 2 op #OnderwijsOnline bij Algemene Informatie.
Toetsmatrijs	Zie beoordelingsformulier presentatie niveau 2 op #OnderwijsOnline bij Algemene Informatie..

M_ATBC-M-P Scientific Research (30 studiepunten)

	M_ATBC-M-P (CHLS)
General information	
Target group/groups	Full-time students main phase Life Science or Chemistry
Name of unit of study	Minor Scientific Research
Code of unit of study	M_ATBC-M-P (CHLS)
Lecture period	Dependent on the chosen course units
ECTS credits	30 EC
Study load in hours	420 SBU
Study hours (contact hours)	The minor comprises chosen course units that broaden or deepen the focus of the chosen major.
Entry requirements for unit of study	Foundation year completed. Additional entry requirements are dependent on the requirements for the chosen course units.
Content and organisation	
General description	Students can choose from: - the researchminor –M_ATBC-M-R30; - the mini researchminor – M_ATBC-M-R15

	Students of the degree program Life Sciences, if they meet the entrance requirements as defined in the relevant course description, may choose one or more courses from: - the chemistry degree program: CH7KT, CH5KT, CH5-7Pa and CH5-7Po; - the chemistry degree program: CH6KT en CH8KT, CH6-8Pa en CH6-8Po; - the graduation subject biotechnology: BMLS8; - the graduation subject molecular plant biology: BMLS9; - the graduation subject biomedical research: BMLS10. Students of the degree program Chemistry, if they meet the entrance requirements as defined in the relevant course description, may choose one or more courses from: - the graduation subject organical chemistry C9, C10 (Dutch) - the graduation subject analytical chemistry CH11, CH12 - the Life Sciences degree program LS5A/LS5B/LS5C or LS6A/LS6B/LS6C. Depending on the semester when you participate in the minor you follow A1 (semester 1) or A2 (semester 2)
Exit qualifications	Dependent on the chosen course units
Professional task	Carrying out life science research
Professional products	Dependent on the chosen course units
Cohesion	The minor comprises chosen course units that broaden or deepen the focus of the chosen major.
Mandatory participation	Dependent on the chosen course units
Maximum number of participants	Dependent on the chosen course units
Compensation options	Dependent on the chosen course units
Activities and/or instructional formats	Dependent on the chosen course units
Required literature	Dependent on the chosen course units
Required software / required materials	Dependent on the chosen course units
Recommended literature	Dependent on the chosen course units
Examination	
Name [exams or modular exams]	Dependent on the chosen course units
Code [exams or modular exams]	Dependent on the chosen course units
Exam and modular exam format(s)	Dependent on the chosen course units
Judgement	Dependent on the chosen course units
Minimum result	Dependent on the chosen course units

Weight factor of modular exam	Dependent on the chosen course units
Exam opportunities	Dependent on the chosen course units
Permitted resources	Dependent on the chosen course units
Method of enrolment for exam / enrolment period	Dependent on the chosen course units
Discussion and review	Dependent on the chosen course units
Number of examiners	Dependent on the chosen course units
Compensation possibility	Dependent on the chosen course units
Assessment criteria	Dependent on the chosen course units
Competences and indicators	Dependent on the chosen course units
Test Matrix	Dependent on the chosen course units

M_ATBC-M-PR15 Research minor LS

	EEU R15 Research minor
General information	
Target group/groups	Full-time students main phase Life Sciences or Chemistry
Name of unit of study	EEU R15 Research minor
Code of unit of study	BMCBI-R15 (CHLS)
Lecture period	P1, P2, P3, P4
ECTS credits	15 EC
Study load in hours	420 SBU
Study hours (contact hours)	There are no lessons planned, the supervising lecturer has 5 hours allocated for supervising and evaluation.
Entry requirements for unit of study	Foundation year must be successfully completed. At least 50 stp have been earned in the 2nd study year and the practical assessment in the 2nd study year must be at least satisfactory. If the research minor follows the internship or graduation project, a prerequisite for starting is that the research report of the preceding internship or graduation project has been submitted to the supervisor. If the student does not fulfil the prerequisites, a request for exemption and permission to follow the research minor may submitted to the Examination Board.
Content and organisation	
General description	A minor must deepen or broaden the focus and have no large overlap with the major. A research minor is not an internship, as the internship is a part of the major. The aim of the research minor is therefore to focus on something new, and what has not (yet) been covered in the major. The combination of the chosen course unit (15 EC) and mini research minor (15 EC) consists of a theoretical component (for example a chosen unit of the course Chemistry or Life Sciences or at the university) and a practical component where the theory is applied with a total duration of 10 weeks (15 EC). If this combination is chosen, then the chosen course of 15 EC counts for the theoretical component of the research minor and a normal research report can be written about the practical component.

