# Appendix Education units MMLS 2020-2021

**Fundamentals Module**

| ***Title of UOS*** | ***Fundamentals***<br>***HMP-MMLS-FUND*** |
|---|---|
| Degree Programme | Master in Molecular Life Sciences |
| Target group | Students enrolled in Master in Molecular Life Sciences |
| Professional task | 2. to apply fundamental knowledge in the area of molecular life sciences to find sustainable solutions for these needs |
| (Professional) Products | • Assignments to apply the Body of Knowledge and Skills |
| Credits/ study load | 7 EC / 196 study load hours, consisting of<br>50 contact hours and<br>146 hours for self-study and work on assignments |
| Relationship with and entry requirements concerning exams | • none |
| General description | The unit of study Fundamentals aims at refreshing the knowledge and skills of a bachelor in bio-molecular research & development. Subjects include molecular biology, cell biology, biochemistry and statistics. Special focus is on the techniques used in the field.<br>Bio informatics will consist of consulting databases and basic online tools. Writing, reading and understanding of scientific articles are subject of the unit of study as well.<br>2-weekly assignments on various subject areas will support students in (re)acquiring the knowledge and skills and in becoming familiar with the education programme.<br>At the end of the module, all students have the fundamental knowledge and skills at post-Bachelor level that enable them to subsequently acquire the knowledge, skills and Competences characteristic for this master in the following units of study. |
| Competences | **Competence 3: Design, analysis and control of experiments** |
| Assessment criteria/ | ***See exams of the UOS Introduction below this table*** |
| Exams | ***See exams of the UOS Introduction below this table*** |
| Compulsory literature | ❖ Reader Fundamentals<br>❖ Original research articles are provided with the weekly assignments |
| Recommended literature | ❖ Alberts, Johnson, Lewis, Morgan, Raff, Roberts, and Walter, (2015 or 2017). *Molecular Biology of the Cell*. (6th or 7th edition). Garland Science:<br>❖ Lodge, Lund & Minchin (2007): *Gene Cloning, Principles and Applications.* Tayler & Francis Group<br>❖ Berg, J.M., Tymoczko, G. Gatto J., Stryer, L. (2015 or 2019). Biochemistry. (8th or 9th edition). W.H. Freeman.<br>❖ Samuel, M.L., Witmer, J.A., & Schaffner, A. (2011 or 2015). *Statistics for the Life Sciences.* (4th or 5th edition). Pearson.<br>❖ Agostino, M. (2012). Practical Bio-informatics. Garland Science. |

| | |
|---|---|
| Software and other materials | Computer and internet connection<br>SPSS software |
| Activities | <u>Introduction to the programme and the facilities</u><br>On the first day, students receive programme material which is introduced by the programme coordinator. Furthermore, the programme aims, structure, contents and organization are explained and students are introduced to the campus facilities.<br><u>Assignments and homework</u><br>The student prepares bi-weekly assignments and discusses these in class, supported by a lecturer. These assignments cover a large part of the BoKS of this unit of study and give the student an indication of where she/he stands in her/his learning process. The assignments and the related discussions form the preparation of the theoretical exam, the formal assessment of this module.<br>The supporting lectures (flipped classroom set up), workshops and trainings are planned to help students to work out their assignments and to achieve their learning goals:<br><u>Lectures (flipped classroom set up):</u><br>- Methods in biochemistry, molecular and cell biology<br>- Overview: The genome<br>- Properties of biomolecules<br>- (Regulation of) gene expression in prokaryotes and eukaryotes<br>- Overview: Signal transduction<br>- Overview: Cell cycle<br>- Overview: Intracellular trafficking<br>- Cell metabolism<br><u>Workshops:</u><br>- Statistics: Introduction and basic statistics for biological data analysis<br><u>Trainings:</u><br>- Bioinformatics: Using databases, Blast search, Tools for gene cloning, Databases for metabolic pathways, Genome databases,<br>- Introduction digital learning environment ‘Scholar’<br><u>Social programme:</u><br>A social programme is part of this unit of study. During this programme, students and teachers can get to know each other personally and have fun together. The activity will be a surprise! |
| Work formats | Start assessment, assignments in flipped classroom set up, lectures, workshops, trainings |
| Lesson / Contact hours | 60 |
| Compulsory participation | - Start assessment<br>- Presentations of Assignments |
| Education period | September - December 2020 |
| Maximum number of participants | - |

**Exam of the UOS Fundamentals**

| | **Assessment criteria/ Indicators / requirements** | | |
|---|---|---|---|
| | ***Competence indicators*** | ***Body of Knowledge and Skills*** | ***Assessment criteria*** |
| ***Code modular exam:*** **MMLS-FUND-EXAM** | *Competence indicators* | *Knowledge indicators* | *In the theoretical exam, these competence and knowledge criteria are translated into the following assessment criteria:* |
| ***Name modular exam:*** **Exam**<br><br>***Type:*** Homework assignments and Written test of theoretical concepts and applications of the body of knowledge and skills<br><br>***Number of examiners:*** 2 for construction and evaluation of test and answer model, 1 for assessment, 2nd in case of doubt<br><br>***Assessment:*** Grade<br><br>***Cut-off value:*** 55%<br><br>***Minimal result:*** 5.5<br><br>***Weighting:*** 100%<br><br>***Period and resit:*** 2 chances per study year; | *Competence indicators*<br>3.1 (intermediate level): Designs experiments based on the required quality and quantity of the product or result.<br>→ In the exam, the student can design experiments based on a research question.<br>3.2 (intermediate level): Applies strict logical thinking to draw conclusions from the results:<br>- in the context of the experiments<br>- in comparison to other analyses, reference/theoretical values, and quality requirements. | *Knowledge criteria - Application of techniques in this exam implies the design of experiments or interpretation of data*<br>• Has knowledge and understanding of the principle of all standard techniques to detect DNA (such as Southern Blot, PCR, FISH, (next generation) sequencing), RNA (such as Northern blot, RT-PCR, expression array, RNAseq, in situ hybridization) and proteins (such as SDS-PAGE, Western blot, immunocytochemistry, immunohistochemistry, protein array, mass spec) and can apply the appropriate technique to answer a question about the presence, quantity, alteration/modification or localization of DNA, RNA or protein<br>• understands how gene expression is regulated in prokaryotes and eukaryotes and applies this knowledge to heterologous gene expression<br>• is able to design a strategy for gene cloning and heterologous expression<br>• has knowledge and understanding of the mechanisms of gene silencing by siRNA and is able to apply siRNA to | → In the exam, the student explains and applies the body of knowledge and skills to design and analyse experiments and data and explains and interprets the theoretical background, aims, methods, results, conclusion and discussion of a current scientific article. The article is provided at the beginning of the exam.<br><br>In addition, the student handed in homework assignments about three bio-informatics cases. |

| | | | |
|---|---|---|---|
| Chance1: November 2020<br>Chance 2: February2021<br><br>***Compensation:***<br>None | | downregulate gene expression<br>• is able to design a (conditional) knock-out strategy<br>• is able to explain the composition and functions of prokaryotic and eukaryotic cells, function of organelles, cell cycle regulation, DNA repair, signal transduction, protein modification and localization<br>• has knowledge and understanding of the principle of techniques to analyze cell proliferation, cell cycle, apoptosis, protein modification and can apply these techniques to answer question on such cellular functions<br>• has knowledge and understanding of the properties of proteins, nucleic acids (DNA, RNA), sugars, lipids, endotoxin, salt, viruses and bacteria<br>• has knowledge and understanding of biomolecule purification methods (such as size exclusion chromatography, ion exchange, hydrophobic interaction, ultrafiltration, affinity chromatography, precipitation, filtration, drying) and is able to choose a purification method depending on the composition of the original sample and the biomolecule to be purified<br>• has knowledge and understanding of methods to analyse biomolecules (such as NMR, chromatography, enzyme assays, ultrafiltration, absorption measurement, selective breakdown, enzyme immune-assay) and is able to choose an analytical method based on the biomolecule(s) to be analyzed | |

| | | | |
|---|---|---|---|
| | | • has knowledge and understanding of metabolic pathways, cell chemistry and biosynthesis and can apply this knowledge to optimize metabolite production (metabolic engineering)<br>• is able to set up an enzyme activity tests<br>Statistics<br>• understands the meaning of: statistical hypotheses, type of variable (continuous / categorical), association versus causation, confounding variables, variation, normal distribution, population versus sample, dependent and independent observations, Type I and Type II error, descriptive statistics, the relationship between central tendency (mean, median) and variance, p-value and statistical significance, log-transformation, one- or two-sided tests, multiple testing problems and its solutions<br>• is able to translate the research question into an appropriate statistical question, experimental setup and corresponding statistical analysis<br>• has awareness of power and sample size calculations<br>• Is able to choose the appropriate statistical method for data Analysis, including t-test, ANOVA, multiple regression, chi square tests<br>• is able to report the results with tables and graphics<br>Bio-informatics/Data Mining | |

| | | | |
|---|---|---|---|
| | | • The student is familiar with the structure and consequences thereof of the main biological databases<br>• The student is able to formulate a biological question in terms of data and consequently to design an effective data retrieval strategy.<br>• The student appreciates the context-dependency of annotation (DNA and protein sequences)<br>• Is able to perform BLAST-searches | |

**Drug Discovery and Development**

| ***Title of UOS*** | ***Drug development***<br>***HMP-MMLS-DRD*** |
|---|---|
| Programme | Master in Molecular Life Sciences |
| Target group | Students enrolled in Master in Molecular Life Sciences programme |
| Professional task | 1. to understand practical, economic, social and/or ecological needs of businesses, market and society that can be anticipated by biotechnology<br>2. to apply fundamental knowledge in the area of molecular life sciences to find sustainable solutions for these needs |
| Professional Products | • High-throughput data analysis<br>• Poster on a drug discovery strategy |
| Credits, study load | 10 EC / 280 study load hours, consisting of 50 contact hours (lectures, workshops and (computer) trainings), 98 contact and online studying at University of Florida and 133 hours for self-study and work on assignments. |
| Cohesion and admission requirements relating to exams | • All assessments of this unit of study have to be sufficient. |
| General description | During this unit of study, students acquire knowledge in the principle of pharmaceutical chemistry and skills in different stages of drug development by designing strategies in drug discovery, development and delivery.<br>The assignments are placed in the context of cancer drug development. Students acquire knowledge and understanding of the diverse molecular and cellular processes involved in cancer development and the multiple strategies to fight the disease. Industry professionals talk about current R&D in the field of fighting cancer. Prognostic tests for treatment outcomes resulting in personal medicine are addressed as well as advanced 'omics technologies used in the field. The data analysis in this unit of study focuses on the analysis of data from high throughput screenings.<br>Understanding drug design and drug properties is necessary to complete a production strategy. Therefore students study in an online environment principles of the pharmaceutical chemistry during this unit of study. Moreover, they will be trained in understanding the analyses methods used to investigate the structure-related properties of different types of drugs. |
| Competences | **Competence 2: Designing strategies for applied research and product development**<br>**Competence 3: Design, analysis and control of experiments**<br>Competence 4: Communication<br>Competence 5: Managing projects<br>Competence 6: Advising |
| Assessment criteria/<br>Indicators / requirements for the UOS. | ***See exams of the UOS Drug Discovery and Development below this table*** |
| Exams | ***See exams of the UOS Drug Discovery and Development below this table*** |

| | |
|---|---|
| Required reading | ❖ Reader Drug Development<br><br>❖ Supporting High-throughput data analysis and interpretation, and Drug Discovery strategy:<br><br>- Stratton, M.R. (2011). Exploring the genomes of cancer cells: progress and promise. *Science, 331* (6024), 1553-1558.<br>- Santarius, T. et al. (2010). A census of amplified and overexpressed human cancer genes. *Nature Reviews Cancer, 10* (1), 59-64.<br>- Yates, L.R. & Campbell, P.J. (2012). Evolution of the Cancer Genome. *Nat Rev Genet, 13* (11), 795-806.<br>- The Cancer Genome Atlas Network (2012). Comprehensive molecular characterization of human colon and rectal cancer. *Nature*, 487, 330-337. |
| Recommended reading | ❖ Alberts, Johnson, Lewis, Morgan, Raff, Roberts, and Walter, (2015 or 2017). *Molecular Biology of the Cell*. (6th or 7th edition). Garland Science.<br><br>❖ Lodge, Lund & Minchin (2007): *Gene Cloning, Principles and Applications.* Tayler & Francis Group<br><br>❖ Berg, J.M., Tymoczko, J., Stryer, L. (2015 or 2019). Biochemistry. (8th or 9th edition). W.H. Freeman.<br><br>❖ Samuel, M.L., Witmer, J.A., & Schaffner, A. (2011 or 2015). *Statistics for the Life Sciences.* (4th or 5th edition). Pearson.<br><br>❖ Agostino, M. (2012). Practical Bioinformatics. (1st edition). Garland Science.<br><br>❖ The *International Conference on Harmonisation* of Technical Requirements for Registration of Pharmaceuticals for Human Use (2000) SAFETY PHARMACOLOGY STUDIES FOR HUMAN PHARMACEUTICALS S7A<br><br>❖ The *International Conference on Harmonisation* of Technical Requirements for Registration of Pharmaceuticals for Human Use (2005) THE NON-CLINICAL EVALUATION OF THE POTENTIAL FOR DELAYED VENTRICULAR REPOLARIZATION (QT INTERVAL PROLONGATION) BY HUMAN PHARMACEUTICALS S7B<br><br>❖ Original Research articles relevant to the assignments<br>***The reading lists are updated regularly. Therefore, the actual reading list for the unit of study might deviate from the list presented above.*** |
| Software and other materials | Computer and internet connection |
| Activities | During this unit of study, students will individually work on their assignments (see also assessment).<br><br>The supporting education programme will help students to work out their assignments and to master the exam, and therefore to achieve their learning goals.<br><u>Lectures:</u><br>• Introduction unit of study and Assignments<br>• Molecular mechanisms in cancer development, cancer diagnosis, cancer drugs<br>• Models to study cancer drugs; assays for drug testing<br>• A short overview clinical trials |

| | |
|---|---|
| | • Lectures on R&D projects by guest lecturers<br>• Registration of drugs<br>• Structure elucidation analyses.<br><br><u>Online lectures</u><br>• Drug action and drug discovery<br>• Drug design principles<br>• Introduction to pharmacokinetics and drug biotransformation<br>• Drug development, production, and regulation<br>• General principles of pharmaceutical chemistry<br><br><u>Workshops:</u><br>• Cancer drugs/cancer drug development<br>• Statistics: multiplicity tests and ANCOVA<br><br><u>Trainings:</u><br>• Analysing High-throughput drug screens |
| Instructional formats | Assignments, (online) Lectures, Trainings, Workshops |
| Teaching / Contact hours | See above: credits, study load |
| Mandatory participation | • Assessments |
| Period of instruction | December 2020 – April 2021 |
| Maximum number of participants | - |

***Exam of the UOS Drug Discovery and Development***

<table>
<tr><td></td><td colspan="3">Assessment criteria/ Indicators / requirements</td></tr>
<tr><td></td><td>Competence indicators</td><td>Body of Knowledge and Skills</td><td>Assessment criteria</td></tr>
<tr><td>Code modular exam:<br>MMLS-DRD-FPhC</td><td>Competence indicators</td><td>Knowledge indicators</td><td>These competence and knowledge criteria are translated into the following assessment criteria*</td></tr>
<tr><td>Name modular exam:<br>Fundamentals in Pharmaceutical Chemistry<br><br>Type:<br>Online knowledge test<br><br>Number of examiners:<br>1 for construction and evaluation of test (UoF) and answer model, 1 for assessment (UoF), HAN assessor verifies.<br><br>Assessment:<br>Grade;<br>Conversion of grades from University of Florida (US):<br>US HAN<br>E 0<br>D 5.5<br>C 6<br>B- 6,5</td><td>2.1. Is able to independently acquire knowledge in a new subject by consulting specific literature and other resources; is able to identify reliable and suitable sources; Discriminates between major and side issues<br>2.2. Combines information from different sources in the context of the own project<br>2.3. Defines the project aim in terms of products and/or results based on the acquired background information<br>2.4. Defines the quality requirements for products and processes based on legal requirements.<br>2.5. Designs different approaches that could lead to the project aim. Evaluates these possibilities and justifies the choice based on scientific arguments and practical parameters such as time, costs, quality and personnel</td><td>• understands the principles of pharmacology, pharmacokinetics & drug-biotransformation, and pharmacodynamics<br>• knows and understands drug design principles<br>• knows and understands the principle of different types of drugs and treatment approaches (such as small molecules, antibodies, gene therapy, antibiotics and anti-virals, chemotherapy, radiotherapy), their advantages and disadvantages.<br>• is able to choose one type of drug as active pharmaceutical ingredient depending on desired biological effect<br>• is able to choose a delivery system based on desired selectivity and bio-availability<br>• knows that structure-analysis can be used to predict the function of the biomolecule and to discover interaction partners/ drugs<br>• knows the different phases of clinical studies<br>• is able to define quality requirement for products and processes based on</td><td>Written assay module assignment and timed quizzes are applied to assess the following criteria:<br><u>Drug Action and Drug Discovery</u><br>- Understand the sources for new lead structures<br>- Describe the LADME process<br>- Define the terms pharmacokinetics and pharmacodynamics<br>- Evaluate a structure in terms of physicochemical properties<br>- Be able to calculate the logP using the π value equation<br>- Apply Lipinski’s rule of five and the degree of ionization to predict the behavior of a substance in solution<br>- Define the terms acid and base<br><u>Drug Design Principles</u><br>- Understand the terms ED50, therapeutic index, certain safety factor, log-dose response curve, and Lineweaver-Burke plot<br>- Relate the principle of a pharmacophore to structure activity relationship, functional group substitutions, and stereochemistry<br>- Analyze a structure according to electronic and steric effects</td></tr>
</table>