	If the mini research minor of 15 EC is combined with the internship or graduation, the theoretical compound must be filled in otherwise. To satisfy the theoretical component, the research report of the RM15 contains a more extensive introduction. A literature report may be written instead of a research report to meet the requirements of the theoretical component. The research minor remains an independent study unit. It must meet the requirements as described and will be assessed independently from the internship.
Exit qualifications	Designing an experimental plan Experimenting Results analysis Quality control Management and administration Reporting and presenting Planning and project-based working Teamwork Professional development
Professional task	Carrying out life science research
Professional products	
Cohesion	Elective component of the Minor Scientific research. During the mini research minor, the theory presented in the preceding (selected) course unit from the scientific research minor is applied.
Mandatory participation	
Maximum number of participants	-
Compensation options	-
Activities and/or instructional formats	The personal tutor guides the student in finding a research minor that fits with the PDP. The student is responsible for finding and applying for a minor research placement. During the research minor, the student is supervised by a workplace supervisor and a lecturer from the HAN.
Required literature	Information under the tile ATBC Minor on #OnderwijsOnline
Required software / required materials	
Recommended literature	
Examination	
	BMCBI-R15-Rv
Name [exams or modular exams]	Reflection report
Code [exams or modular exams]	BMCBI-R15-Rv
Exam and modular exam format(s)	In writing, individual
Judgement	Satisfactory/unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0

Exam opportunities	2 opportunities per year. Deadline is the last day of the research minor. If handed in late, a 0 is given for the first chance. In consultation with the minor lecturer, a new deadline is set. Resits are possible up to 2 months after the last day of the research minor.
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in OWE BMCBI-R15 applies as registration for BMCBI-R15-Rv
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner based on assessment form (Minor lecturer).
Compensation possibility	
Assessment criteria	See assessment form "Reflection report" on #OnderwijsOnline - General information.
Competences and indicators	Competence 6: Reporting and presenting 6.3.1. Reports (on the research) in the form of a report/lab journal according to internationally accepted criteria (partially). Competency 11 Professional development Guides own competency development: 11.1.2. Works on learning aims according to the PDP and collects evidence of competency. 11.3.2 Looks back critically (reflects) on their own actions and learning process; learns from mistakes; is open to learning opportunities.
Test matrix	See assessment form "Reflection report" on #OnderwijsOnline - General information.
	BMCBI-R15-P
Name [exams or modular exams]	Practical work
Code [exams or modular exams]	BMCBI-R15-P
Exam and modular exam format(s)	Practical
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	There is only one opportunity per academic year for the modular exam P (EER paragraph 8.5).
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in OWE BMCBI-R15 applies as registration for BMCBI-R15-P
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.