| | | | |
|---|---|---|---|
| B+ 7<br>A- 7.5<br>A+ (90.0-92.5%) 8<br>A+ (92.5-95.0%) 8.5<br>A+(95.0-97.5%) 9<br>A+(97.5-99.9%) 9.5<br>***Cut-off value:***<br>55%<br>***Minimal result:***<br>5.5<br>***Weighting:***<br>35%<br>***Period and resit:***<br>2 chances per study year;<br>Chance 1: April 2021<br>Chance 2: in agreement with University of Florida and student<br>***Compensation:***<br>None | | regulatory guidelines<br>• is aware of the requirements for entering the clinical phase, and for market entry | - Present a basic understanding of quantitative structure-activity relationship (QSAR) principles<br>- Combine their knowledge of lessons 1 and 2 to synthesize and analyze a drug structure<br><u>Introduction to Pharmacokinetics & Drug Biotransformation</u><br>- Understand and be able to explain the pharmacokinetic terms half-life, volume of distribution, first-order kinetics, zero-order kinetics, linear and non-linear kinetics, area under the curve (AUC), one- and multi-compartment models<br>- Describe the differences between drug administration and pharmacokinetic behavior following enteral and parenteral routes<br>- Distinguish between one-compartment and multicompartment pharmacokinetic models<br>- Explain the functions of biotransformation and the impact it has on bioavailability and activity of a drug Apply the concepts of phase I and phase II metabolism<br>- Predict the potential routes of metabolism for a drug based on structure and knowledge of the various metabolic enzymes involved in phase I and phase II metabolism<br><u>Drug Development, Production, and Regulation</u><br>- Describe the past and current legislation regulating drug products in the US<br>- Explain the stages of drug development |

| | | | |
|---|---|---|---|
| | | | - Distinguish between preclinical and clinical drug testing and its purposes<br>- Differentiate between the regulatory authority of the FDA for marketed drug products<br>- Understand the basics of patent protection for a drug product<br><u>Comprehensive HyLighter assignment</u><br>- Apply knowledge learned throughout the course to the development of a new drug entity<br>- Transfer knowledge and research information specific to a drug used in therapy<br>For details see the Syllabus PHA6432 Fundamentals of Pharmaceutical Chemistry of the University of Florida. |

| | | | |
|---|---|---|---|
| ***Code modular exam:***<br>**MMLS-DRD-SEA**<br>**Name:**<br>**Structure Elucidation Analysis**<br>***Type:***<br>Written Product<br>***Number of examiners:***<br>2 for construction and evaluation of test and answer model, 2 for assessment.<br>***Assessment:***<br>Grade<br>***Cut-off value:***<br>55%<br>***Minimal result:***<br>5.5<br>***Weighting:***<br>30%<br>***Period and resit:***<br>2 chances per study year;<br>Chance1: April 2021<br>Chance 2: June 2021<br>***Compensation:***<br>None | 2.1. Is able to independently acquire knowledge in a new subject by consulting specific literature and other resources; is able to identify reliable and suitable sources; Discriminates between major and side issues<br>2.2. Combines information from different sources in the context of the own project. | • Familiar with the analytical procedures of IR, MS, and NMR and understand the theory of how each technique.<br>• Understand the differences and specific advantages and disadvantages of each analytical technique introduced in this course. | Written assay module assignment to assess the following criteria:<br>- General Principles of structure elucidation<br>- Advantages and disadvantages of each technique<br>- Principles of IR radiation.<br>- Beer-Lambert law<br>- Advantages and disadvantages of IR for structure identification<br>- Important functional groups in IR analysis<br>- Principles of mass spectrometry<br>- Different modes of fragmentation and detection<br>- Ionization techniques<br>- MS and separation techniques<br>- Interpret a mass spectrum generated by different ionization methods<br>- Limitations of mass spectrometry<br>- Specific applications of mass spectrometry for structure elucidation in Forensics and the pharmaceutical industry<br>- Basic principles of NMR spectroscopy.<br>- Chemical shifts<br>- Spectra of crystalline organic solids and it’s interpretation<br>- Tying together the data from the different techniques to make an accurate structural determination.<br>- Understanding what constitutes “good enough” in structure elucidation for different audiences |

| | | | |
|---|---|---|---|
| | **Competence indicators** | ***Knowledge indicators*** | ***For this assignment, these indicators and knowledge criteria are translated into the following assessment criteria**** |
| ***Code modular exam:*** **MMLS-DRD-PRES**<br>***Name modular exam:*** **Poster Presentation on Drug Discovery Strategy**<br>***Type:***<br>Group product<br>***Number of examiners:***<br>2 for assessment<br>***Assessment:***<br>Insufficient/Sufficient<br>***Cut-off value:***<br>55%<br>***Minimal result:***<br>Sufficient<br>***Weighting:***<br>-<br>***Period and resit:***<br>2 chances per study year;<br>Chance1: April 2021<br>Chance 2: June 2021<br>***Compensation:***<br>none | 2.1. Is able to independently acquire knowledge in a new subject by consulting specific literature and other resources; is able to identify reliable and suitable sources; Discriminates between major and side issues;<br>2.2. Combines information from different sources in the context of the own project<br>2.3. Defines the project aim in terms of products and/or results based on the acquired background information<br>3.1. Designs experiments based on the required quality and quantity of the product or result.<br>4.2. Presents project plans and results in English to colleagues, other researchers in the field or to clients. The poster presentation is at a level equivalent to a presentation at an international symposium<br>6.5. Gives advice about choosing new equipment or methods based on project goals, overall goals and available resources | • explains the principle of all standard techniques to detect DNA (such as Southern Blot, PCR, FISH, (next generation) sequencing), RNA (such as Northern blot, RT-PCR, expression array, RNAseq, in situ hybridization) and proteins (such as SDS-PAGE, Western blot, immunocytochemistry, immunohistochemistry, protein array, mass spec) and can apply the appropriate technique to answer a question about the presence, quantity or localization of DNA, RNA or protein<br>• has knowledge and understanding of prokaryotic and eukaryotic cells, function of organelles, cell cycle regulation, DNA repair, signal transduction, protein modification and localization<br>• understands the principle of techniques to analyze cell proliferation, cell cycle, apoptosis, protein modification and can apply these techniques to answer question on such cellular functions<br>• has knowledge and understanding of the molecular mechanisms that contribute to cancer development and can apply this knowledge for the design of cancer diagnostics and anti-cancer drugs<br>• understands the principles of pharmacology, pharmacokinetics & | - At least 10 recent (majority published within the last 5 years) peer-reviewed research articles relevant to the subject are referenced to. This is shown by a reference list included in the presentation.<br>Content<br>*Introduction*<br>- Describes the impact of the syndrome and the presently available treatments.<br>*Design*<br>- A valid argumentation supported by the literature is given for choosing this strategy of solution to improve the drug's efficacy, bio-availability, specificity or production strategy.<br>*Assay*<br>- The screening methodology to test/identify is correct and justified (measuring efficacy, bio-availability, specificity, toxic effect or delivery)<br>Poster Presentation:<br>- Figures and tables are clearly/correctly labelled.<br>- Audience is on the whole informed.<br>- Is intelligible.<br>- Uses mostly appropriate vocabulary when talking about familiar topics. |

| | | | |
|---|---|---|---|
| | | drug-biotransformation, and pharmacodynamics<br>• knows and understands drug design principles<br>• knows and understands the principle of different types of drugs and treatment approaches (such as small molecules, antibodies, gene therapy, chemotherapy, radiotherapy, immunotherapy), their advantages and disadvantages<br>• is able to choose one type of drug as an active pharmaceutical ingredient depending on the desired biological effect<br>• is able to choose a delivery system based on desired selectivity and bio-availability.<br>• is able to design a strategy to measure the bio-availability of the drug.<br>• can explain methods to analyze biomolecules (such as NMR, chromatography, enzyme assays, ultrafiltration, absorption measurement, selective breakdown, enzyme immune-assay) and is able to choose an analytical method based on the biomolecule(s) to be analyzed<br>• is able to design appropriate *in vitro* and *in vivo* assays to test the efficacy, selectivity and the toxicology of a drug<br>• knows which animal models can be used to test drugs, and the advantages and disadvantages of these models<br>• understands the meaning of: | |

| | | | |
|---|---|---|---|
| | | statistical hypotheses, type of variable (continuous / categorical), association versus causation, confounding variables, variation, normal distribution, population versus sample, dependent and independent observations, Type I and Type II error, descriptive statistics, the relationship between central tendency (mean, median) and variance, p-value and statistical significance, log-transformation, one- or two-sided tests, multiple testing problems and its solutions<br>• Is able to choose the appropriate statistical method for data Analysis, including t-test, ANOVA, multiple regression, chi square tests<br>• is able to report the results with tables and graphics | |
| ***Code modular exam:*** **MMLS-DRD-HTDA**<br><br>***Name modular exam:*** **High-throughput data analysis**<br><br>***Type:*** Individual written professional product<br><br>***Number of examiners:*** 2 for construction and evaluation of assignment and assessment form, 2 for assessment | ***Competence indicators***<br><br>1.1. Is able to independently acquire knowledge in a new subject by consulting specific literature and other resources; is able to identify reliable and suitable sources; Discriminates between major and side issues<br>1.2. Combines information from different sources in the context of the own project<br>1.5 Designs different approaches that could lead to the project aim. Evaluates these possibilities and justifies the choice based on | ***Knowledge indicators***<br><br>• Understands the principle and application of statistical hypothesis, hypothesis test, one- or two-tailed test, p-value, adjustment for multiple testing<br>Data Mining<br>• The student is familiar with biological databases Databases (such as Uniprot, Genbank, PDBe, PFAM, PROSITE, CDD, PubMed, KEGG.EBI, EMBL, NCBI) Sequence annotation (DNA and protein sequences)<br>• The student is able to formulate a | ***For this assignment, these indicators and knowledge criteria are translated into the following assessment criteria****<br><br>• is able to define relevant features for genes/proteins that might serve as drug targets (applies appropriate filtering, de-multiplexing).<br>• can decide which data could be relevant and how or where this kind of data could be obtained. (use quality control and find reference databases).<br>• has devised an effective workflow to analyse and interpret the data.(applies the correct steps to compare the data).<br>• has analysed relevant data using the |

| | | | |
|---|---|---|---|
| ***Assessment:***<br>Grade<br>***Cut-off value:***<br>55%<br>***Minimal result:***<br>5.5<br>***Weighting:***<br>35%<br>***Period and resit:***<br>2 chances per study year;<br>Chance1: January 2021<br>Chance 2: March 2021<br>***Compensation:***<br>none | scientific arguments and practical parameters such as time, costs, quality and personnel<br>3.2. Applies strict logical thinking to draw conclusions from the results and interprets them:<br>- in the context of the experiments<br>- in the context of the project aim (helicopter view)<br>- in comparison to other analyses, reference/theoretical values, and quality requirements.<br>4.1. (intermediate level) Reports project plans and results according to the standard format of scientific documents and the reader recognizes the scientific international conventions criteria | data strategy to answer a biological question.<br>High-throughput data analysis<br>• understands the principle steps in analyzing high-throughput data obtained by –omics approaches.<br>• has analyzed and interpreted a limited number of high-throughput data and is able to communicate to specialists about such analyses | appropriate statistics and/or reasoning.<br>• is able to identify relevant information in the public domain and able to connect the analysis results to that information. (appropriate use of genome browsers, pathway databases and reference databases).<br>• use the information at hand properly to draw conclusions and provide useful advice. (draw meaningful conclusions about the biological interpretation) |

**** Note: Adjustments in the <u>exact description</u> of the assessment criteria can be made based on experiences with previous students groups with the aim to improve relevance, reliability and transparency of the assessment.***

**Production of Biomolecules 1**

| ***Title of UOS*** | ***Production of Biomolecules 1***<br>***HMP-MMLS-POB1*** |
|---|---|
| Degree Programme | Master in Molecular Life Sciences |
| Target group | Students enrolled in Master in Molecular Life Sciences programme |
| Professional task | 1. to understand practical, economic, social and/or ecological needs of businesses, market and society that can be anticipated by biotechnology<br>2. to apply fundamental knowledge in the area of molecular life sciences to find sustainable solutions for these needs |
| (Professional) Products | • Presentation on gene discovery strategy to optimize microbial oil production in yeast |
| Credits/ study load | 5 EC / 140 study load hours, consisting of<br>24 contact hours<br>116 hours for self-study and work on assignments |
| Relationship with and entry requirements concerning exams | • All assessments of this unit of study have to be sufficient. |
| General description | Central to this unit of study is the development of a strategy to increase the microbial oil production by yeast. To this end, bio-informatics skills will be applied by students to annotate genes and to identify gene products in yeast which might be involved in microbial oil production. Based on this, students suggest a metabolic engineering strategy to manipulate the cells in such a way that production of microbial oil can be increased. Growing cells on biobased materials is considered in the strategy as well. |
| Competences | **Competence 2: Designing strategies for applied research and product development**<br>**Competence 3: Design, analysis and control of experiments**<br>Competence 4: Communication<br>Competence 5: Managing projects<br>Competence 6: Advising |
| Assessment criteria | ***See exams of the UOS Production of Biomolecules below this table*** |
| Exams | ***See exams of the Production of Biomolecules below this table*** |
| Compulsory literature | ❖ Students will get access to the HAN BioCentre literature database as background literature for their assignments, especially assignment 6.1. |
| Recommended literature | ❖ Alberts, Johnson, Lewis, Raff, Roberts, and Walter, (2015 or 2017). *Molecular Biology of the Cell*. (6th or 7th edition). Garland Science:<br>❖ Lodge, Lund & Minchin (2007): *Gene Cloning, Principles and Applications.* Tayler & Francis Group:<br>❖ Samuel, M.L., Witmer, J.A., & Schaffner, A. (2011 or 2015). *Statistics for the Life Sciences.* (4th or 5th edition). Pearson.<br>❖ Agostino, M. (2012). Practical Bio-informatics. Garland Science.<br>❖ Original research articles related to the assignments |

| | |
|---|---|
| | Further literature can be found in the PubMed database and journals on biotechnology/ microbiology, respectively, and might be provided with the specific assignments. To access full-text articles, students can make use of the online facilities of the HAN.<br><br>***The reading lists are updated regularly. Therefore, the actual reading list of this unit of study might deviate from the list presented above.*** |
| Software and other materials | Computer and Internet connection |
| Activities | During this unit of study, students individually work on their different assignments.<br>The supporting education programme will help students to work out their assignments and to master the exam, and therefore to achieve their learning goals.<br><br><u>Lectures</u><br>- Introduction Unit of Study<br>- Introduction biotechnology<br>- Microbial oil production in yeast<br>- Metabolic engineering<br><u>Workshop/Trainings</u><br>- Bio-informatics: study databases for genes and metabolic pathways/ verify gene annotation<br>- |
| Work formats | Lectures, workshops, online education, assignments |
| Lesson/<br>Contact hours | See above: credits, study load |
| Compulsory participation | - |
| Education period | May-July 2021 |
| Maximum number of participants | - |

| ***Code modular exam:*** **MMLS-POB1-MICRO** | ***Competence indicators*** | ***Knowledge indicators*** | ***For this assignment, these indicators and knowledge criteria are translated into the following assessment criteria**** |
|---|---|---|---|
| ***Name modular exam:*** **Presentation on research strategy to optimize microbial oil production in yeast**<br><br>***Type:***<br>Presentation in pairs of 2 students<br><br>***Number of examiners:***<br>2 for construction and evaluation of assignment and assessment form,<br>2 for assessment<br><br>***Assessment:***<br>Grade<br><br>***Cut-off value:***<br>55%<br><br>***Minimal result:***<br>5.5<br><br>***Weighting:***<br>100%<br><br>***Period and resit:***<br>2 chances per study year;<br>Chance1: June 2021<br>Chance 2: July 2021 | 2.1 Is able to independently acquire knowledge in a new subject by consulting specific literature and other resources; is able to identify reliable and suitable sources; Discriminates between major and side issues;<br>2.2. Combines information from different sources in the context of the own project<br>→ In this gene discovery strategy, the student demonstrates that he/she acquired knowledge about yeast morphology and metabolism, about metabolic pathways that contribute to microbial oil production, and about annotating genes and gene function, and combines this knowledge to describe a strategy to enhance microbial oil production from yeast.<br>2.3 Defines the project aim in terms of products and/or results based on the acquired background information<br>2.5 Designs different approaches that could lead to the project aim. Evaluates these possibilities and justifies the choice based on scientific arguments and practical | • has knowledge and understanding of metabolic pathways, cell chemistry and biosynthesis and can apply this knowledge to optimize metabolite production (metabolic engineering)<br>• The student is able to explain the composition and functions of prokaryotic and eukaryotic cells, function of organelles, cell cycle regulation, DNA repair, signal transduction, protein modification and localization<br>• explains the principle of all standard techniques to detect DNA (such as Southern Blot, PCR, FISH, (next generation) sequencing), RNA (such as Northern blot, RT-PCR, expression array, RNAseq, in situ hybridization) and proteins (such as SDS-PAGE, Western blot, immunocytochemistry, immune-histochemistry, protein array, mass spec) and can apply the appropriate technique to answer a question about the presence, quantity or localization of DNA, RNA or protein<br>• is able to design a strategy for gene cloning and heterologous expression<br>• is able to design a (conditional) knock-out strategy<br>• understands how gene expression is | - At least 10 recent (majority published within the last 5 years) peer-reviewed research articles relevant to the subject are referenced to.<br><u>Content:</u><br>- The student describes the background and research aim, convincing the audience that achieving the aim is of added value to science and society.<br>- The student describes the cellular pathway(s) generally occurring in yeast and that are relevant to answer the research question.<br>- The relationship between the pathway and the research aim is made clear.<br>- The students identified and verified which of the above described pathways and involved genes do exist in the HBC strain by<br>  - gene searches by searching the HBC database with known genes of other strains, and<br>  - verification of the identified genes by blasting the HBC gene against other sequences and<br>  - multiple alignments |

| | | | |
|---|---|---|---|
| ***Compensation:***<br>none | parameters such as time, costs, quality and personnel<br>2.6 Designs a complete strategy leading to the project aim (project of about 3-4 months; see also: managing projects)<br>3.1. Designs experiments based on the required quality and quantity of the product or result<br>4.2. Presents project plans and results in English to colleagues, other researchers in the field or to clients. The presentation is at a level equivalent to a presentation at an international symposium<br>6.5 Gives advice about choosing new equipment or methods based on project goals, overall goals and available resources | regulated in prokaryotes and eukaryotes and applies this knowledge to heterologous gene expression<br>Data Mining<br>• The student is familiar with biological databases Databases (such as Uniprot, Genbank, PDBe, PFAM, PROSITE, CDD, PubMed, KEGG.EBI, EMBL, NCBI) Sequence annotation (DNA and protein sequences)<br>• The student is able to formulate a data strategy to answer a biological question.<br>Sequence annotation (DNA and protein sequences)<br>• Is able to use the principles of transcription, mRNA processing, translation, post-translational modifications and protein structure/domains to evaluate sequence annotation.<br>• Is able to perform BLAST-searches and analyse the results in a correct way.<br>Sequence alignments and score matrices<br>• Knows the features of a qualitatively good alignment.<br>• Is able to illustrate the use of (multiple) sequence alignments.<br>• Is able to evaluate the evolution of sequences | - Explains these pathways / genes in relation to the research aim.<br>- The student verified the annotation of the genes and gene products (discussed above) in HBC by multiple sequence alignments with correct conclusions.<br>- The student explains a genetic engineering strategy that will probably lead to increased PMO production. The strategy is supported by convincing scientific arguments based on the pathways explained.<br>- The student outlines the genetic engineering strategy by showing the experimental steps (e.g. PCR, transfection) involved in a flowchart, including experiments demonstrating that:<br>- Genetic engineering was successful on the genome level<br>- Genetic engineering was successful on the level of the functional gene product<br>- PMO production is increased<br>Presentation, minimum level:<br>- The presentation stays within the given time limit (+/- 5 mins). Slides are clear with only occasional spelling and grammar mistakes. Figures and tables are clearly/correctly labelled.<br>- The presentation has an introduction-body- conclusion structure and is easy to understand. |

| | | | |
|---|---|---|---|
| | | | - Is intelligible. Intonation is generally appropriate.<br>- Uses appropriate vocabulary to give and exchange views, on familiar topics<br>- Produces extended stretches of language despite some hesitation..<br><u>Presentation, excellent level:</u><br>- Slides are visually interesting. Uses correct spelling and grammar. Figures and tables are easy to understand.<br>- All content is relevant to the task. Audience is fully informed.<br>- The presentation tells a cohesive story: it is exceptionally well-organised and easy to understand and follow.<br>- Natural posture, Gestures and movements that enhance the verbal and visual message.<br>- Is intelligible. Intonation is appropriate.<br>- Uses a wide range of grammatical forms and appropriate vocabulary to give and exchange views on familiar and unfamiliar topics<br>- Natural and spontaneous: Produces extended stretches of language with ease and very little hesitation. Contributions are relevant, coherent and varied.<br><u>Answering questions</u><br>- The student can further explain and defend the chosen strategy using arguments that are scientifically |

| | | | |
|---|---|---|---|
| | | | correct and based on efficiently achieving the project aim<br>- The student stuck to the set deadline for giving the presentation |

**** Note: Adjustments in the exact description of the assessment criteria can be made based on experiences with previous students groups with the aim to improve relevance, reliability and transparency of the assessment.***

**Production of Biomolecules 2**

| ***Title of UOS*** | ***Production of Biomolecules 2***<br>***HMP-MMLS-POB2*** |
|---|---|
| Degree Programme | Master in Molecular Life Sciences |
| Target group | Students enrolled in Master in Molecular Life Sciences programme |
| Professional task | 1. to understand practical, economic, social and/or ecological needs of businesses, market and society that can be anticipated by biotechnology<br>2. to apply fundamental knowledge in the area of molecular life sciences to find sustainable solutions for these needs |
| (Professional) Products | • Preparing a project proposal on the production of a heterologous protein |
| Credits/ study load | 4 EC / 112 study load hours, consisting of<br>18 contact hours<br>94 hours for self-study and work on assignments |
| Relationship with and entry requirements concerning exams | • All assessments of this unit of study have to be sufficient. |
| General description | In the unit of study Production of Biomolecules 2 students will continue their studies of part 1 by setting up a project proposal for the heterologous production of a protein. Students apply their knowledge of various production strains, upstream processing, downstream processing and cost calculations. Furthermore, students will become familiar with product development for pharmaceutical purposes and the principles behind Quality by Design. The guidelines of working according to Good Manufacturing Practice (GMP) standards and the consequences thereof are also subject of this unit of study. |
| Competences | **Competence 2: Designing strategies for applied research and product development**<br>**Competence 3: Design, analysis and control of experiments**<br>Competence 4: Communication<br>Competence 5: Managing projects<br>Competence 6: Advising |
| Assessment criteria | ***See exams of the UOS Production of Biomolecules below this table*** |
| Exams | ***See exams of the Production of Biomolecules below this table*** |
| Compulsory literature | ❖ Quality by Design:<br>- Bioproduction Group (2012). Quality by Design in Biomanufacturing. White paper. Available from: www.bio-g.com/<br>- FDA (2011). Guidance for industry: process validation: general principles and practices.<br>❖ GMP:<br>- ICH (2000). Good Manufacturing Practice Guide for Active Pharmaceutical Ingredients Q7.<br>- Allport-Settle, M.J. (2009). Good Manufacturing Practice (GMP) Guidelines: The Rules Governing Medicinal Products in the European Union, EudraLex Volume 4 Concise Reference. Available from: http://ec.europa.eu/health/documents/eudralex/vol-4/index_en.htm |

| | |
|---|---|
| | Students will get access to the HAN BioCentre literature database as background literature for their assignments, especially assignment 6.1. |
| Recommended literature | ❖ Alberts, Johnson, Lewis, Raff, Roberts, and Walter, (2015 or 2017). *Molecular Biology of the Cell*. (6th or 7th Edition). Garland Science:<br><br>❖ Lodge, Lund & Minchin (2007): *Gene Cloning, Principles and Applications.* Tayler & Francis Group:<br><br>❖ Samuel, M.L., Witmer, J.A., & Schaffner, A. (2011 or 2015). *Statistics for the Life Sciences.* (4th or 5th edition). Pearson.<br><br>❖ Agostino, M. (2012). Practical Bio-informatics. Garland Science.<br><br>❖ <u>Original research articles</u> related to the assignments<br><br>Further literature can be found in the PubMed database and journals on biotechnology/ microbiology, respectively, and might be provided with the specific assignments. To access full-text articles, students can make use of the online facilities of the HAN.<br><br>***The reading lists are updated regularly. Therefore, the actual reading list of this unit of study might deviate from the list presented above.*** |
| Software and other materials | Computer and Internet connection |
| Activities | During this unit of study, students individually work on their different assignments.<br>The supporting education programme will help students to work out their assignments and to master the exam, and therefore to achieve their learning goals.<br><br><u>Lectures</u><br>- Introduction Unit of Study<br>- Microbial oil production in yeast<br>- Metabolic engineering<br>- Biologicals for pharmaceutical use: Quality by Design<br><u>Workshop/Trainings</u><br>- Bio-informatics: study databases for genes and metabolic pathways/ verify gene annotation<br>- Good Manufacturing Practice (GMP) |
| Work formats | Lectures, workshops, online education, assignments |
| Lesson/<br>Contact hours | See above: credits, study load |
| Compulsory participation | - |
| Education period | August - September 2020 |
| Maximum number of participants | - |

**Exam of the UOS Production of Biomolecules 2**

| | **Assessment criteria/ Indicators / requirements** | | |
|---|---|---|---|
| ***Code modular exam:*** **MMLS-POB2-PP** | ***Competence indicators*** | ***Knowledge indicators*** | ***For this assignment, these indicators and knowledge criteria are translated into the following assessment criteria**** |
| ***Name modular exam:*** Project proposal on protein production<br><br>***Type:*** Individual written professional product<br><br>***Number of examiners:*** 2 for construction and evaluation of assignment and assessment form, 1-2 for assessment<br><br>***Assessment:*** Mark<br><br>***Minimal result:*** 5.5<br><br>***Weighting:*** 100%<br><br>***Period and resit:*** **2 chances per study year;** **Chance1:** September 2020 **Chance 2:** November 2020 | 2.1 Is able to independently acquire knowledge in a new subject by consulting specific literature and other resources; is able to identify reliable and suitable sources; Discriminates between major and side issues;<br>2.2 Combines information from different sources in the context of the own project<br>2.3 Defines the project aim in terms of products and/or results based on the acquired background information<br>2.5. Designs different approaches that could lead to the project aim. Evaluates these possibilities and justifies the choice based on scientific arguments and practical parameters such as time, costs, quality and personnel<br>2.6. Designs a complete strategy leading to the project aim (project of about 3-4 months; see also: managing projects)<br>3.1. Designs experiments based on the required quality and quantity of the product or result.<br>4.1. (intermediate level): Reports project plans and results according to the standard format used in the company/field and the | • understands the mechanisms of regulation of gene expression in pro- and eukaryotic cells and applies this knowledge for heterologous gene expression<br>• is able to design a strategy for gene cloning and heterologous expression<br>• has knowledge and understanding of biomolecule purification methods (such as size exclusion chromatography, ion exchange, hydrophobic interaction, ultrafiltration, affinity chromatography, precipitation, filtration, drying) and is able to choose a purification method depending on the composition of the original sample and the biomolecule to be purified<br>• has knowledge and understanding of methods to analyze biomolecules (such as NMR, chromatography, enzyme assays, ultrafiltration, absorption measurement, selective breakdown, enzyme immune-assay) and is able to choose an analytical method based on the biomolecule(s) to be analyzed<br>• is able to identify critical parameters in the process | Proposal:<br>• The background information<br>- places project in context and<br>- indicates the motivation and need for the project<br>• The project aim is concisely described and is in line with the assignment and a description of the aim and added value.<br>• type of deliverables conform the assignment<br>• Requirements for the deliverables are specifically defined<br>• The described exclusions are potential alternative strategies or follow-up projects<br>• The Project approach in scheme presents the main activities to be performed to obtain the deliverables<br>• It is presented in such a way that the relation between deliverables/milestones and main activities are easy to catch.<br>• Milestones / Decision points are shown at crucial moments of the project.<br>Work Breakdown Structure:<br>• main activities are subdivided into activities from which a time planning an responsibilities can be based on<br>• the activities related to the USP and |

| | | | |
|---|---|---|---|
| | reader recognizes the scientific international conventions criteria.<br>5.1. Defines project deliverables based on the needed quality and quantity<br>5.2. Identifies project risks based on the (experimental) approach and on (putative) competitors<br>5.3. Defines project exclusions5.4. Organizes the project in phases and defines decision points/milestones<br>5.5. Describes the project organisation including the responsibilities of all project members<br>5.6. Writes a communication plan concerning all project members and parties involved<br>5.7. Describes a times schedule based on the (experimental) plan<br>5.8. Describes the required budget | Enzymes:<br>• knows the industrial applications of enzymes<br>Process development and optimization:<br>• knows the advantages and disadvantages of different production strains and is able to choose a suitable production strain for the production of specific proteins<br>• tests critical parameters in the production process (USP and DSP) and interprets the outcome<br>• is able identify critical parameters in the process<br>• is aware of the fact that scaling up or down requires process re-optimization<br><br>Biobased Economy:<br>• is able to describe a target product profile and criteria l quality attributes<br>• Is able to explain the main principles of a biobased economy and its new technological challenges<br>• Is able to explain the difference between first, second and third generation feedstocks<br>• Is able to describe the steps needed to convert plant biomass into fermentation feedstock<br>Is able to describe the technological challenges by using biomass as fermentation feedstocks | DSP inform which culture conditions and purification approaches, respectively, are worthwhile testing and relevant for<br>• the project<br>• the activity related to enzyme analysis informs which enzyme analysis method is used.<br>• activities are divided in the phases of 'Initiation and Definition', 'Design and Planning', ' Execution and Control', and 'Project Close Out'<br>• all activities are numbered<br>• the interdependencies of the different activities are shown by indicating to which previous activity (number) each activity is related<br>• it is shown which activities lead to which derivable / milestone<br>Project Proposal:<br>• The risks presented to the client are a balanced choice between a realistic risk for the project to fail and the effect of informing the client about it.<br>• Specific and restricted strategies to work around risks are described.<br>• The project members, their role as well as relationships/communication lines are visualized in scheme.<br>Work Breakdown Structure:<br>• indicates for each activity by which project member it is executed and the number of hours required<br>Project Proposal:<br>• It is described who, when, how and about what communicates between the HAN BioCentre and the client. |

| | | | |
|---|---|---|---|
| | | | This includes a clear proposal for progress updates of the client.<br><br>• the project activities, deliverables/milestones and decision points are placed into a time frame.<br>• the time schedule is presented in a lay-out that makes it easy to catch.<br>Work Breakdown Structure:<br>• each activity is placed into the time frame it is carried out during the project<br>• the time planning matches with the interdependencies of the activities described in the project approach<br>Project Proposal:<br>• The sales price for the project is based on:<br>- The cost price for the project (see Work Breakdown Structure)<br>- The added value for the customer.<br>- The argumentation is provided in the Work Breakdown Structure (see below)<br><br>Work Breakdown Structure:<br>• The estimated amount of needed working hours for each activity is indicated. If one activity is carried out by more than one project member, the working hours for each of these project members are given.<br>• Based on the number of total working hours for each project member and a fictive, but indicated price per hour for each project member, the costs for working hours are calculated and given. |

| | | | |
|---|---|---|---|
| | | | • The costs for materials are calculated as 5% of the costs for the working hours.<br>• An argumentation for the sales price asked is included. This is based on the cost price and the added value for the customer.<br>• Relevant internal and external literature is used to design the project approach.<br>Format and language:<br>• The project proposal summarizes all project information that is important for the client.<br>• The project proposal excludes information that is not relevant for the client.<br>• The structure follows the layout prescribed.<br>• The document is written in correct scientific style: uses everyday vocabulary and phrases, with occasional inappropriate use. Simple, mostly correct grammar is used. Error may be noticeable but the meaning can be determined.<br>• Text is well organised and coherent. Paragraphs and a variety of linking words and cohesive devices are used to generally good effect. Uses a range of vocabulary and phrases, appropriately. Correct grammar is used with control and flexibility to convey intended meaning. Only occasional errors at most, but communication is not impeded.<br>• The purpose of the document is clear. |

**** Note: Adjustments in the exact description of the assessment criteria can be made based on experiences with previous students groups with the aim to improve relevance, reliability and transparency of the assessment.***

**Vaccines and Diagnostics**

| ***Title of UOS*** | ***Vaccines and Diagnostics***<br>***HMP-MMLS-VAD*** |
|---|---|
| Degree Programme | Master in Molecular Life Sciences |
| Target group | Students enrolled in Master in Molecular Life Sciences programme |
| Professional task | 1. to understand practical, economic, social and/or ecological needs of businesses, market and society that can be anticipated by biotechnology<br>2. to apply fundamental knowledge in the area of molecular life sciences to find sustainable solutions for these needs<br>3. to implement such solutions in a successful and efficient way by organizing their realization in projects, considering the interdisciplinary dimension and communicating with different experts. Such projects have a duration of at least three months. |
| (Professional) Products | • Proposal for development of a putative new/ improved vaccine<br>• Validation plan for the analytical validation of the improved diagnostic test including the project plan |
| Credits, study load | 9 EC / 252 study load hours, consisting of<br>60 contact hours and<br>192 hours for self-study and work on assignments |
| Relationship with and entry requirements concerning exams | • All assessments and assignments of this module have to be sufficient |
| General description | During this unit of study, students acquire knowledge and skills in the area of vaccine discovery and production, and the development and validation of a diagnostic test.<br>By writing a proposal on the development of a putative new or improved vaccine, they deepen their knowledge on immunological processes and the interaction between pathogens and hosts. They also focus on the production and efficacy testing of a vaccine and get an idea of the costs and time planning involved in the R&D phase of vaccine development.<br>Students train their professional writing skills, learning how to write a proposal that is convincing for the scientific community. Part of the proposal will be focussed on translating the key points of their scientific argumentation into a summary that is understandable and convincing for a layman audience, in this case the financial department.<br>By choosing an improved diagnostic test from literature, students will acquire knowledge and understanding of different types of diagnostic tests, and their advantages and limitations in detecting specific pathogens. Students write a validation plan for the analytical validation of their diagnostic test, thereby integrating quality and project management aspects with their scientific ideas. Statistical aspects of diagnostic tests/analytical procedures are addressed as well.<br>The competence development of students is focussed on ‘Designing strategies for applied research and product development’, ‘Design, analysis and control of experiments’, ‘Communication’ and ‘Advising’.<br>. |
| Competences | **Competence 2: Designing strategies for applied research and product development**<br>**Competence 3: Design, analysis and control of experiments** |