Number of examiners	Assessment by one examiner based on assessment form (Minor lecturer) filled in by the workplace supervisor
Compensation possibility	
Assessment criteria	See assessment form “Practical work R15” on #OnderwijsOnline - General information.
Competences and indicators	Competence 1: Design 1.2.1. Identifies independently which background information is required to answer the research question. 1.2.2.,(1.3.3.) Independently searches for, selects and processes information from relevant sources for scientific research 1.2.5.,(1.3.5.) Independently integrates information into a comprehensive research plan (e.g. justifying the chosen method, describing necessary controls and availability of equipment). 1.2.6. Understands and applies intermediate English literature relevant to the given context. Competence 2: Experiment Preparation 2.1.2. Performs calculations prior to beginning lab work. 2.1.5. Carries out the experiments within the stated time 2.2.1.,(2.3.1.) Can justify (all) the basic steps of the experiments theoretically 2.2.3.,(2.3.3.) Ensures (independently) that all requirements are ready before the experiment is started; makes solutions 2.2.4.,(2.3.4.) Carries out experiments according to protocol so that reliable reproducible data is obtained; (but can, if necessary, deviate from this) 2.2.6.Makes a start with execution of several experiments at the same time (multitasking) 2.3.4. Works on several experiments at the same time and can carry out these within the stated time, can switch easily and keep an overview 2.2.7. Attempts to solve problems if the experiment does not run as was anticipated (trouble shooting) / 2.3.7. Solves practical problems if the experiment does not run as expected (trouble shooting Competence 3: Results analysis 3.1.2.,(3.3.2.) Independently assesses the usability of results based on accuracy and reliability. 3.1.4. Discusses the execution and experimental results 3.2.1.,(3.3.1.) Carries out results analysis with appropriate methods (independently); if applicable uses statistics. 3.2.2.,(3.3.3.) Independently makes conclusions relating to the initial research question (if possible) and overarching research project. 3.2.5.,(3.3.5.) Independently discusses results relative to other experiments and compares them with the results in literature. 3.2.6. Makes proposals for improving the execution of the research. 3.3.7. Makes proposals for follow-up experiments.

	Competence 4: Quality control 4.1.1. Is aware of and adheres to the workplace health and safety rules. 4.1.3. Uses controls to evaluate the reliability of the results. Competence 5: Management and administration 5.2.1.Codes chemicals and samples and keeps these in a correct way 5.2.2.Contributes to an efficiently functioning lab (clears up, indicates if reagents are almost finished, carries out minor maintenance on the equipment) 5.2.3. Manages and archives data in lab journal (purpose, experiments description, results, conclusion) and if required, in other ways so that others can understand these. Competence 6:Reporting/presenting 6.2.5. Presents research to audience with same background in a clear manner according to the conventional standards of presentation techniques and answers questions there is structure in the presentation (head-body-tail)speaks clearly and intelligibly; stands upright and keeps hands relaxed; makes eye contact with the audience; makes well-structured and clear slides or other visual products verbal and visual message form a whole; uses visual capabilities of PowerPoint as visual support; Conducts a substantive discussion with audience. 6.3.5 Presents research to varying audiences in a clear and convincing way, according to the conventional standards of presentation techniques and answers questions: there is structure in the presentation (head-body-tail)speaks clearly and intelligibly; stands upright and keeps hands relaxed makes eye contact with the public and checks whether the essence of the message comes across to the target group; makes well-structured and clear slides or other visual products verbal and visual message form a whole; Uses visual aids of a presentation medium effectively to communicate the message Conducts a substantive discussion with audience. Competence 7:Planning/project-based working 7.2.2. Carries out activities according to planning; also under time pressure. 7.2.3.Ensures that aims are achieved and adapts the work if required. 7.3.2. Responds to changing circumstances; determines priorities in activities. Competence 8: Teamwork Functioning in a group 8.1.1. Observes the rules. 8.2.1. Makes concrete agreements and keeps to these 8.3.4. Recognizes own role and contribution to the group and know what other roles there are in the team; functions adequately; takes others into consideration. Communication Communicates about his research with fellow students and teacher according to basic rules of communication: 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Allows others to finish speaking

	8.1.9. Shows initiative to actively solve conflicts. 8.2.5. Shows initiative in conversation. 8.2.8. States his/her opinion/message clearly. 8.2.10. Interacts with with discussion partner. 8.2.7. Is aware of intercultural differences in the professional field.
Test matrix	See assessment form “Practical work R15” on #OnderwijsOnline - General information.
	BMCBI-R15-V
Name [exams or modular exams]	Report
Code [exams or modular exams]	BMCBI-R15-V
Exam and modular exam format(s)	written individual
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	2 opportunities per year. Deadline is the last day of the research minor. If handed in late, a 0 is given for the first chance. In consultation with the minor lecturer, a new deadline is set. Resits are possible up to 2 months after the last day of the research minor.
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in OWE BMCBI-R15 applies as registration for BMCBI-R15-V

Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner based on assessment form (Minor lecturer).
Compensation possibility	
Assessment criteria	See assessment forms “Research report R15” or “Literature report” on #OnderwijsOnline - General information.
Competences and indicators	*General:* Competence 1: Design 1.2.1. Identifies independently which background information is required to answer the research question. 1.2.2.,(1.3.3.) Independently searches for, selects and processes information from relevant sources for scientific research 1.3.6. Understands and applies advanced English literature relevant to the given context. 1.3.7. Links own research with the overarching research project Competence 3: Results analysis 3.2.2.(3.3.3.) Independently makes conclusions relating to the initial research question (if possible) and overarching research project. 3.3.7.Makes proposals for follow-up experiments. Competence 6: Reporting and presenting 6.2.1. Reports (on his research) in the form of a report/lab journal/poster according to the in-house standards as described in ‘product criteria: lab journal and report level 2’. 6.3.1. Reports (on the research) in the form ofa report/lab journal according to internationally accepted criteria (product criteria lab journal and report level 3). 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing. *Specific for research report:* Competence 2: Experiment preparation 2.3.1. Can justify all steps of the experiments theoretically Competence 3: Results analysis 3.1.2.(3.3.2.) Independently assesses the usability of results based on accuracy and reliability. 3.1.4. Discusses the execution and experimental results 3.2.1.(3.3.1.) Carries out (independently) results analysis according suitable methods; if applicable makes use of statistics. 3.2.5.,(3.3.5.) Independently discusses results relative to other experiments and compares them with the results in literature. 3.2.6.Makes proposals for improving the execution of the research. Competence 4: Quality control

	4.1.3. Uses controls to evaluate the reliability of the results. Competence 5: Management and administration 5.3.3.Manages and archives data in lab journal (purpose, experiments description, changes, results, conclusion, future proposals) and if applicable in other ways so that others can use these.
Test matrix	See assessment form “Research report R15” or “Literature report” on #OnderwijsOnline - General information.

M_ATBC-M-PR30 Research minor LS

	EEU R30 Research minor
General information	
Target group/groups	Full-time students main phase Life Sciences or Chemistry
Name of unit of study	EEU R30 Research minor
Code of unit of study	BMCBI-R30 (CHLS)
Lecture period	P1, P2, P3, P4
ECTS credits	30 EC
Study load in hours	840 SBU
Study hours (contact hours)	There are no lessons planned, the supervising lecturer has 12,5 hours allocated for supervising and evaluation. The 2nd assessor has 2,5 hours for evaluation.
Entry requirements for unit of study	Foundation year must be successfully completed. At least 50 stp have been earned in the 2nd study year and the practical assessment in the 2nd study year must be at least satisfactory. If the research minor follows the internship or graduation project, a prerequisite for starting is that the research report of the preceding internship or graduation project has been submitted to the supervisor and the portfolio assessed as satisfactory (with the exception of the research report)If the student does not fulfil the prerequisites, a request for exemption and permission to follow the research minor may submitted to the Examination Board.
Content and organisation	
General description	A minor must deepen or broaden the focus and have no large overlap with the major. A research minor is not an internship, as the internship is a part of the major. The aim of the research minor is therefore to focus on something new, and what has not (yet) been covered in the major. The research minor therefore consists of a theoretical component (min. 4 study points = 4x28 SBU) and a practical component where you apply what you have learned. The total duration is 20 weeks (30 credits). The theoretical component can take the form of a literature review, but can also be implemented in a different way for example by a course (MOOC) or EEU of minimally 4 study points. The research minor may be completed at the same location as the internship/graduation internship. However, the research minor remains an independent study unit. It must meet the requirements as described and will be assessed independently from the internship.