| | |
|---|---|
| | **Competence 4: Communication**<br>Competence 5: Managing projects<br>**Competence 6: Advising** |
| Assessment criteria | ***See exams of the Vaccines and Diagnostics below this table*** |
| Exams | ***See exams of the Vaccines and Diagnostics below this table*** |
| Compulsory literature | ❖ Reader Vaccines and Diagnostics<br>❖ Reader Scientific Writing<br>❖ Quality guidelines<br>- The *International Conference on Harmonisation* of Technical Requirements for Registration of Pharmaceuticals for Human Use. (2005). Validation of Analytical Procedures: Text and Methodology Q2(R1).<br>- Food and Drug Administration, Center for Biologics Evaluation and Research (CBER). (2015). Guidance for Industry: Analytical Procedures and Methods Validation for Drugs and Biologics.<br><br>❖ Specific assignments<br>- Key articles are provided with the specific assignments<br>- Further assignment-specific literature can be found in the PubMed database |
| Recommended literature | Books:<br><br>❖ For immunological background: any good immunology study book, such as:<br>o Murphy, K. (2016). *Janeway's Immunobiology* (9th edition). Garland Science<br>o Belves, P.J., Martin, S.J., Burton, D.R., Roitt, I.M. (2010, 2012 or 2017). *Roitt's Essential Immunology.* (11th , 12th or 13th Edition). Wiley-Blackwell<br>o Male, D., Brostoff, J., Roth, D.B. & Roitt, I.M. (2012). *Immunology* (8th edition). Philadelphia: Elsevier<br>o Parts of: Alberts, Johnson, Lewis, Raff, Roberts, and Walter (2011 or 2015). *Molecular Biology of the Cell.* (6th or 7th Edition). Garland Science.<br>o Wood, P. (2011). *Understanding Immunology.* (3rd edition). Person Education Limited (advice from previous student to start with in cases of very little background knowledge)<br>=> focus on the chapters about innate and adaptive immunity against pathogens, antigen presentation, activation of B and T cells, vaccination and antibody production<br><br>❖ Lodge, Lund & Minchin (2007) *Gene Cloning, Principles and Applications.* Tayler & Francis Group; parts of Chapter 13: Medical applications<br>❖ Tang, Y., Stratton, C.W. (2013 or 2018) *Advanced Techniques in Diagnostic Microbiology* (2nd or 3rd edition). Springer, New York<br>❖ Samuel, M.L., Witmer, J.A., & Schaffner, A. (2011 or 2015). *Statistics for the Life Sciences* (4th or 5th edition). Pearson.<br>❖ Agostino, M. (2012). Practical Bio-informatics. Garland Science.<br><br>❖ Glasman-Deal, H. (2009). *Science Research Writing for non-native speakers of English.* Imperial College Press<br>❖ Scientific writing: Stevens, M. (2007). *Subtleties of Scientific Style.* Sciencescape Editing, Australia |

| | |
|---|---|
| | Regulatory Guidelines:<br>❖ Food and Drug Administration. (2018). Guidance for Industry: Bioanalytical Method Validation<br>❖ European Medicines agency. (2011). Guideline on bioanalytical method validation<br>❖ Food and Drug Administration. (2007). Guidance for Industry and FDA Staff: Statistical Guidance on Reporting Results from Studies Evaluating Diagnostic Tests<br>❖ Research articles relevant to the assignments:Further assignment-specific literature can be found in the PubMed database (do not forget to make use of the Journals the HAN has access to)<br>***The reading lists are updated regularly. Therefore, the actual reading list of the unit of study might deviate from the list presented above.*** |
| Software and other materials | Computer and Internet connection |
| Activities | During this module, students will individually work on their central assignments which are advising on the improvement of a vaccine and the validation of a diagnostic test (see also assessment).<br>The supporting education programme will help students to work out their assignments and to master the exam, and therefore to achieve their learning goals.<br><br><u>Lectures:</u><br>- Lectures on immunology, infections and vaccines<br>- Lectures on the validation of diagnostic tests<br>-<br>- Guest lectures on immunology, infections, vaccines and diagnostic tests<br>- World Café on vaccine development<br>- Brainstorm meeting on diagnostic tests<br>- Interactive lectures on advantages and disadvantages of diagnostic tests<br>-<br><br><u>Workshops /Trainings:</u><br>- Statistics for diagnostic tests<br>- Bioinformatics training: Predicting conserved regions<br>- Scientific writing for non-specialists |
| Work formats | Assignments, Lectures, Trainings, Meetings and Feedback |
| Lesson/ Contact hours | See above: Credits, study load |
| Compulsory participation | Assessments |
| Education period | October 2020 – February 2021 |
| Maximum number of participants | - |

**Exam of the UOS Vaccines and Diagnostics**

| | **Assessment criteria/ Indicators / requirements** | | |
|---|---|---|---|
| | ***Competence indicators*** | ***Body of Knowledge and Skills*** | ***Assessment criteria*** |
| ***Code modular exam:*** **MMLS-VAD-VAC DP** | **Competence indicators** | ***Knowledge indicators*** | ***For this assignment, these indicators and knowledge criteria are translated into the following assessment criteria**** |
| ***Name modular exam:*** Vaccine development proposal<br>***Type:*** Individually written professional product<br>***Number of examiners:*** 2 for construction and evaluation of assignment and assessment form, 2 for assessment based on random sampling<br>***Assessment:*** Grade<br>***Cut-off value:*** 55%<br>***Minimal result:*** 5.5<br>***Weighting:*** 60%<br>***Period and resit:*** 2 chances per study year;<br>Chance 1: December 2020<br>Chance 2: | 2.1. Is able to independently acquire knowledge in a new subject by consulting specific literature and other resources; is able to identify reliable and suitable sources; Discriminates between major and side issues;<br>2.2. Combines information from different sources in the context of the own project<br>2.3. Defines the project aim in terms of products and/or results based on the acquired background information<br>2.5. Designs different approaches that could lead to the project aim. Evaluates these possibilities and justifies the choice based on scientific arguments and practical parameters such as time, costs, quality and personnel<br>2.6 Designs a complete strategy leading to the project aim (project of about 3-4 months; see also: managing projects)<br>3.1 Designs experiments based on the required quality and quantity of the product or result. | • has knowledge and understanding of prokaryotic and eukaryotic cells, function of organelles, cell cycle regulation, DNA repair, signal transduction, protein modification and localization<br>• understand the mechanisms by which micro-organisms can cause disease<br>• has knowledge and understanding of the immune response to pathogens (action of innate and adaptive immune system, induction and effects of cellular and humoral immunity, mechanisms for induction of memory)<br>• knows different types of vaccines (such as attenuated, inactivated, subunit, recombinant, DNA), their mode of action and their advantages and disadvantages<br>• is able to choose a vaccine antigen, adjuvant and administration route depending on the immune response that is required and on practical aspect<br>• knows different vaccine production platforms, their advantages and disadvantages | - At least 10 recent (the majority published within the last 5 years) peer-reviewed research articles relevant to the subject are referenced to.<br>- References are given according to international standards.<br>- The proposal follows the prescribed format.<br><u>Expert summary</u><br>- The resulting advice is convincingly summarized with reference to the motivation, aim and the key arguments for the presumable success of the vaccine.<br><u>Motivation</u><br>- The motivation for the production of an improved vaccine is based on impact of the disease and problems with current vaccination programmes<br><u>Summary of the literature</u><br>- The student explains the molecular and immunological mechanisms by which the pathogen causes disease and concludes about the desired effects of the improved vaccine on the immune system<br><u>Preliminary results.</u> |

| | | | |
|---|---|---|---|
| February 2021<br><br>***Compensation:***<br>none | 3.2 Applies strict logical thinking to draw conclusions from the results and interprets them:<br>- in the context of the experiments<br>- in the context of the project aim (helicopter view)<br>- in comparison to other analyses, reference/theoretical values, and quality requirements<br>4.1. Reports project plans and results according to the standard format of scientific documents and meets the scientific international conventions criteria.<br>4.3. Describes the key message of the project relevant for patenting, registration, and/or business development. Uses terminology that is understandable for experts from different departments.<br>5.7 Describes a schedule based on the (experimental) plan<br>5.8. Describes the required budget<br>6.4. Integrates own project results in the multidisciplinary defined goals and advises to other departments<br>6.5. Gives advice about choosing new equipment or methods based on project goals, overall goals and available resources | • is able to design experiments to test the potency of a vaccine<br>• knows different types of diagnostic tests, their principle of action and their advantages and disadvantages<br>• understands the principles, advantages and disadvantages of different diagnostic tests, e.g. serology and molecular diagnostics<br>• is able to choose a type of diagnostic test based on the required specificity, sensitivity and practical aspects such as duration, requirement for staff training | - The student explains which type of vaccine he/she would further develop by critically discussing the current literature. The effect of the vaccine on the immune system is explicitly addressed.<br><u>Plan of investigation</u><br>- The student describes the development of the vaccine including the practical aspects, a time schedule, the production system and how the potency of the is tested. This needs to be justified both scientifically and practical-economically.<br><u>Diagnostic test</u><br>- The student selects a molecular diagnostic test based on its advantages and disadvantages that is not commercially available. The student describes this test and gives relevant arguments for his choice.<br><br><u>Writing</u> (minimal level):<br>- The purpose of the document is clear; Text is generally well organised and coherent (a variety of linking words and cohesive devices are used).<br>- The document is written in correct scientific style: Uses everyday vocabulary and phrases, with occasional inappropriate use.<br>- Simple, mostly correct grammar is used. Errors may be noticeable but the meaning can be determined.<br><u>Writing</u> (excellent level):<br>- Text is a well-organised, coherent whole. Paragraphs are structured effectively.<br>- Uses a range of appropriate |

| | | | |
|---|---|---|---|
| | | | vocabulary and phrases effectively and precisely. Correct grammar is used with flexibility and sophistication.<br><u>Summary for financial department (weighting about 20%, 55% of points are required for sufficient):</u><br>- The summary for the financial department contains convincing arguments for financial support including an estimation of the needed investment, based on the plan of investigation and the expected win. The summary is well understandable for people with other backgrounds than biotechnology. |
| ***Code modular exam:*** **MMLS-VAD-VAL PL** | ***Competence indicators*** | ***Knowledge indicators*** | ***For this assignment, these indicators and knowledge criteria are translated into the following assessment criteria**** |
| ***Name modular exam:*** **Validation plan for analytical validation of new/improved diagnostic test**<br><br>***Type:*** Individually written professional product<br><br>***Number of examiners:*** 2 for construction and evaluation of assignment and assessment form, 2 for assessment<br><br>***Assessment:*** Grade | 2.1. Is able to independently acquire knowledge in a new subject by consulting specific literature and other resources; is able to identify reliable and suitable sources; Discriminates between major and side issues;<br>2.2. Combines information from different sources in the context of the own project<br>2.3. Defines the project aim in terms of products and/or results based on the acquired background information<br>2.4. Defines the quality requirements for products and processes based on legal requirements.<br>2.5. Designs different approaches | • explains the principle of all standard techniques to detect DNA (such as Southern Blot, PCR, FISH, (next generation) sequencing), RNA (such as Northern blot, RT-PCR, expression array, RNAseq, in situ hybridization) and proteins (such as SDS-PAGE, Western blot, immunocytochemistry, immunohistochemistry, protein array, mass spec) and can apply the appropriate technique to answer a question about the presence, quantity or localization of DNA, RNA or protein<br>• has knowledge and understanding of methods to analyze biomolecules (such as NMR, chromatography, enzyme assays, ultrafiltration, | <u>Content:</u><br>- The subject of the validation plan is concisely described.<br>- The choice of the diagnostic test is described based on scientific and practical arguments and is supported with scientific literature<br>- The intended use is concisely described and matches with the assignment. Limitations, when applicable, are defined.<br>- The principle of the method to be used is transparently explained. A figure visualizes the principle.<br>- The testing algorithm is described with respect to tested samples and timeline.<br>- The student describes the theoretical |

| | | | |
|---|---|---|---|
| ***Cut-off value:***<br>55%<br>***Minimal result:***<br>5.5<br>***Weighting:***<br>40%<br>***Period and resit:***<br>2 chances per study year;<br>Chance1: February 2021<br>Chance 2: March 2021<br><br>***Compensation:***<br>none | that could lead to the project aim. Evaluates these possibilities and justifies the choice based on scientific arguments and practical parameters such as time, costs, quality and personnel<br>2.6. Designs a complete strategy leading to the project aim (project of about 3-4 months; see also: managing projects)<br>3.1. Designs experiments based on the required quality and quantity of the product or result.<br>4.1. Reports project plans and results according to the standard format of scientific documents and meets the scientific international conventions criteria. | absorption measurement, selective breakdown, enzyme immune-assay) and is able to choose an analytical method based on the biomolecule(s) to be analyzed<br>• has knowledge and understanding of prokaryotic and eukaryotic cells, function of organelles, cell cycle regulation, DNA repair, signal transduction, protein modification and localization<br>• knows different types of diagnostic tests, their principle of action and their advantages and disadvantages<br>• understands the principles, advantages and disadvantages of different diagnostic tests, e.g. serology and molecular diagnostics<br>• is able to define the importance of sensitivity, specificity, and practical aspects such as costs, duration or required trained staff, based on the desired application of the diagnostic test<br>• is able to choose a type of diagnostic test based on the required specificity, sensitivity and practical aspects such as duration, requirement for staff training | and the practical specificity aimed for.*<br>- The student describes how the theoretical and practical specificity will be determined.*<br>- The student describes the sensitivity (Limit of Detection, Limit of Quantification, Linearity and Range) aimed for.*<br>- The student describes how the sensitivity (Limit of Detection, Limit of Quantification, Linearity and Range) will be determined *<br>- The student describes the accuracy aimed for *<br>- The student describes how the accuracy will be determined *<br>- The student describes the precision (repeatability, intermediate precision and reproducibility) aimed for *<br>- The student describes how the precision (repeatability, intermediate precision and reproducibility) will be determined *<br>- The student describes the robustness aimed for *<br>- The student describes how the robustness will be determined. *<br>- The student describes the interference and inhibition (not) acceptable in the test *<br>- The student describes how the interference and inhibition will be determined *<br>- * three of the six parameters specificity, sensitivity, accuracy, precision, robustness and interference and inhibition are discussed in each validation plan. |

| | | | |
|---|---|---|---|
| | | • is able to define quality requirement for products and processes based on regulatory guidelines<br>• is able to design a strategy to validate a diagnostic test<br>• is able to determine the accuracy, sensitivity and specificity of a diagnostic test, and to understand ROC curves | <u>Writing:</u><br>- The validation plan and work plan follow the prescribed format. References are given according to international standards.<br><br>Writing (minimal level):<br>- The purpose of the document is clear; Text is generally well organised and coherent (a variety of linking words and cohesive devices are used).<br>- The document is written in correct scientific style: Uses everyday vocabulary and phrases, with occasional inappropriate use.<br>- Simple, mostly correct grammar is used. Errors may be noticeable but the meaning can be determined.<br>Writing (excellent level):<br>- Text is a well-organised, coherent whole. Paragraphs are structured effectively.<br>- Uses a range of appropriate vocabulary and phrases effectively and precisely. Correct grammar is used with flexibility and sophistication. |

**** Note: Adjustments in the <u>exact description</u> of the assessment criteria can be made based on experiences with previous students groups with the aim to improve relevance, reliability and transparency of the assessment.***

**Research and Product Development Skills 1**

| ***Title of UOS*** | ***Research and Product Development Skills 1***<br>***HMP-MMLS-RD1*** |
|---|---|
| Degree Programme | Master in Molecular Life Sciences |
| Target group | Students enrolled in Master in Molecular Life Sciences programme |
| Professional task | 1. to understand practical, economic, social and/or ecological needs of businesses, market and society that can be anticipated by biotechnology<br>2. to apply fundamental knowledge in the area of molecular life sciences to find sustainable solutions for these needs |
| (Professional) Products | • Scientific document<br>• R&D Presentation<br>• Research performance 1<br>• Design of Experiments<br>• Scientific progress report |
| Credits/ study load | 23 EC / 644 study load hours, consisting of<br>55 contact hours at HAN and<br>589 contact hours learning on the (placement) workplace of which 280 hours related to professional products and 309 hours related to professional performance development |
| Relationship with and entry requirements concerning exams | • All assessments of this unit of study have to be sufficient. |
| General description | This unit of study focuses on the skills necessary for research and product development in various stages of product development pipelines in bioscience. Students become aware of the different stages of the product development pipelines in bio business and will develop the necessary Research and Product Development skills required to run projects within this pipeline.<br>Research skills trained in this unit of study comprise finding and interpreting relevant literature, experimental excellence, data analysis and interpretation, and Design of Experiments. In addition, students are trained in scientific writing, presenting and discussions, and advising about the own or similar projects in an interdisciplinary context.<br>Students perform this unit of study in the context of their (placement) workplace. The product, a Scientific progress report, and the Design of Experiments are preferentially produced by students using their very own professional environment.<br>Students with work experience prior to the study programme can demonstrate that the already acquired the intermediate competence level by handing in a portfolio at the start of the unit of study. After demonstration of this intermediate level, they are exempted from the respective study activities.<br>This competences Designing strategies for applied research and product development, Design, analysis and control of experiments and Communication are the focus in this unit of study.<br>These competences are integrally applied with competences in Managing Projects, which are trained during the unit of study Managing Projects 1 that runs in parallel to this unit of study. |
| Competences | Competence 1: Professional conduct and guiding professional development |

| | |
|---|---|
| | **Competence 2: Designing strategies for applied research and product development**<br>**Competence 3: Design, analysis and control of experiments**<br>**Competence 4: Communication**<br>Competence 5: Managing projects<br>Competence 6: Advising |
| Assessment criteria | ***See exams of the UOS R&D Skills below this table*** |
| Exams | ***See exams of the R&D Skills below this table*** |
| Compulsory literature | ❖ Reader Research and Product Development Skills<br>❖ Scientific literature related to the (placement) workplace projects and provided during the unit of study<br>❖ Quality Guidelines of the ICH<br>❖ Scientific writing guide (provided online) |
| Recommended literature | ❖ Glasman-Deal; H. (2009). *Science Research Writing for Non-Native Speakers of English.* Imperial College Press<br>❖ Stevens, M. (2007). *Subtleties of Scientific Style.* Sciencescape Editing, Australia<br>***The reading lists are updated regularly. Therefore, the actual reading list of the unit of study might deviate from the list presented above.*** |
| Software and other materials | Computer and Internet connection<br>SPSS Statistics |
| Activities | During this unit of study, students individually learn on their (internship) workplace by contributing to project work and working on their different assignments.<br>The supporting education programme will help students to work out their assignments and to develop to the required level in practice, and therefore to achieve their learning goals.<br><br><u>Lectures</u><br>- Introduction into the product development pipelines<br><br><u>Workshop/Trainings</u><br>- Research skills and Project Development Skills (e.g. Journal clubs**,** analysing scientific literature, market surveys)<br>- Design of Experiment DOE/Statistics<br>- Scientific writing<br>- Presenting skills<br>- Feedback sessions |
| Work formats | Learning on the (placement) work place, lectures, workshops, practical, meetings |
| Lesson/<br>Contact hours | See above: credits/ study load |
| Compulsory participation | The participation in the placement according to the placement contract is compulsory for students enrolled in the full-time programme. |
| Education period | September 2020 – August 2021 |
| Maximum number of participants | The maximum number of participants is defined by the number of (placements) workplaces for the full-time programme.<br>The number of participants taking part in this unit of study as part-time or modular student is unlimited. |