Exit qualifications	Designing an experimental plan Experiment Results analysis Quality control Management and administration Reporting and presenting Planning and project-based working Teamwork Professional development
Professional task	Carrying out life science research
Professional products	
Cohesion	Elective component of the Minor Scientific research. During the research minor, the theory presented in the preceding (selected) course unit from the scientific research minor is applied.
Mandatory participation	
Maximum number of participants	-
Compensation options	-
Activities and/or instructional formats	The personal tutor guides the student in finding a research minor that fits with the PDP. The student is responsible for finding and applying for a minor research placement. During the research minor, the student is supervised by a workplace supervisor and a lecturer from the HAN.
Required literature	Information under the tile SABC Minor on #OnderwijsOnline
Required software / required materials	
Recommended literature	
Examination	
	BMCBI-R30-Rv
Name [exams or modular exams]	Reflection report
Code [exams or modular exams]	BMCBI-R30-Rv
Exam and modular exam format(s)	In writing, individual
Judgement	Satisfactory/unsatisfactory
Minimum result	Satisfactory
Weight factor of modular exam	0
Exam opportunities	2 opportunities per year. Deadline is the last day of the research minor. If handed in late, a 0 is given for the first chance. In consultation with the minor lecturer, a new deadline is set. Resits are possible up to 2 months after the last day of the research minor.
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in OWE BMCBI-R30 applies as registration for BMCBI-R30-Rv

Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner based on assessment form (Minor lecturer).
Compensation possibility	
Assessment criteria	See assessment form "Reflection report" on #OnderwijsOnline - General information.
Competences and indicators	Competence 6: Reporting and presenting 6.3.1. Reports (on the research) in the form of a report/lab journal according to internationally accepted criteria (partially). Competency 11 Professional development Guides own competency development: 11.1.2. Works on learning aims according to the PDP and collects evidence of competency. 11.3.2 Looks back critically (reflects) on their own actions and learning process; learns from mistakes; is open to learning opportunities.
Test matrix	See assessment form "Reflection report" on #OnderwijsOnline - General information.
	BMCBI-R30-P
Name [exams or modular exams]	Practical work
Code [exams or modular exams]	BMCBI-R30-P
Exam and modular exam format(s)	Practical
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	There is only one opportunity per academic year for the modular exam P (EER paragraph 8.5).
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in OWE BMCBI-R30 applies as registration for BMCBI-R30-P
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by one examiner based on assessment form (Minor lecturer) filled in by the workplace supervisor
Compensation possibility	
Assessment criteria	See assessment form “Practical work R30” on #OnderwijsOnline - General information.

Competences and indicators	Competence 1: Design 1.2.1. Identifies independently which background information is required to answer the research question. 1.2.2.,(1.3.3.) Independently searches for, selects and processes information from relevant sources for scientific research 1.2.5.,(1.3.5.) Independently integrates information into a comprehensive research plan (e.g. justifying the chosen method, describing necessary controls and availability of equipment). 1.2.6. Understands and applies intermediate English literature relevant to the given context. Competence 2: Experiment Preparation 2.1.2. Performs calculations prior to beginning lab work. 2.1.5. Carries out the experiments within the stated time 2.2.1., (2.3.1.) Can justify (all) the basic steps of the experiments theoretically 2.2.3., (2.3.3.) Ensures (independently) that all requirements are ready before the experiment is started; makes solutions 2.2.4.,(2.3.4.) Carries out experiments according to protocol so that reliable reproducible data is obtained; (but can, if necessary, deviate from this) 2.2.6. Makes a start with execution of several experiments at the same time (multitasking) / 2.3.4. Works on several experiments at the same time and can carry out these within the stated time, can switch easily and keep an overview 2.2.7. Attempts to solve problems if the experiment does not run as was anticipated (trouble shooting) / 2.3.7. Solves practical problems if the experiment does not run as expected (trouble shooting Competence 3: Results analysis 3.1.2.,(3.3.2.) Independently assesses the usability of results based on accuracy and reliability. 3.1.4. Discusses the execution and experimental results 3.2.1.,(3.3.1.) Carries out results analysis with appropriate methods (independently); if applicable uses statistics. 3.2.2.,(3.3.3.) Independently makes conclusions relating to the initial research question (if possible) and overarching research project. 3.2.5.,(3.3.5.) Independently discusses results relative to other experiments and compares them with the results in literature. 3.2.6. Makes proposals for improving the execution of the research. 3.3.7. Makes proposals for follow-up experiments. Competence 4: Quality control 4.1.1. Is aware of and adheres to the workplace health and safety rules. 4.1.3. Uses controls to evaluate the reliability of the results. Competence 5: Management and administration 5.2.1. Codes chemicals and samples and keeps these in a correct way