**Exam of the UOS Research and Product Development Skills 1**

| | **Assessment criteria/ Indicators / requirements** | | |
|---|---|---|---|
| | ***Competence indicators*** | ***Body of Knowledge and Skills*** | ***Assessment criteria*** |
| ***Code modular exam:*** **MMLS-RD1-*SD*** | *Competence indicators* | *Knowledge indicators* | *assessment criteria** |
| ***Name modular exam:*** **Scientific document**<br>***Type:*** Individual written professional product<br>***Number of examiners:*** 2 for construction and evaluation of criteria, 1-2 for assessment considering advice of workplace supervisor<br>***Assessment:*** Sufficient/ insufficient<br>***Cut-off value:*** -<br>***Minimal result:*** sufficient<br>***Weighting:*** 0%<br>***Period and resit:*** 2 chances per study year;<br>Chance1: November 2020 (ft); September 2020-July 2021 (pt)<br>Chance 2:<br>January 2021 (ft);<br>in agreement with | 4.1. (intermediate level):<br>Reports project plans and results according to the standard format of scientific documents and the reader recognizes the scientific international conventions criteria. | *Depending on context of (internship) workplace* | ***Content:***<br>- Communicate straightforward Science concepts/ideas that are discussed in the context of scientific literature. Irrelevances may be present.<br>*(minimum level)*<br>- Communicate straightforward Science concepts/ideas that are discussed in the context of scientific literature. Minor irrelevances may be present.<br>*(above minimum level)*<br>- Communicate straightforward Science concepts/ideas that are discussed in the context of scientific literature. No irrelevances present.<br>*(excellent level)*<br>***Organisation:***<br>- Text is connected and coherent (limited use of linking words and cohesive devices).<br>*(minimum level)*<br>- Holds the target reader's attention most of the time:<br>- Text is generally well organised and coherent (a variety of linking words and cohesive devices are used).<br>*(above minimum level)*<br>- Holds the target reader's attention throughout the document: Text is well |

| | | | |
|---|---|---|---|
| student (pt)<br>***Compensation:***<br>None | | | organised and coherent. Paragraphs and a variety of linking words and cohesive devices are used) to generally good effect. *(excellent level)*<br>***Language:***<br>- Uses everyday vocabulary and phrases, with occasional inappropriate use.<br>- Simple, mostly correct grammar is used. Errors may be noticeable but the meaning can be determined.<br>*(minimum level)*<br>- Uses a range of everyday vocabulary and phrases, with occasional inappropriate use.<br>- Correct grammar is used most of the time to convey intended meaning. Errors do not impede communication<br>*(above minimum level)*<br>- Uses a range of vocabulary and phrases, appropriately. Correct grammar is used with control and flexibility to convey intended meaning. Only occasional errors at most, but communication is not impeded<br>*(excellent level)* |
| ***Code modular exam:***<br>**MMLS-RD1-P** | ***Competence indicators*** | ***Knowledge indicators*** | ***For this assignment, these indicators and knowledge criteria are translated into the following assessment criteria**** |
| ***Name modular exam:***<br>R&D Presentation<br>***Type:***<br>Individual presentation<br>***Number of examiners:***<br>2 for construction and evaluation of criteria,<br>1 for assessment | 4.2. (intermediate level):<br>Presents experimental data and results in English to colleagues. | *Depending on context of (internship) workplace* | - The presentation stays in the given time limit (15-20 min; no more than 5 mins more or less than the given range)<br>- Slides (or other suitable visual aids) are sometimes unclear. There are occasional spelling and grammar mistakes. Figures and tables are |

| | | | |
|---|---|---|---|
| considering advice of workplace supervisor<br>***Assessment:***<br>Sufficient / insufficient<br>***Cut-off value:***<br>-<br>***Minimal result:***<br>sufficient<br>***Weighting:***<br>0%<br>***Period and resit:***<br>2 chances per study year;<br>Chance1: January 2021 (ft); September 2020-July 2021 (pt)<br>Chance 2:<br>February 2021 (ft),<br>in agreement with student (pt)<br>***Compensation:***<br>none | | | labelled.<br>- Communicate straightforward Science concepts/ideas that are discussed in the context of scientific literature. Irrelevances may be present.<br>- The presentation has an introduction-body- conclusion structure.<br>- Stiff or no movement in posture and gestures<br>- Is mostly intelligible.<br>- Produces responses which are extended beyond short phrases, despite hesitation.<br>- Shows a good degree of control of simple grammatical forms. Uses mostly appropriate vocabulary when talking about familiar topics.<br>(minimal level)<br>- Slides (or other suitable visual aids) are clear. There are occasional spelling and grammar mistakes. Figures and tables are clearly/correctly labelled.<br>- Communicate straightforward Science concepts/ideas that are discussed in the context of scientific literature. Minor irrelevances may be present.<br>- The presentation has an introduction-body- conclusion structure and is easy to understand.<br>- Some, but not all characteristics of column to the right.<br>Is intelligible. Intonation is generally appropriate. Sentence and word stress is generally accurately placed. |

| | | | |
|---|---|---|---|
| | | | - Produces extended stretches of language despite some hesitation.<br>- Uses simple grammatical forms, attempts complex grammatical forms. Uses appropriate vocabulary to give and exchange views, on familiar topics<br>(above minimum level)<br>- Slides (or other suitable visual aids) are clear and visually interesting. Uses correct spelling and grammar. Figures and tables are clearly/correctly labelled and easy to understand.<br>- Communicate straightforward Science concepts/ideas that are discussed in the context of scientific literature. No irrelevances may be present.<br>- The presentation is exceptionally well-organised and easy to understand and follow. It is structured in such way that tells a cohesive story<br>- Natural posture, Gestures and movements that enhance the verbal and visual message.<br>- Is intelligible. Intonation is appropriate. Sentence and word stress is accurately placed.<br>- Natural and spontaneous: Produces extended stretches of language with very little hesitation.<br>- Uses a range of simple and some complex grammatical forms.<br>- Uses a range of appropriate vocabulary to give and exchange views on familiar and unfamiliar |

| | | | |
|---|---|---|---|
| | | | topics<br>(Excellent level) |
| ***Code modular exam:*** **MMLS-RD1- RP1** | ***Competence indicators*** | ***Knowledge indicators*** | ***Assessment criteria*** |
| ***Name modular exam:*** **Research performance 1**<br><br>***Type:***<br>Performance assessment<br>***Number of examiners:***<br>2 for construction and evaluation of criteria, 1-2 for assessment considering advice of workplace supervisor<br>***Assessment:***<br>Sufficient/insufficient<br>***Cut-off value:***<br>All criteria sufficient<br>***Minimal result:***<br>sufficient<br><br>***Weighting:***<br>0%<br>***Period and resit:***<br>2 chances per study year;<br>Chance1: February-August 2021 (ft), September 2020 – September 2021 (pt)<br><br>Chance 2: November 2021 (ft),<br>in agreement with | Intermediate Level (insufficient/ sufficient)<br>1.1. (intermediate level):<br>Is able to independently acquire knowledge in a new subject by consulting specific literature<br>1.2. (intermediate level):<br>Combines information from different sources in the context of the own experiment<br>1.3. (intermediate level):<br>Designs different approaches that could lead to the experimental results.<br>Evaluates these possibilities and justifies the choice based on arguments and practical parameters.<br>3.1. (intermediate level):<br>Designs experiments based on a requested intermediate product.<br>1.1. (intermediate level):<br>Applies strict logical thinking to draw conclusions from the results:<br>- in the context of the experiments<br>- in comparison to other analyses, reference/theoretical values, and quality requirements.<br>3.3. (intermediate level):<br>Solves practical problems if experiments do not work as planned (trouble shooting); consults colleagues if necessary.<br>1.1. (intermediate level):<br>Describes a schedule for a set of necessary experiments. | *Depending on context of (internship) workplace* | - Quickly gains familiarity with the subject by reading field-specific literature, at least in parts on own initiative.<br>- Takes the initiative to understand and become familiar with the subject. Consults supervisors, colleagues, literature and asks suitable questions.<br>- Establishes the relationship between the experiments to be carried out and the underlying research question (of the own research) and has a helicopter view.<br>- The student discussed experimental approaches that can lead to the intermediate results or products.<br>- The choices he/she had made were based on scientific and/or practical arguments.<br>- The student designed experiments that will lead to the requested intermediate product or result.<br>- Uses the correct controls in the experiments. Independently selects controls.<br>- Prepares for the experiments well and quickly. Makes few errors in the preparation phase that benefits the speed of the work.<br>- Makes conclusions from the analysed data about the (sub-)aim related to the experiment and does this in the context of the overarching project (helicopter view) and |

| | | | |
|---|---|---|---|
| student (pt)<br><br>***Compensation:***<br>none | 1.11. (intermediate level):<br>Works efficiently towards a set of defined deliverables.<br>1.12. (intermediate level):<br>Is in control of the experiments.<br>1.13. (intermediate level):<br>Is flexible with changing circumstances by adapting the experimental strategy<br>1.2. (intermediate level):<br>Actively participates in a discussion about related projects by asking critical questions.<br>1.3. (intermediate level):<br>Advises about follow-up projects of the own experiments.<br>1.4. (intermediate level):<br>Gives advice about choosing new equipment. | | - compares with other analyses, reference values or theoretical values from the literature.<br>- Deals with problems if the experiment does not run as was anticipated in a structured manner, is flexible, pro-active, recognises limits.<br>- Generates independently realistic schedule for a set of experiments covering minimally 4 weeks.<br>- Works systematically according to a plan, manages the practical activities efficiently,<br>- Masters new techniques<br>- Works on several experiments at the same time. Can switch easily between the experiments, while keeping an overview.<br>- Works efficiently, quantity of the data is according to the experimental plan.<br>- Knows during the execution of the experiment what he/she is doing at all times, is critical on its own actions and is able to justify his/her own actions.<br>- Performs experiments in such a way that reliable reproducible data is obtained.<br>- Works efficiently, quality of the data is high (trusted by peers).<br>- Adjusts the experiment during implementation if necessary and justifies modifications to the study.<br>- The student ask questions during work discussions.<br>- Is able to make realistic proposals for follow-up experiments<br>- And<br>- Is able to design new experiments in response to a research question. |

| | | | |
|---|---|---|---|
| | | | - The student chose suitable methods and equipment materials based on practical aspects. |
| ***Code modular exam:*** **MMLS-RD1-DoE** | ***Competence indicators*** | ***Knowledge indicators*** | ***For this assignment, these indicators and knowledge criteria are translated into the following assessment criteria**** |
| ***Name modular exam:*** Design of experiments<br><br>***Type:*** Group activity and individual written professional product<br><br>***Number of examiners:*** 2 for construction and evaluation of criteria, 2 for assessment considering advice of workplace supervisor<br><br>***Assessment:*** sufficient/insufficient<br><br>***Cut-off value:*** sufficient<br><br>***Minimal result:*** sufficient<br><br>***Weighting:*** 0%<br><br>***Period and resit:*** 2 chances per study year;<br>Chance 1: February 2021<br>Chance 2:<br>March 2021 (ft),<br>in agreement with | 3.1. Designs experiments based on the required quality and quantity of the product or result.<br>3.2. Applies strict logical thinking to draw conclusions from the results and interprets them:<br>- in view of the experiments<br>- in view of the project aim (helicopter view)<br>- in comparison to other analyses, reference/theoretical values, and quality requirements.<br>5.1 Defines project deliverables based on the needed quality and quantity<br>5.2 Identifies project risks based on the (experimental) approach and on (putative) competitors | • understands the basics of design of experiments (DoE) methodology, including: design of experiments, randomization, blocking by nuisance factor, factorial design, screening design, comparative designs, optimization design, one-factor at a time Is able to report the results with tables and graphics<br>• is able to design and analyze a screening and / or process optimization experiment using experimental design<br>• is able to report the results with tables and graphics | - The student describes the aim of his/her experimental design.<br>- The student can explain the readout (way to analyse) used in the experiments.<br>- The student describes which parameters will be tested. He/she can explain his/her choice with scientific insights and relevant literature in a transparent way.<br>- The student describes which parameters (see above) might influence each other's effect on the readout. He/she can explain his/her arguments with scientific insights and relevant literature in a transparent way.<br>- The student can explain the choice of his/her design, including the range of the parameters, based on scientific insights and relevant literature.<br>- The student describes the correct statistical method to analyse the data.<br>- The student describes the risks of the approach. |

| | | | |
|---|---|---|---|
| student (pt)<br><br>***Compensation:***<br>none | | | |
| ***Code modular exam:***<br>**MMLS-RD1-PR**<br><br>***Name modular exam:***<br>**Scientific Progress report**<br><br>***Type:***<br>Individual written professional product<br><br>***Number of examiners:***<br>2 for construction and evaluation of criteria,<br>2 for assessment considering advice of workplace supervisor<br><br>***Assessment:***<br>Grade<br><br>***Cut-off value:***<br>55%<br><br>***Minimal result:***<br>5.5<br><br>***Weighting:***<br>100%<br><br>***Period and resit:***<br>2 chances per study year;<br>Chance1: August 2021 | 3.2 Applies strict logical thinking to draw conclusions from the results and interprets them:<br>- in the context of the experiments<br>- in the context of the project aim (helicopter view)<br>- in comparison to other analyses, reference/theoretical values, and quality requirements.<br>3.3 Solves practical problems if experiments do not work as planned (trouble shooting); couples back to the theory or consults colleagues if necessary; suggests alternative experiments.<br>4.1. (intermediate level):<br>Reports project plans and results according to the standard format of scientific documents and the reader recognizes the scientific international conventions criteria. | *Depending on context of (internship) workplace* | 'Pass'-level:<br>- The report follows the format: summary, introduction, materials and methods, results, discussion and conclusion, reference list.<br>- The methods are described in a way that they can be repeated by others.<br>- The information presented in the introduction describes the background information relevant to research.<br>- Irrelevant information is present and/or relevant information is partly missing.<br>- The student informs the reader on the result. Relevant information is partly missing.<br>- Figures are described according to scientific conventions.<br><br>- Discussion: The student discussed the results meaningfully in the light of the experimental procedure, the project aim and the literature. Relevant follow-up experiments are suggested.<br>- Relevant information is partly missing.<br>- The purpose of the document is clear; Text is connected and coherent (limited use of linking words and cohesive devices).<br>- The document is written in correct |

| | | | |
|---|---|---|---|
| (ft), August 2021 – August 2022 (pt)<br>Chance 2:<br>October 2021 (ft), in agreement with student<br><br>***Compensation:***<br>none | | | scientific style: Uses everyday vocabulary and phrases, with occasional inappropriate use.<br>- Simple, mostly correct grammar is used. Errors may be noticeable but the meaning can be determined.<br>'Good' –level:<br>- The information presented in the introduction describes the background information relevant to research.<br>A minimum of Irrelevant information is present.<br>- The student fully informs the reader on the result.<br>Figures are described according to scientific conventions.<br>- The student discussed the results comprehensively in the light of the experimental procedure, the project aim and the literature. The relevance and/or added value of the results to the project aim are convincingly discussed.<br>- A comprehensive set of relevant follow-up experiments is described.<br>- Holds the target reader's attention most of the time: Text is generally well organised and coherent<br>- Uses a range of vocabulary and phrases, appropriately. Correct grammar is used with control and flexibility to convey intended meaning. Only occasional errors at most, but communication is not impeded.<br>'Excellent'-level:<br>- The information presented in the introduction describes the |

| | | | |
|---|---|---|---|
| | | | background information relevant to research. The information is of excellent clarity and fully informs the reader.<br>- The student described the results in a transparent and convincing manner.<br>- Figures are described according to scientific conventions.<br>- ('good'-level).. and the results are put in the context of recent developments in the field.<br>- A comprehensive set of relevant follow-up experiments and projects are described.<br>- Holds the target reader's attention throughout the document: Text is very well organised and coherent.<br>- Uses a range of vocabulary and phrases, appropriately. Correct grammar is used with control and flexibility to convey intended meaning. |

**** Note: Adjustments in the exact description of the assessment criteria can be made based on experiences with previous students groups with the aim to improve relevance, reliability and transparency of the assessment.***