	5.2.2. Contributes to an efficiently functioning lab (clears up, indicates if reagents are almost finished, carries out minor maintenance on the equipment) 5.2.3. Manages and archives data in lab journal (purpose, experiments description, results, conclusion) and if required, in other ways so that others can understand these. Competence 6: Reporting/presenting 6.2.5. Presents research to audience with same background in a clear manner according to the conventional standards of presentation techniques and answers questions there is structure in the presentation (head-body-tail)speaks clearly and intelligibly; stands upright and keeps hands relaxed; makes eye contact with the audience; makes well-structured and clear slides or other visual products verbal and visual message form a whole; uses visual capabilities of PowerPoint as visual support; Conducts a substantive discussion with audience. 6.3.5. Presents research to varying audiences in a clear and convincing way, according to the conventional standards of presentation techniques and answers questions: there is structure in the presentation (head-body-tail)speaks clearly and intelligibly; stands upright and keeps hands relaxed makes eye contact with the public and checks whether the essence of the message comes across to the target group; makes well-structured and clear slides or other visual products verbal and visual message form a whole; Uses visual aids of a presentation medium effectively to communicate the message Conducts a substantive discussion with audience. Competence 7: Planning/project-based working 7.2.1. Plans and organises his experiments resulting in a work plan that covers a minimum of 4 lessons to prepare for practical 7.2.2. Carries out activities according to planning; also under time pressure. 7.2.3. Ensures that aims are achieved and adapts the work if required. 7.3.1. Plans and organises his project resulting in a work plan of a minimum of 4 weeks. 7.3.2. Responds to changing circumstances; determines priorities in activities. Competence 8: Teamwork Functioning in a group 8.1.1. Observes the rules. 8.2.1. Makes concrete agreements and keeps to these 8.3.4. Recognizes own role and contribution to the group and know what other roles there are in the team; functions adequately; takes others into consideration. Communication Communicates about his research with fellow students and teacher according to basic rules of communication: 8.1.6. Maintains eye contact with conversation partner. 8.1.7. Allows others to finish speaking 8.1.9. Shows initiative to actively solve conflicts. 8.2.5. Shows initiative in conversation. 8.2.8. States his/her opinion/message clearly. 8.2.10. Interacts with with discussion partner.

	8.2.7. Is aware of intercultural differences in the professional field.
Test matrix	See assessment form “Practical work R30” on #OnderwijsOnline - General information.
	BMCBI-R30-V
Name [exams or modular exams]	Research report
Code [exams or modular exams]	BMCBI-R30-V
Exam and modular exam format(s)	written individual
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	2 opportunities per year. Deadline is the last day of the research minor. If handed in late, a 0 is given for the first chance. In consultation with the minor lecturer, a new deadline is set. Resits are possible up to 2 months after the last day of the research minor.
Permitted resources	
Method of enrolment for exam / enrolment period	Participation in OWE BMCBI-R30 applies as registration for BMCBI-R30-V
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by two examiners based on assessment form (Minor lecturer and 2nd assessor).
Compensation possibility	
Assessment criteria	See assessment form “Research report R30” on #OnderwijsOnline - General information.
Competences and indicators	Competence 1: Design 1.2.2.,(1.3.3.) Independently searches for, selects and processes information from relevant sources for scientific research 1.3.6. Understands and applies complex English literature relevant to the given context. 1.3.7. Links own research with the overarching research project Competence 2: Experiment preparation 2.3.1. Can justify all steps of the experiments theoretically Competence 3: Results analysis

	3.1.2. (3.3.2.) Independently assesses the usability of results based on accuracy and reliability. 3.1.4. Discusses the execution and experimental results 3.2.1. (3.3.1.) Carries out (independently) results analysis according suitable methods; if applicable makes use of statistics. 3.2.2. (3.3.3.) Independently makes conclusions relating to the initial research question (if possible) and overarching research project. 3.2.5., (3.3.5.) Independently discusses results relative to other experiments and compares them with the results in literature. 3.2.6. Makes proposals for improving the execution of the research. 3.3.7. Makes proposals for follow-up experiments. Competence 4: Quality control 4.1.3. Uses controls to evaluate the reliability of the results. Competence 5: Management and administration 5.3.3. Manages and archives data in lab journal (purpose, experiments description, changes, results, conclusion, future proposals) and if applicable in other ways so that others can use these. Competence 6: Reporting and presenting 6.2.1. Reports (on his research) in the form of a report/lab journal/poster according to the in-house standards as described in 'product criteria: lab journal and report level 2'. 6.3.1. Reports (on the research) in the form of a report/lab journal according to internationally accepted criteria (product criteria lab journal and report level 3). 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing.
Test matrix	See assessment form "Research report R30" on #OnderwijsOnline - General information.
	BMCBI-R30-L
Name [exams or modular exams]	Literature review
Code [exams or modular exams]	BMCBI-R30-L
Exam and modular exam format(s)	In writing, individual
Judgement	Grade
Minimum result	5,5
Weight factor of modular exam	1
Exam opportunities	2 opportunities per year. Deadline is the last day of the research minor. If handed in late, a 0 is given for the first chance. In consultation with the minor lecturer, a new deadline is set. Resits are possible up to 2 months after the last day of the research minor.
Permitted resources	

Method of enrolment for exam / enrolment period	Participation in OWE BMCBI-R30 applies as registration for BMCBI-R30-L
Discussion and review	Returning the completed assessment form to the student and any remarks on the form or in the professional product serves as inspection and discussion of this partial examination.
Number of examiners	Assessment by two examiners based on assessment form (Minor lecturer and 2nd assessor).
Compensation possibility	
Assessment criteria	See assessment form “Literature report” on #OnderwijsOnline - General information.
Competences and indicators	Competence 1: Design 1.2.1. Identifies independently which background information is required to answer the research question. 1.2.2., (1.3.3.) Independently searches for, selects and processes information from relevant sources for scientific research 1.3.7. Links own research with the overarching research project 1.2.6. Understands and applies intermediate English literature relevant to the given context Competence 3: Results analysis 3.3.3. Independently makes conclusions relating to the initial research question (if possible) and overarching research project. 3.3.7. Makes proposals for follow-up experiments. Competence 6: Reporting and presenting 6.2.1. Reports (on his research) in the form of a report/lab journal/poster according to the in-house standards as described in ‘product criteria: lab journal and report level 2’. 6.3.1. Reports (on the research) in the form ofa report/lab journal according to internationally accepted criteria (product criteria lab journal and report level 3). 6.2.3. Is familiar with and applies the international conventions of scientific and academic writing.
Test matrix	See assessment form “Literature report” on #OnderwijsOnline - General information.

9.4 Graduation specialisations

The study program Biology and Medical Laboratory research has the following graduation specialisations: Biotechnology, Molecular Plant Biology and Biomedical Research. These include the following educational units with the associated study load. The Course unit descriptions can be found in section 9.2.

Graduation specialisation Biotechnology

- Course unit 8: BMLS8 (30 study credits)
- Course unit 11: LS11 (30 study credits)
- Course unit 12: LS12 (30 study credits)

Graduation subject Molecular Plant Biology:

- Course unit 9: BMLS9 (30 study credits)
- Course unit 11: LS11 (30 study credits)
- Course unit 12: LS12 (30 study credits)

Graduation specialisation biomedical research:

- Course unit 10: BMLS10 (30 study credits)
- Course unit 11: LS11 (30 study credits)
- Course unit 12: LS12 (30 study credits)

9.5 Honours, talent and bridging programs

9.5.1 Honours programs

Not applicable

9.5.2 Talent programs

The degree program has no talent program, but it has an extra-curricular Analytical Sciences Talent Program (ASTP) in the area of analytical chemistry. The ASTP is offered by the Centre of Expertise Analytical Sciences, a partnership between HAN and COAST. The three-year ASTP program is not a part of the curriculum. The program is concluded with a COAST certificate; there is no mention of the ASTP program on the HAN Bachelor Diploma.

9.5.3 Bridging programs

The bridging programs (EER Chapter 5) offered by a university can be followed as part of a free minor.