**Research and Product Development Skills 2**

| ***Title of UOS*** | ***Research and Product Development Skills 2***<br>***HMP-MMLS-RD2*** |
|---|---|
| Degree Programme | Master in Molecular Life Sciences |
| Target group | Students enrolled in Master in Molecular Life Sciences programme |
| Professional task | 1. to understand practical, economic, social and/or ecological needs of businesses, market and society that can be anticipated by biotechnology<br>2. to apply fundamental knowledge in the area of molecular life sciences to find sustainable solutions for these needs |
| (Professional) Products | • Quality guidelines assignment<br>• Business plan/case<br>• Research performance 2 |
| Credits/ study load | 10 EC / 280 study load hours, consisting of<br>25 contact hours at HAN and<br>255 contact hours learning on the (placement) workplace of which 130 hours related to professional products and 125 hours related to professional performance development |
| Relationship with and entry requirements concerning exams | • Successful completion of the modular exams of the modular exams "Research Performance 1", of the unit of study Research and Product Development Skills 1 is entry requirement for the assessment of "Research Performance 2" of this unit of study<br>• All assessments of this unit of study have to be sufficient. |
| General description | This unit of study is a follow-up of the unit of study Research and Product Development Skills 1. It again focuses on the skills necessary for research and product development in various stages of product development pipelines in bioscience. Students become aware of the different stages of the product development pipelines in bio business and will develop the necessary Research and Product Development skills required to run projects within this pipeline.<br>Research skills trained in this unit of study comprise finding and interpreting relevant literature, experimental excellence, data analysis and interpretation. Product development skills of this unit of study comprise interpreting relevant quality guidelines and develop a business plan/case. In addition, students are trained in scientific writing, presenting and discussions, and advising about the own or similar projects in an interdisciplinary context.<br>Students perform this unit of study in the context of their (placement) workplace. Their studies on quality guidelines and business development are preferentially related to their own professional environment.<br>This competences Designing strategies for applied research and product development, Design, analysis and control of experiments and Communication are the focus in this unit of study.<br>These competences are integrally applied with competences in Managing Projects, which are trained during the unit of study Managing Projects 2 that runs in parallel to this unit of study. |

| | |
|---|---|
| Competences | Competence 1: Professional conduct and guiding professional development<br>**Competence 2: Designing strategies for applied research and product development**<br>**Competence 3: Design, analysis and control of experiments**<br>**Competence 4: Communication**<br>Competence 5: Managing projects<br>Competence 6: Advising |
| Assessment criteria | ***See exams of the UOS R&D Skills below this table*** |
| Exams | ***See exams of the R&D Skills below this table*** |
| Compulsory literature | ❖ Reader Research and Product Development Skills<br>❖ Scientific literature related to the (placement) workplace projects and provided during the unit of study<br>❖ Quality Guidelines of the ICH<br>❖ Scientific writing guide (provided online) |
| Recommended literature | ❖ Glasman-Deal; H. (2009). *Science Research Writing for Non-Native Speakers of English.* Imperial College Press<br>❖ Stevens, M. (2007). *Subtleties of Scientific Style.* Sciencescape Editing, Australia<br><br>***The reading lists are updated regularly. Therefore, the actual reading list of* the unit of study *might deviate from the list presented above.*** |
| Software and other materials | Computer and Internet connection |
| Activities | During this unit of study, students individually learn on their (placement) workplace by contributing to project work and working on their different assignments.<br>The supporting education programme will help students to work out their assignments and to develop to the required level in practice, and therefore to achieve their learning goals.<br><u>Lectures</u><br>- Overview Quality guidelines<br>- Business development and writing business plans<br><u>Workshop/Trainings</u><br>- Research skills and Project Development Skills (e.g. Journal clubs**,** analysing scientific literature, market surveys)<br>- Scientific writing<br>- Interpreting quality guidelines<br>- Patent searches & summarizing patent claims (given by an expert from the Dutch Patent Office)<br>- Feedback sessions |
| Work formats | Learning on the (placement) work place, lectures, workshops, practical, meetings |
| Lesson/<br>Contact hours | See above: credits/ study load |
| Compulsory participation | The participation in the placement according to the placement contract is compulsory for students enrolled in the full-time programme. |
| Education period | September 2020 – February 2021 |

| | |
|---|---|
| Maximum number of participants | The maximum number of participants is defined by the number of (placements) workplaces for the full-time programme.<br>The number of participants taking part in this unit of study as part-time or modular student is unlimited. |

**Exam of the UOS Research and Development Skills 2**

| | **Assessment criteria/ Indicators / requirements** | | |
|---|---|---|---|
| ***Code modular exam:*** **MMLS-RD2- RP2** | ***Competence indicators*** | ***Knowledge indicators*** | ***Assessment criteria*** |
| ***Name modular exam:*** **Research performance 2**<br><br>***Type:***<br>Performance assessment<br>***Number of examiners:***<br>2 for construction and evaluation of criteria, 1-2 for assessment considering advice of workplace supervisor<br>***Assessment:***<br>Grade<br>***Cut-off value:***<br>55%<br>***Minimal result:***<br>5.5<br>***Weighting:***<br>60%<br>***Period and resit:***<br>2 chances per study year;<br>Chance1:<br>January/February 2021 (ft), January/February 2021- August 2022 (pt)<br>Chance 2:<br>March 2021 (ft);<br>in agreement with | 1.1. Is able to independently acquire knowledge in a new subject by consulting specific literature and other resources; is able to identify reliable and suitable sources; Discriminates between major and side issues<br>1.2. Combines information from different sources in the context of the own project<br>2.5. Designs different approaches that could lead to the project aim. Evaluates these possibilities and justifies the choice based on scientific arguments and practical parameters such as time, costs, quality and personnel.<br>1.1. Designs experiments based on the required quality and quantity of the product or result.<br>1.2. Applies strict logical thinking to draw conclusions from the results and interprets them:<br>- in the context of the experiments<br>- in the context of the project aim (helicopter view)<br>- in comparison to other analyses, reference/theoretical values, and quality requirements.<br><br>3.3. Solves practical problems if experiments do not work as planned | | Novice level:<br>- The student searched and asked for relevant information about the subject.<br>- The student combined relevant information in the context of the agreed aims.<br>- The student discussed different experimental strategies prior to and during the project.<br>- The choices he/she has made were based on scientific and/or practical arguments.<br>- The student independently designed experiments that will partly lead to the desired product or result.<br>- The student draws valid conclusions from the experiments. Additional help from experts (e.g. statistician) is requested when needed.<br>- The student was able to solve experimental challenges with supervision.<br>- Generates a realistic schedule for a set of multiple experiments covering minimally 8 weeks.<br>- The student used many of his/her days efficiently in view of the project. He/she prioritized properly with supervision.<br>- The student monitors project development and showed an active resolving attitude. |

| | | | |
|---|---|---|---|
| student (pt)<br>***Compensation:***<br>none | (trouble shooting); couples back to the theory or consults colleagues if necessary; suggests alternative experiments.<br>5.11. Sets priorities and works efficiently towards the defined project aim/deliverables<br>5.12. Is in control of the project during all phases by being pro-active if the project does not run according to the plans and initiating an alternative strategy<br>5.13. Is flexible with changing circumstances by adapting the experimental, project and/or communication strategy<br>5.14. Obtains the deliverables in time and with the described resources; if not, reasons and justifies the decisions that have been taken in the course of the project<br>6.1. Actively involves different specialist to collect advise contributing to the progress of the project.<br>6.2. Actively participates in a discussion about related projects by asking critical questions and suggesting follow-up experiments.<br>6.3. Advises about follow-up projects of the own project.<br>6.5. Gives advice about choosing new equipment or methods based on project goals, overall goals and available resources | | - When prompted: In response to changing circumstances, the student adapted to the situation by changing the experimental or project strategy.<br>- The student obtained most of the deliverables, though exceeding time and/or described resources; if not, reasons and lessons learned are justified.<br>- When prompted: involves different specialists to collect advise with the aim to improve the progress of the project.<br>- When prompted, the student ask questions and makes suggestions for related projects.<br>- The student suggests follow-up experiments/projects that can be performed to answer relevant follow-up questions.<br>- The student chooses suitable methods and/or equipment based on experimental/project aims and available resources.<br><br>'Intermediate' level:<br>- The student searched and asked for relevant information about the subject. The student collected relevant information.<br>- The student combined relevant information to push the project forward in the context of the agreed aims.<br>- The student discussed different experimental strategies prior to and during the project.<br>- The choices he/she has made were based on scientific and/or practical |

| | | | |
|---|---|---|---|
| | | | arguments and were deemed feasible to execute.<br>- The student independently designed experiments that will lead to the desired product or result.<br>- The student draws valid conclusions from the experiments and valued those in the achievement of the project aim. Additional help from experts (e.g. statistician) is requested when needed.<br>- The student was able to independently solve experimental challenges.<br>- Generates a realistic schedule for a set of multiple experiments covering minimally 12 weeks.<br>- The student used many of his/her days efficiently in view of the project. He/she prioritised properly with some supervision.<br>- The student demonstrated a project management approach by taking actions.<br>- When prompted: In response to changing circumstances, the student adapted to the situation by changing the experimental, project and/or communication strategy.<br>- The student obtained most of the deliverables on time and with the described resources; if not, can demonstrate the he/she took adequate actions to obtain the deliverables or changed to adequate alternative strategies.<br>- Involves different specialists to collect advise with the aim to improve the progress of the project. |

| | | | |
|---|---|---|---|
| | | | - The student ask questions and makes suggestions for related projects<br>- The student suggests relevant follow-up experiments/projects that can be performed to answer relevant follow-up questions.<br>- The student independently chooses suitable methods and/or equipment based on experimental /project aims and available resources.<br><br>'Advanced' level:<br>- Often, the student independently acquired the relevant background information.<br>- The student combined relevant information to push the project forward in the context of the agreed aims from a variety of sources.<br>- The student discussed different experimental strategies prior to and during the project.<br>- The choices he/she has made were based on scientific and/or practical arguments and were deemed feasible to execute. Choices were well justified.<br>- The student independently designed experiments that will lead to the desired product or result. The experiments were well justified.<br>- The student demonstrated independent thinking when drawing valid conclusions from the results and valued those in the achievement of the project aim.<br>- The student was able to independently solve complex experimental challenges. |

| | | | |
|---|---|---|---|
| | | | - Independently generates a realistic schedule for a set of multiple experiments covering minimally 12 weeks.<br>- The student used most of his/her days efficiently in view of the project. Independently, he/she prioritised properly.<br>- The student demonstrated a project management approach by taking actions that contributed to an efficient progress of the project and prevented unnecessary delay.<br>- At most times, the student independently responded to changing circumstances, the student convincingly adapted to the situation by changing the experimental, project and/or communication strategy.<br>- The student obtained all of the deliverables, minimally exceeding time and/or described resources; if not, can demonstrate the he/she pro-actively took adequate actions to obtain the deliverables and/or changed to adequate alternative strategies.<br>- Involves different specialists and uses the advice of different specialists to improve the progress of the project.<br>- The contributions of the student were to-the point and significant.<br>- The student suggests highly relevant and creative follow-up experiments/projects that can be performed to answer relevant follow-up questions<br>- The student independently chooses most suitable methods and/or |

| | | | |
|---|---|---|---|
| | | | equipment based on experimental/project aims and available resources.<br><br>‘Expert’ level:<br>- At all times, the student independently acquired the relevant background information.<br>- The student combined relevant information to push the project forward in the context of the agreed aims from a variety of sources and in a time-efficient way.<br>- The student discussed different experimental strategies prior to and during the project.<br>- The choices he/she has made were based on scientific and/or practical arguments and were deemed feasible to execute. Choices were well justified and highly convincing.<br>- The student independently designed experiments that will lead to the desired product or result. The experiments were well justified and sound.<br>- The student demonstrated independent thinking when drawing valid conclusions from the results, related those to the literature and valued those in the achievement of the project aim.<br>- The student devised innovative solutions to complex experimental challengers.<br>- Independently generates a realistic and very efficient schedule for a set of multiple experiments covering minimally 12 weeks. |

| | | | |
|---|---|---|---|
| | | | - The student used always his/her days efficiently in view of the project. Independently, he/she always prioritised properly.<br>- The student demonstrated a systematic project management approach by taking actions that contributed to an efficient progress of the project and prevented unnecessary delay.<br>- At all times, the student independently responded to changing circumstances, the student convincingly adapted to the situation by changing the experimental, project and/or communication strategy.<br>- The student obtained all of the deliverables on time and with the described resources; if not, can demonstrate the he/she pro-actively took most adequate actions to obtain the deliverables and/or changed to most adequate alternative strategies.<br>- Pro-actively involves different specialists and thereby maximises the progress of the project.<br>- The contributions of the student were to-the point and significantly contributed to the progress of group projects.<br>- The student advices about useful follow-up projects based on the outcome of the project and the broader (multidisciplinary) context of the field.<br>- The student independently chooses most suitable and efficient methods and/or equipment based on experimental/project aims and |

| | | | |
|---|---|---|---|
| | | | available resources. |
| ***Code modular exam:*** **MMLS-RD2-Q** | ***Competence indicators*** | ***Knowledge indicators*** | ***For this assignment, these indicators and knowledge criteria are translated into the following assessment criteria**** |
| ***Name modular exam:*** Assignment on quality guidelines<br>***Type:*** Individual assignment and group discussion<br>***Number of examiners:*** 2 for construction and evaluation of criteria, 2 for assessment considering advice of workplace supervisor<br>***Assessment:*** Grade<br>***Cut-off value:*** 55%<br>***Minimal result:*** 5.5<br>***Weighting:*** 40%<br>***Period and resit:*** 2 chances per study year; Chance1: October 2020 | 2.4 Defines the quality requirements for products and processes based on legal requirements. | • Is able to define quality requirements for products and processes based on regulatory guidelines<br>• Is able to describe a target product profile and critical quality attributes | - The student describes the (putative) product to be developed/ made.<br>- The student explains quality guidelines and/or documents that are relevant to safeguard the quality requirements of this product?<br>- relevant quality guidelines and/or documents are named<br>- explains the reasons that these guidelines and/or documents are relevant to safeguard the quality requirements of the (putative) product<br>- The student explains the consequences of these guidelines for the development/manufacturing of the product in practice in a transparent way:<br>- Identifies the paragraphs that are applicable to safeguard the quality requirements of the product<br>- Translates the demands described in the paragraphs to a practical approach (e.g. experiments, assays and measurements) to fulfil these |

| | | | |
|---|---|---|---|
| (ft), October 2020 – August 2022 (pt)<br>Chance 2:<br>December 2020 (ft), in agreement with student (pt)<br><br>***Compensation:***<br>none | | | demands<br>- Language<br>- The purpose of the document is clear; Text is generally well organised and coherent.<br>- The document is written in correct scientific style; occasional inappropriate use of vocabulary and phrases is accepted.<br>- Simple, mostly correct grammar is used. Errors may be noticeable but the meaning can be determined.<br>- Text is a well-organised, coherent whole. Paragraphs are structured effectively.<br>- Uses a range of appropriate vocabulary and phrases effectively and precisely. Correct grammar is used with flexibility and sophistication.<br>- References, including regulatory guidelines are referred to according to the APA-guidelines. |
| ***Code modular exam:***<br>**MMLS-RD2-BP** | ***Competence indicators*** | ***Knowledge indicators*** | ***For this assignment, these indicators and knowledge criteria are translated into the following assessment criteria**** |
| ***Name modular exam:***<br>Business plan<br><br>***Type:***<br>Individual document and pitch<br><br>***Number of examiners:***<br>2 for construction and evaluation of criteria,<br>2 for assessment considering advice of workplace supervisor | 2.1. Is able to independently acquire knowledge in a new subject by consulting specific literature and other resources; is able to identify reliable and suitable sources; Discriminates between major and side issues<br>2.2. Combines information from different sources in the context of the own project<br>2.3. Defines the project aim in terms of | • is able to use patent databases to identify patent blocks<br>• is aware that he/she needs to contact patent experts if he/she is not sure how to interpret patent databases<br>• is aware of the rights derived from intellectual properties and understands which implications these have for the production of generics and biosimilars<br>• understands the meaning of the | Business plan:<br>- All criteria of the business plan are concisely summarized in ~~1-2~~2-4 pages. The summary is understandable for the managerial audience.<br>- The business vision expressing the ambition and direction in which the company wants to develop is described. This vision includes a description of what the company |

| | | | |
|---|---|---|---|
| ***Assessment:***<br>sufficient/ insufficient<br>***Cut-off value:***<br>-<br>***Minimal result:***<br>sufficient<br>***Weighting:***<br>0%<br>***Period and resit:***<br>2 chances per study year;<br>Chance1: January 2021 (ft), January 2021 - August 2022 (pt)<br>Chance 2:<br>March 2021 (ft),<br>in agreement with student (pt)<br>***Compensation:***<br>none | products and/or results based on the acquired background information<br>2.4 Defines the quality requirements for products and processes based on legal requirements.<br>2.5 Designs different approaches that could lead to the project aim. Evaluates these possibilities and justifies the choice based on scientific arguments and practical parameters such as time, costs, quality and personnel<br>2.6 Designs a complete strategy leading to the project aim (project of about 3-4 months; see also: managing projects)<br>2.7 Identifies opportunities to patent products, results and strategies<br>3.1 Designs experiments based on the required quality and quantity of the product or result.<br>4.3 Describes the key message of the project relevant for patenting, registration, and/or business development. Uses terminology that is understandable for experts from different departments<br>5.1 Defines project deliverables based on the needed quality and quantity<br>5.2 Identifies project risks based on the (experimental) approach and on (putative) competitors<br>5.4. Organizes the project in phases and defines decision points/ milestones<br>5.7 Describes a schedule based on the (experimental) plan<br>5.8 Describes the required budget<br>6.4 Integrates own project results in the | terms business models and business development, business value and financing<br>• is able to translate his/her projects plans in a concise business plan<br>• is able to define quality requirement for products and processes based on regulatory guidelines<br>• is able to describe a target product profile and critical quality attributes | will look like in the future. (maximum of 4 sentences)<br>- The goals in terms of global aims, potential clients, finances, and employees are described.<br>- The uniqueness of the product is described<br>- Patents: The used search terms match with the product properties, production and application strategy, the search codes correspond to the search strategy and valid conclusions are drawn from the found patent database entries with respect to the own strategy are drawn.<br>- The legal business description and strategic alliances are based on the product properties, patent situation and on expertise, technologies and finances available at the company.<br>- Market: The current situation of the market and expected future market development are described, including market size, governmental legislation and opportunities, (socio)economic status, costs of the products).<br>- Competition status: alternatives (different types of drugs) and prediction of competition strategy are described<br>- Finances: Yearly cost and profit table is a realistic presentation of the expected (investment) costs and incoming money<br>- The phases of product development are scheduled and |

| | | | |
|---|---|---|---|
| | multidisciplinary defined goals and advises other departments | | align with legal requirements<br>- Deliverables of each phase are described including quality criteria in line with guidelines<br>- Decision points are given and are based on deliverables/results crucial to the development process |

**** Note: Adjustments in the <u>exact description</u> of the assessment criteria can be made based on experiences with previous students groups with the aim to improve relevance, reliability and transparency of the assessment.***

**Managing Projects 1**

| ***Title of UOS*** | ***Managing Projects 1***<br>***HMP-MMLS-PRJM1*** |
|---|---|
| Degree Programme | Master in Molecular Life Sciences |
| Target group | Students enrolled in Master in Molecular Life Sciences programme |
| Professional task | 1. to understand practical, economic, social and/or ecological needs of businesses, market and society that can be anticipated by biotechnology<br>3. to implement such solutions in a successful and efficient way by organizing their realization in projects, considering the interdisciplinary dimension and communicating with different experts.<br>Such projects have a duration of at least three months. |
| Professional Products | • Professional conduct (intermediate level) including a Network Analysis (intermediate level)<br>• Project proposal |
| Credits/ study load | 15 EC / 420 study load hours, consisting of<br>60 contact hours and<br>360 hours learning on the (placement) workplace of which 140 hours related to professional products and 220 related to professional development |
| Relationship with and entry requirements concerning exams | • All assessments of this unit of study have to be sufficient. |
| General description | Focus of this unit of study is the training of the competences Professional conduct and Guiding the Professional Development, and Managing Projects. Students perform this unit of study in the context of their own (placement) workplace, and are supported in their development by various teaching and assessment activities.<br>In the beginning, the unit of study focusses on professional conduct and getting the awareness of challenges when managing projects. A network analysis gives students insights in the network available to them in comparison to the expertise required for their professional tasks and learning goals.<br>Next, students are trained in the project planning including the definition of deliverables and their quality, project stages, milestones, decision points, exclusions, risks and strategies to deal with them, the project organization and communication plan, a time schedule and budget planning.<br>Students acquire knowledge and understanding during the trainings, and apply this in practice on their (placement) workplace. The experiences made in practice are discussed during classes.<br>This unit of study is integrally carried out with the unit of study Research and Product Development Skills which runs in parallel to this unit of study. |
| Competences | **Competence 1: Professional conduct and guiding professional development**<br>Competence 3: Design, analysis and control of experiments<br>Competence 4: Communication<br>**Competence 5: Managing projects**<br>Competence 6: Advising |

| | |
|---|---|
| Assessment criteria | ***See exams of the UOS Managing Projects 1 below this table*** |
| Exams | ***See exams of the UOS Managing Projects 1 below this table*** |
| Compulsory literature | ❖ Reader Project Management<br>❖ Reader Project Planning and Control |
| Recommended literature | ❖ Porny, S.E. (2010). *Project Management for Dummies*. (3rd edition). John Wiley and Sons Ltd.<br>***The reading lists are updated regularly. Therefore, the actual reading list of this unit of study might deviate from the list presented above.*** |
| Software and other materials | - |
| Activities | <u>Professional conduct, professional identity and network analysis</u><br>- Workshops, Intervision/ supervision<br><br><u>Planning and control of projects</u><br>The trainings cover organisational, attitude and communication aspects of managing projects. There will be 10 trainings of about half a day with the following subjects:<br>- Aim, result, exclusions and presentation techniques<br>- Defining Project phases and Work breakdown<br>- Project Organization and communication, organizing project meetings<br>- Risk management, Techniques used in project meetings<br>- Presentation of Project Work Plans<br>- Intervision, supervision<br><br>Trainings are held in an interactive way where the transfer of theory is alternating offered with discussions and exercises. |
| Work formats | Learning on the (placement) work place, assignments, lectures, workshops, trainings |
| Lesson/ Contact hours | See above: credits/ study load |
| Compulsory participation | The participation in the placement according to the placement contract is compulsory for students enrolled in the full-time programme. |
| Education period | September 2020 – August 2021 |
| Maximum number of participants | The maximum number of participants is defined by the number of (placements) workplaces for the full-time programme.<br>The number of participants taking part in this unit of study as part-time or modular student is unlimited. |

**Exam of the UOS Managing Projects 1**

| | **Assessment criteria/ Indicators / requirements** | | |
|---|---|---|---|
| | ***Competence indicators*** | ***Body of Knowledge and Skills*** | ***Assessment criteria*** |
| ***Code modular exam:*** **MMLS-PRJM1 – PC1** | *Competence indicators* | *Knowledge indicators* | *For this assignment, these indicators and knowledge criteria are translated into the following assessment criteria** |
| ***Name modular exam:*** Professional conduct<br>***Type:*** Individual performance<br>***Number of examiners:*** 2 for construction and evaluation of criteria, 1-2 for assessment considering advice of workplace supervisor<br>***Assessment:*** Sufficient / insufficient<br>***Cut-off value:*** -<br>***Minimal result:*** sufficient<br>***Weighting:*** 0%<br>***Period and resit:*** 2 chances per study year; Chance1: March-August 2021 (ft), September 2020-august 2022 (pt) Chance 2: November 2021 (ft), in agreement with | 1.1. (intermediate level): Shows a professional, pro-active, curious, touching scientific attitude: adapts quickly, motivates him/herself, shows initiative, is goal-oriented, and acts honestly and efficiently<br>1.2. (intermediate level): Works efficiently in a team (colleagues, project leader, client) during the experimental phase of a project through open communication.<br>1.5. (intermediate level): Critically reflects on the own role in the experimental phase of a project.<br>1.6. (intermediate level): Critically reflects on the own personality.<br>1.7. (intermediate level): Defines personal learning goals (based on project/work requirements).<br>4.5. (intermediate level): Contributes to the efficiency of meetings by being prepared.<br>4.6. (intermediate level): Is efficient in keeping the project leader informed on progress of the experiments.<br>5.9. (intermediate level): Performs his/her responsibilities. | *Depending on context of the (internship) workplace* | - Performance during internship shows that the student:<br>- Takes initiative to find background information and formulates goals in keeping with the practical assignment.<br>- Recognises opportunities and acts accordingly in keeping with own goals and the goals of the organisation.<br>- Acts honestly and describes own conduct in an open and self-critical way.<br>- Pro-actively approaches others to drive the project forward and uses an open communication:<br>- Considers own needs and needs of others and offers solutions.<br>- Expresses own opinion/question in clear statements.<br>- Has consideration for own emotions and emotions of others.<br>- Is respectful for opinion/goals of others<br>- Works according to personal development plans (collects information and analyses own performance, formulates learning goals, plans activities and evaluates results) |

| | | | |
|---|---|---|---|
| student (pt)<br>***Compensation:***<br>None | | | - Describes awareness of personal characteristics. Shows awareness how these characteristics influences professional conduct in terms of strengths and weaknesses and is able to link them to own professional development and project progress.<br>- Is prepared for meetings: has completed the actions as agreed upon on. Has read and prepared relevant documents and provides others with necessary information.<br>- Pro-actively shares relevant information with the project leader and take minutes to document agreements and other relevant information.<br>- Understands own role in the organisation, acts accordingly by performing the proper assigned tasks, and shows responsibility in the interest of the project /organisation. |
| ***Code modular exam:***<br>**MMLS-PRJM1-PC2** | ***Competence indicators*** | ***Knowledge indicators*** | ***For this assignment, these indicators and knowledge criteria are translated into the following assessment criteria**** |
| ***Name modular exam:***<br>Professional conduct 2<br>***Type:***<br>Individual performance including assignments<br>***Number of examiners:***<br>2 for construction and evaluation of criteria, 1-2 for assessment<br>***Assessment:***<br>Sufficient / insufficient<br>***Cut-off value:***<br>- | 1.3. (intermediate level): uses a professional network within the own organisation<br>1.5. (intermediate level): Critically reflects on the own role in the experimental phase of a project.<br>4.5. (intermediate level): Contributes to the efficiency of meetings by being prepared. | *Depending on context of the (internship) workplace* | - Actively contributes to the efficiency of professional and/or intervision meetings through various roles<br>- Describes possible positions (roles, functions, tasks and responsibility) regarding the project;<br>- Describes own positions within the project and, if possible, its own prospects.<br>- Describes network:<br>- Reflects on own needs based on own position;<br>- Describes relevant persons in relation |

| | | | |
|---|---|---|---|
| ***Minimal result:*** sufficient<br>***Weighting:*** 0%<br>***Period and resit:*** 2 chances per study year;<br>Chance1: Feb-August 2020 (ft), September 2019-august 2021 (pt)<br>Chance 2:<br>November 2020 (ft), in agreement with student (pt)<br>***Compensation:*** None | | | to own position, their position and expertise and how this can be used in the interest of the own position |
| ***Code modular exam:*** **MMLS-PRJM1-PP** | ***Competence indicators*** | ***Knowledge indicators*** | ***For this assignment, these indicators and knowledge criteria are translated into the following assessment criteria**** |
| ***Name modular exam:*** Project Proposal<br>***Type:*** Individual written professional product<br>***Number of examiners:*** 2 for construction and evaluation of criteria, 2 for assessment considering advice of workplace supervisor<br>***Assessment:*** Grade<br>***Cut-off value:*** | 1.1 Shows a professional, pro-active, curious, scientific and entrepreneurial attitude: adapts quickly, motivates him/herself, shows initiative, is goal-oriented, and acts honestly and efficiently<br>2.2. Combines information from different sources in the context of the own project.<br>2.3. Defines the project aim in terms of products and/or results based on the acquired background information.<br>2.4. Defines the quality requirements for | *Depending on context of the (internship) workplace* | - A Project Work Plan (PWP) was written for the own project in professional practice including the background/ motivation, aim, deliverables and exclusions, phases, milestones, work packages, schedule, project risks, project organization and communication and required budget.<br>- The background information explains the added value of the project.<br>- The aim is in harmony with the background information. |

| | | | |
|---|---|---|---|
| 55%<br>***Minimal result:***<br>5.5<br>***Weighting:***<br>100%<br>***Period and resit:***<br>2 chances per study year;<br>Chance1: May/June 2021 (ft), May/June 2021- June 2022 (pt)<br>Chance 2: August/September 2021 (ft),<br>in agreement with student (pt)<br>***Compensation:***<br>None | products and processes based on customer / legal requirements.<br>2.5 Designs different approaches that could lead to the project aim. Evaluates these possibilities and justifies the choice based on scientific arguments and practical parameters such as time, costs, quality and personnel<br>2.6. Designs a complete strategy leading to the project aim (project of about 3-4 months; see also: managing projects).<br>3.1 Designs experiments based on the required quality and quantity of the product or result.<br>4.1. (intermediate level): Reports project plans and results according to the standard format of scientific documents and the reader recognizes the scientific international conventions criteria.<br>4.2. Presents project plans and results in English to colleagues, other researchers in the field or to clients. The presentation is at a level equivalent to a presentation at an international symposium.<br>5.1. Defines project deliverables based on the needed quality and quantity.<br>5.2. Identifies project risks based on the (experimental) approach and on (putative) competitors. | | - The deliverables are described in terms of specific, measurable products or results. Nouns are used to describe the deliverables.<br>- Convincing arguments are given for the choice of approach.<br>- The project approach is transparently described and is in line with the project aim and defined phases.<br>- The approach leads to the defined deliverables on schedule and within budget.<br>- Risks with high chance and important consequences are based on a risk assessment. Preventive measures to minimize the risks are defined.<br>- The described exclusions efficiently restrict the project.<br>- The activities are described leading to the identified (intermediate) deliverables. Verbs are used to describe the activities.<br>- The project is divided in phases in a logical way; milestones are defined.<br>- The project organization described matches with the project approach.<br>- The responsibilities of all project members are transparently described and match with their qualification and role. |

| | | | |
|---|---|---|---|
| | 5.3. Defines project exclusions.<br>5.4. Organizes the project in phases and defines decision points/milestones.<br>5.5. Describes the project organisation including the responsibilities of all project members.<br>5.6. Writes a communication plan concerning all project members and parties involved.<br>5.7. Describes a schedule based on the (experimental) plan.<br>5.8. Describes the required budget.<br>6.1.Actively involves different specialist to collect advise contributing to the progress of the project. | | - The communication plan transparently describes the frequency and communication between different project members and relevant parties. The proposed communication serves the efficiency of the project.<br>- The project is set in a realistic time frame.<br>- The budget includes both personnel and material costs.<br>Writing, minimum level:<br>- The purpose of the document is clear; Text is connected and coherent (limited use of linking words and cohesive devices)<br>- The document is written in correct scientific style: Uses everyday vocabulary and phrases, with occasional inappropriate use.<br>- Simple, mostly correct grammar is used. Errors may be noticeable but the meaning can be determined<br>Writing, excellent level:<br>- Text is well organised and coherent. Paragraphs and a variety of linking words and cohesive devices are used) to generally good effect. |

| | | | |
|---|---|---|---|
| | | | - Uses a range of vocabulary and phrases, appropriately. Correct grammar is used with control and flexibility to convey intended meaning. Only occasional errors at most, but communication is not impeded.<br>Project peer review:<br>- Audience feels well informed in such a way that sufficient support for the project is obtained.<br>- Is responsive on feedback obtained and shows attitude for implementing suggestions for improvement<br>- Produces responses that are extended beyond short phrases, despite hesitation.<br>- Uses mostly appropriate vocabulary when talking about familiar topics<br>- Penalty points are subtracted in cases students missed the (intermediate) deadline |

**** Note: Adjustments in the <u>exact description</u> of the assessment criteria can be made based on experiences with previous students groups with the aim to improve relevance, reliability and transparency of the assessment.***

**Managing Projects 2**

| ***Title of UOS*** | ***Managing Projects 2***<br>***HMP-MMLS-PRJM2*** |
|---|---|
| Degree Programme | Master in Molecular Life Sciences |
| Target group | Students enrolled in Master in Molecular Life Sciences programme |
| Professional task | 1. to understand practical, economic, social and/or ecological needs of businesses, market and society that can be anticipated by biotechnology<br>3. to implement such solutions in a successful and efficient way by organizing their realization in projects, considering the interdisciplinary dimension and communicating with different experts.<br>Such projects have a duration of at least three months. |
| Professional Products | • SWOT, Personal Development Plan and Reflection |
| Credits/ study load | 7 EC / 196 study load hours, consisting of<br>20 contact hours and<br>176 hours learning on the (placement) workplace of which 56 hours related to professional products and 120 related to professional development |
| Relationship with and entry requirements concerning exams | • The modular exams “Professional Conduct 1” and “Professional Conduct 2” of the unit of study Managing Projects 1 are successfully completed for the assessment of “Professional Effectiveness” of the unit of study Managing Projects 2.<br>• The modular exam “Project Proposal” of the unit of study Managing Projects 1 is successfully completed for the assessment of the modular exam “Reflection on Project Proposal Realisation and contribution” of the unit of study Managing Projects 2.<br>• All assessments of this module have to be sufficient. |
| General description | This unit of study is a follow-up of the Managing Projects 1. Focus is the training of the competences Professional conduct and Guiding the Professional Development, and Managing Projects. Students perform this unit of study in the context of their own (placement) workplace, and are supported in their development by various teaching and assessment activities.<br>The core of this module is the development of Professional Effectiveness. As part of this, students investigate their professional identity by describing their own Strength-Weaknesses, Opportunities and Threats in the context of their professional developments towards master level. They define personal learning goals, work on realising these goals in their professional and study context, and reflect on this on a regular base.<br>The training inter-personal effectiveness focusses on insights and skills required to efficiently contribute to and control projects within teams. Students become familiar with personal styles (MBTI test), leadership styles and communication styles, the concept of situational leadership and different organization cultures. Principles of time management, how to organize efficient project meetings and ways of dealing with conflicts are also part of this training. In the end of this unit of study, students critically reflect on the course of project(s) they were involved in and their own contribution to them.<br>Students acquire knowledge and understanding during the trainings, and apply this in practice on their (placement) workplace. The experiences made in practice are discussed during classes. |

| | |
|---|---|
| | This unit of study is integrally carried out with the unit of study Research and Product Development Skills 2 which runs in parallel to this unit of study. |
| Competences | **Competence 1: Professional conduct and guiding professional development**<br>Competence 3: Design, analysis and control of experiments<br>Competence 4: Communication<br>**Competence 5: Managing projects**<br>Competence 6: Advising |
| Assessment criteria | ***See exams of the UOS Managing Projects 2 below this table*** |
| Exams | ***See exams of the UOS Managing Projects 2 below this table*** |
| Compulsory literature | ❖ Reader Interpersonal effectiveness |
| Recommended literature | ❖ Porny, S.E. (2010). *Projectmanagement for Dummies*. (3rd edition). John Wiley and Sons Ltd.<br><br>***The reading lists are updated regularly. Therefore, the actual reading list of this unit of study might deviate from the list presented above.*** |
| Software and other materials | - |
| Activities | <u>Professional identity</u><br>- Workshops, Intervision/ supervision<br><br><u>Interpersonal effectiveness</u><br>- Work styles, personal effectiveness, time management<br>- Communication and communication styles<br>- Situational leadership and styles in decision-making<br>- Organisation cultures and handling conflicts, management game<br>- Discussion of practical experiences<br><br>Trainings are held in an interactive way where the transfer of theory is alternating offered with discussions and exercises. |
| Work formats | Learning on the (placement) work place, assignments, lectures, workshops, trainings |
| Lesson/ Contact hours | See above: credits/ study load |
| Compulsory participation | The participation in the placement according to the placement contract is compulsory for students enrolled in the full-time programme. |
| Education period | September 2020 - February 2021 |
| Maximum number of participants | The maximum number of participants is defined by the number of (placements) workplaces for the full-time programme.<br>The number of participants taking part in this unit of study as part-time or modular student is unlimited. |