9.6 Part-time and/or work-study degree format

9.6.1 Part-time degree format

Not applicable

9.6.2 Work-study degree format

Not applicable

9.7 Tracks with special feature

9.7.1 Fast track

Not applicable

9.7.2 Abridged track

For some well-defined target groups it is possible on the basis of exemptions to follow an abridged version of the degree course.

1. Composition of the abridged version of the degree course for Biology and Medical Laboratory Research, Life Sciences and Chemistry.

1.1
The following certificates lead to an abridged programme:

a. Students with a **MLO-4 diploma** who enroll in the BML, Life Sciences or Chemistry degree course receive exemption based on their MLO-4 diploma for Course units CHLS1B and CHLS2B

(Practical and tutor) and Course units CHLS1C and CHLS2C (Basic knowledge LS and CH) and the mini-internship (LS4T-st).

b. Students with a **VWO diploma** including the profile subjects Maths A or B and Chemistry who enroll in the BML, Life Sciences or Chemistry degree course can participate in the abridged programme. They obtain exemption for the modular exams Labcalculation (CHLS1A-Lab and CHLS2A-Lab) with a qualification 7 or higher for Chemistry on the VWO-diploma and exemption for the modular exams Maths (CHLS1A-Wis and CHLS2A-Wis)) with a qualification 7 or higher for Maths B on the VWO-diploma.
c. Students with a HBO or WO certificate or a certificate of related HBO or WO examinations based on which participation in the abridged programme can be justified. A foreign certificate of related examinations should be at least equivalent to HBO-level.

Students are not required to take the abridged programme, thery are free to choose for the regular 4-year degree programme.

1.2
The Examination Committee will grant students with a VWO or MLO diploma as referred to in 1.1, that wish to enroll in the BML, Life Sciences or Chemistry Degree access to the taking of one or more components of the final examination before the foundation year examination has been successfully completed.

1.3
Students referred to in paragraph 1.1 meet the requirements for the foundation year exam if it can be shown that course units CHLS1A and CHLS2A have been completed and the professional tasks of Course 3 and Course 4, including General Higher Vocational Education competences are mastered at level 1 by passing the exams associated with:

a. Course units LS3KPT and Course units LS4KPT (Level 1) including the Higher Professional Education competences Level 1.

or

b. Course unit LS5A2 or LS6A2 (professional competency semester 2)
and
Course unit LS5B (Molecular and biochemical research practical) or Course unit LS6B (interaction between human plant and micro-organism practical)
and
Course unit LS5C (Molecular and biochemical research theory) or Course unit LS6C (interaction between human plant and micro-organism theory) from the second year of the BML degree course (level 2).

After passing course units LS5A2/LS6A2 and LS5C/LS6C, exemption shall be given for LS3K, LS4K, LS3T and LS4T. After passing course units LS5B/LS6B, exemption shall be given for LS3P and LS4P.

After passing course units LS3 and LS4, exemption is granted for course units CHLS1B, CHLS1C, CHLS2B and CHLS2C when these exemptions were not granted earlier (based on the MLO-4 diploma).

1.4

a. In case of 1.3 if the student can prove, as referred to in 1.1 that he has passed a (modular) exam associated with a course at a higher level, he has also passed this (modular) examination associated with an course at a lower level (see course unit descriptions). This rule does not apply if the student participates in the course unit at the lower level.

b. For all other students, the examination committee decides whether the student that demonstrates components at a higher level also has mastered the components at a lower level.

1.4

c. In case of 1.3 if the student can prove, as referred to in 1.1 that he has passed a (modular) exam associated with a course at a higher level, he has also passed this (modular) examination associated with an course at a lower level (see course unit descriptions). This rule does not apply if the student participates in the course unit at the lower level.
d. For all other students, the examination committee decides whether the student that demonstrates components at a higher level also has mastered the components at a lower level.

9.7.3 Abridged track from associate to bachelor degree

Not applicable

9.7.4 Track for elite athletes

Not applicable

9.7.5 D-stream

Not applicable

9.7.6 Combined track

Not applicable

9.7.7 Other track with special feature

Not applicable