**Exam of the UOS Managing Projects 2**

| | **Assessment criteria/ Indicators / requirements** | | |
|---|---|---|---|
| | ***Competence indicators*** | ***Body of Knowledge and Skills*** | ***Assessment criteria*** |
| ***Code modular exam:*** **MMLS-PRJM2-R**<br><br>***Name modular exam:*** Reflection on project proposal realization and contribution<br><br>***Type:*** Active participation in group discussion<br><br>***Number of examiners:*** 2 for construction and evaluation of criteria, 1-2 for assessment<br><br>***Assessment:*** sufficient/insufficient<br><br>***Cut-off value:*** -<br><br>***Minimal result:*** sufficient<br><br>***Weighting:*** 0%<br><br>***Period and resit:*** 2 chances per study year;<br>January 2021 (ft), January– August 2022 (pt))<br><br>Chance 2:<br>January 2021 (ft), | 1.4 Critically reflects on the project with respect to scientific project management approach and results.<br>1.5 Critically reflect on the own role in the course of a project.<br>5.13 Is flexible with changing circumstances by adapting the experimental, project and/or communication strategy. | *Depending on context of the (internship) workplace* | The student analysed the project he/she described in the project proposal described in the Managing Projects module part 1. He/she prepared a poster on which he/she gives the following aspects of the project (proposal) an appreciation from 1 (unsatisfactory), 2 (satisfactory), to 3 (could not have gone any better):<br>- Quality of the initial definition of the deliverables<br>- Planned scientific approach<br>- Defined exclusions<br>- Described risk analysis<br>- Described responsibilities<br>- Described communication plan<br>- Described time schedule<br>- Described budget<br>- Working towards the deliverables<br>- Effectiveness of communication during the project<br>- Sticking to responsibilities<br>- Controlling resources<br>- Effectiveness and efficiency of meetings<br>- Quality of presentations<br>- Dealing with conflicts<br>- Team effectiveness<br>- Situational leadership |

| | | | |
|---|---|---|---|
| in agreement with student (pt)<br>***Compensation:***<br>None | | | - The student identified factors that were critical to the failure or success of the project and critically discussed these factors with fellow students.<br><br>- He/she has a reflective and improvement-oriented attitude in this discussion.<br><br>- The student adds a well justified description of critical factors for the success of the own graduation project and of specific and measurable actions how to be in control of these factors to the poster and submits the poster as assessment product. |
| ***Code modular exam:***<br>**MMLS-PRJM2-PE** | ***Competence indicators*** | ***Knowledge indicators*** | ***For this assignment, these indicators and knowledge criteria are translated into the following assessment criteria**** |
| ***Name modular exam:***<br>Professional Effectiveness<br>***Type:***<br>Individual assessment of professional performance, written products<br>***Number of examiners:***<br>2 for construction and evaluation of criteria, 1-2 for assessment considering advice of workplace supervisor<br>***Assessment:***<br>Grade<br>***Cut-off value:*** | 1.1. Shows a professional, pro-active, curious, scientific and entrepreneurial attitude: adapts quickly, motivates him/herself, shows initiative, is goal-oriented, and acts honestly and efficiently<br><br>1.2 Works efficiently in a team (colleagues, project leader, client) during all phases of the project through open communication and by considering the needs of others<br>1.3 Pro-activity contributes to setting up and maintaining a professional network.<br>1.6 Critically reflects on the own personality and how this influences professional conduct. | - Has insight in different factors that contribute to an effective communication process.<br>- Is aware of his own cognitive style and recognizes the styles of team members.<br>- Knows how to deal with possible conflicts.<br>- Is aware of intercultural differences.<br>- Knows the principles of situational leadership. | Novice level:<br>- meets all criteria of indicator 1.1. (left) to some extend<br>- Organized and moderated meeting<br>- Is prepared for meetings and has a constructive contribution aiming for efficiency<br>- showed insight in different factors that contribute to an effective communication process, e.g. by being aware of subjective perception and nonverbal communication<br>- gives regular progress updates (written and/or meetings); highlights deviations of original plan; informs about crucial developments/ outcomes<br>- considers own (project) goals, common goals and needs of others and |

| | | | |
|---|---|---|---|
| 55%<br>***Minimal result:***<br>5.5<br>***Weighting:***<br>100%<br>***Period and resit:***<br>Chance1:<br>January/February 2021 (ft), January/February 2021 – August 2022(pt)<br><br>Chance 2:<br>March 2021 (ft),<br>in agreement with student (pt)<br>***Compensation:***<br>None | 1.7 Defines personal learning goals (based on project/work requirements) and guides personal development to reach learning goals<br>4.2. Presents project plans and results in English to colleagues, other researchers in the field or to clients. The presentation is at a level equivalent to a presentation at an international symposium.<br>4.4 Organises and moderates meetings<br>4.5 Contributes to the efficiency of meetings by being prepared and actively participating<br>4.6 Keeps client and project members informed about project progress at all stages, especially when the project is not progressing as planned<br>4.7 Shows initiative to adapt communication styles to the others and the situation at hand<br>5.9. Sticks to his/her responsibilities<br>5.10. Approaches others if they do not perform to their responsibilities. | | communicates to work efficiently in team<br>- Mostly sticks to his/her own responsibilities/ agreements<br>- Shows awareness of organisation culture and/or intercultural differences<br>- Actively deals with different opinions and/or conflicts; approaches others when they do not perform to their responsibilities<br>- Uses network to work towards (project) goals, extends it if required for a task<br>- Prepares a SWOT in the context of being a project-responsible master. Analyses own personality and how this influences professional conduct<br>- Uses the SWOT analysis to set-up a personal development plan and uses this to work towards learning goals<br>- Participates actively during the training programme. Speaks up when necessary<br>- The student recognized the style of leadership of his manager/ project leader<br>- Recognized own cognitive style and cognitive style of manager/ project leader / colleagues<br>- 'Intermediate' level:<br>- meets all criteria of indicator 1.1. (left) to large extend Organized and moderated meetings. Took actions to make meetings efficient<br>- (novice level description) … and contributes to efficiency of meetings<br>- (novice level description).. and attempts to deal with these factors in the interest of the project/ organisation<br>- Pro-actively gives progress updates |

| | | | |
|---|---|---|---|
| | | | (written and/or meetings); highlights deviations of original plan; pro-actively informs about crucial developments/ outcomes<br>- (novice level description) … and thereby mostly works efficiently within the team<br>- (novice level description) … and in a way that contributes the progress of the project<br>- (novice level description) … and pro-actively extends his/her network<br>- Always sticks to his/her own responsibilities / agreements<br>- Anticipates on organisation culture and /or intercultural differences<br>- Prepares a SWOT in the context of being a project-responsible master. Analyses own personality and how this influences professional conduct in a self-critical manner<br>- And acts as reflective practitioner: analyses own performance, undertakes activities supporting professional development at critical points.<br>- Evaluates activities according to a personal development plan.<br>- Participates pro-actively during the training programme. Pro-actively contributes to the progress and/or quality of the meetings<br>- (novice level description) ... and can explain the consequences for the interaction with his/her manager/project leader<br>- (novice level description) … and can explain consequences for interaction<br><br>'Advanced' level:<br>- Fully meets all criteria of indicator 1.1. |

| | | | |
|---|---|---|---|
| | | | (left)<br>- Organized and moderated efficient meetings<br>- (intermediate level description) … and contributions are of good quality pushing forward the development of own projects<br>- (intermediate level description) …and deals with these factors in the interest of the project/ organisation<br>- (intermediate level description) … and suggests adequate adaptation<br>- (intermediate level description) … and thereby always works efficiently within the team<br>- Has a broad perception of the responsibilities belonging to his/her role and mostly takes these responsibilities<br>- (intermediate level description) … and deals with it in the interest of project and company success<br>- Consistently deals with different opinions and/or conflicts; approaches others when they do not perform to their responsibilities in a way that contributes the progress of projects<br>- Sets up and uses a network to diligently and effectively work towards (project) goals<br>- Prepares a SWOT in the context of being a project-responsible master. Systematically and comprehensively analyses own personality and how this influences professional conduct in a self-critical manner<br>- Act as reflective practitioner: analyses own performance systematically, continuously undertakes activities supporting professional development. |

| | | | |
|---|---|---|---|
| | | | - Evaluates activities according to a personal development plan.<br>- Participates pro-actively during the training programme. Consistently and pro-actively contributes to the progress and/or quality of the meetings<br>- (intermediate level description) … and anticipated on this style<br>- And anticipated on this style in the interest of the project<br><br>'Expert' level:<br>- And is an example to others<br>- Organised and moderated meetings of outstanding quality, also compared to experienced colleagues<br>- (advanced level description) … and contributions are of outstanding quality pushing forward the development of groups projects<br>- Is extremely effective in using appropriate communication styles pushing the success of the project/ organisation forward<br>- (advanced level description) and suggests the most appropriate adaptations<br>- (advanced level description)... and thereby works extremely efficient within the team.<br>- Has a broad perception of the responsibilities belonging to his/her role and always takes these responsibilities<br>- (advanced level description) … and deals with it in the interest of project and company success in an exceptional way<br>- (advanced level description) … and team performance<br>- Pro-actively extends and maintains |

| | | | |
|---|---|---|---|
| | | | network in the interest of project goals and company goals<br>- And is an example for others in his/her improvement-oriented attitude<br>- And is an example for others in his/her improvement-oriented behavior<br>- Has exceptional contributions to the quality and/or efficiency of meetings/ management games<br>- (advanced level description) … and anticipated on this style in a very effective way<br>- (advanced level description) … and anticipated on this style in a very effective way |

**** Note: Adjustments in the <u>exact description</u> of the assessment criteria can be made based on experiences with previous students groups with the aim to improve relevance, reliability and transparency of the assessment.***

| ***Title of UOS*** | ***Graduation Project***<br>***HMP-MMLS-GP*** |
|---|---|
| Degree Programme | Master in Molecular Life Sciences |
| Target group | Students enrolled in the Master in Molecular Life Sciences programme |
| Professional task | 1. to understand practical, economic, social and/or ecological needs of businesses, market and society that can be anticipated by biotechnology<br>2. to apply fundamental knowledge in the area of molecular life sciences to find sustainable solutions for these needs<br>3. to implement such solutions in a successful and efficient way by organizing their realization in projects, considering the interdisciplinary dimension and communicating with different experts.<br>Such projects have a duration of at least three months. |
| Professional Products | • Project proposal<br>• Project report (Master thesis)<br>• Project presentation and defence |
| Credits/ study load | 30 EC / 840 study load hours, consisting of<br>Approximately 10 contact hours with HAN lecturers 60 hours to write the project proposal, 690 hours project work, including practical work, 60 hours to write the master report and project reflection and 20 hours to prepare the presentation and defence |
| Relationship with and entry requirements concerning exams | • Successful completion of the exam of the unit of study “Fundamentals”,<br>• Successful completion of the exam of the unit of study “Drug Discovery and Development”, “Production of Biomolecules 1 and 2”, “Vaccines and Diagnostics” except for one modular exam in one of these modules<br>• Successful completion of the exam of the unit of study “Research and Product Development Skills 1 and 2” and “Managing Projects 1 and 2” |
| General description | During this final unit of study, all competences of the Master in Molecular Life Sciences are integrally applied and further developed to reach the final qualifications of this applied master programme.<br>Students work individually on a project in applied/translational research or product development in biotechnology/pharmaceutical companies or other R&D institutions. Such projects can contribute to the development of bio-assays, diagnostic tests, vaccines or drugs, the production of enzymes or other biomolecules of industrial use, among many other possible applications.<br>Students plan and control their project. Upon finalisation, reports on the results and a reflection on the course of the project are written. The project is defended and answering the questions of the examers is the last proof-of-competence during this master programme. |
| Competences | Competence 1: Professional conduct and guiding professional development<br>Competence 2: Designing strategies for applied research and product development<br>Competence 3: Design, analysis and control of experiments<br>Competence 4: Communication<br>Competence 5: Managing projects<br>Competence 6: Advising |

| | |
|---|---|
| Assessment criteria | *The assessment criteria will be directly derived from the following final qualifications:*<br>*Competence 1: Professional conduct and guiding professional development*<br>1.1. Shows a professional, pro-active, curious, scientific and entrepreneurial attitude: adapts quickly, motivates him/herself, shows initiative, is goal-oriented, and acts honestly and efficiently<br>1.2. Works efficiently in a team (colleagues, project leader, client) during all phases of the project through open communication and by considering the needs of others.<br>1.3. Pro-activity contributes to setting up and maintaining a professional network.<br>1.4. Critically reflects on the project with respect to scientific project management approach and results.<br>1.5. Critically reflect on the own role in the course of a project.<br>1.6. Critically reflects on the own personality and how this influences professional conduct.<br>1.7. Defines personal learning goals (based on project/work requirements) and guides personal development to reach learning goals<br>*Competence 2: Designing strategies for applied research and product development*<br>2.1. Is able to independently acquire knowledge in a new subject by consulting specific literature and other resources; is able to identify reliable and suitable sources; Discriminates between major and side issues<br>2.2. Combines information from different sources in the context of the own project<br>2.3. Defines the project aim in terms of products and/or results based on the acquired background information<br>2.4. Defines the quality requirements for products and processes based on legal requirements.<br>2.5. Designs different approaches that could lead to the project aim. Evaluates these possibilities and justifies the choice based on scientific arguments and practical parameters such as time, costs, quality and personnel<br>2.6. Designs a complete strategy leading to the project aim (project of about 3-4 months; see also: managing projects)<br>2.7. Identifies opportunities to patent products, results and strategies<br><br>*Competence 3: Design, analysis and control of experiments*<br>3.1. Designs experiments based on the required quality and quantity of the product or result.<br>3.2. Applies strict logical thinking to draw conclusions from the results and interprets them:<br>- in the context of the experiments<br>- in the context of the project aim (helicopter view)<br>- in comparison to other analyses, reference/theoretical values, and quality requirements.<br>3.3. Solves practical problems if experiments do not work as planned (trouble shooting); couples back to the theory or consults colleagues if necessary; suggests alternative experiments.<br>*Competence 4: Communication*<br>4.1. Reports project plans and results according to the standard format of scientific documents and meets the scientific international conventions criteria<br>4.2. Presents project plans and results in English to colleagues, other researchers in the field or to clients. The presentation is at a level equivalent to a presentation at an international symposium |

| | | |
|---|---|---|
| | 4.3. Describes the key message of the project relevant for patenting, registration, and/or business development. Uses terminology that is understandable for experts from different departments<br>4.4. Organises and moderates meetings<br>4.5. Contributes to the efficiency of meetings by being prepared and actively participating<br>4.6. Keeps client and project members informed about project progress at all stages, especially when the project is not progressing as planned<br>4.7. Shows initiative to adapt communication styles to the others and the situation at hand<br>*Competence 5: Managing projects*<br>Takes responsibility for a project by:<br>5.1. Defines project deliverables based on the needed quality and quantity<br>5.2. Identifies project risks based on the (experimental) approach and on (putative) competitors<br>5.3. Defines project exclusions<br>5.4. Organizes the project in phases and defines decision points/ milestones<br>5.5. Describes the project organisation including the responsibilities of all project members<br>5.6. Writes a communication plan concerning all project members and parties involved<br>5.7. Describes a schedule based on the (experimental) plan<br>5.8. Describes the required budget<br>5.9. Performs his/her responsibilities<br>5.10. Approaches others if they do not perform to their responsibilities<br>5.11. Sets priorities and works efficiently towards the defined project aim/deliverables<br>5.12. Is in control of the project during all phases by being pro-active if the project does not run according to the plans and initiating an alternative strategy<br>5.13. Is flexible with changing circumstances by adapting the experimental, project and/or communication strategy<br>5.14. Obtains the deliverables in time and with the described resources; if not, reasons and justifies the decisions that have been taken in the course of the project<br>*Competence 6: Advising*<br>6.1. Actively involves different specialist to collect advise contributing to the progress of the project.<br>6.2. Actively participates in a discussion about related projects by asking critical questions and suggesting follow-up experiments.<br>6.3. Advises about follow-up projects of the own project.<br>6.4. Integrates own project results in the multidisciplinary defined goals and advises other departments<br>6.5. Gives advice about choosing new equipment or methods based on project goals, overall goals and available resources | |
| Exams | Code modular exam: | MMLS-GP-Final |
| | Name modular exam: | Graduation Project integral exam |
| | Type: | Individual final |
| | Number of examiners: | 2 for assessment |
| | Assessment: | grade |
| | Cut-off value: | 55% |
| | Minimal result: | 5.5 |
| | Weighting: | 100% |
| | Period and resit: | 2 chances per study year; depending on student |

| | |
|---|---|
| | Compensation: None |
| Compulsory literature | • Graduation project handbook<br>• Specialized literature relevant to the project |
| Recommended literature | Scientific literature relevant to the specific project |
| Software and other materials | Dependent on the specific project |
| Activities | Placement in the professional practice |
| Work formats | Literature studies, writing project plans and results, controlling experiments, team work, work meetings, project presentations and discussions |
| Lesson/ Contact hours | See above: credits/ study load |
| Education Period | September - August |

**Exam of the UOS Graduation Project**

| | **Assessment criteria/ Indicators / requirements** | | |
|---|---|---|---|
| | ***Competence indicators*** | ***Body of Knowledge and Skills*** | ***Assessment criteria*** |
| ***Code modular exam:*** **MMLS-GP-PP** | *Competence indicators* | *Knowledge indicators* | *These competence and knowledge criteria are translated into the following assessment criteria** |
| ***Name modular exam:*** **Project proposal**<br><br>***Type:*** Individual written professional product<br>***Number of examiners:*** 2 for construction and evaluation of assignment and assessment form, 2 for assessment<br>***Assessment:*** Grade<br>***Cut-off value:*** 55%<br>***Minimal result:*** 5.5<br>***Weighting:*** 15% | 2.1. Is able to independently acquire knowledge in a new subject by consulting specific literature and other resources; is able to identify reliable and suitable sources; discriminates between major and side issues.<br>2.2. Combines information from different sources in the context of the own project to result in a relevant and comprehensive proposal.<br>2.3. Defines the project aim in terms of products and/or results based on the acquired background information.<br>2.4. Defines the (quality) requirements for products and processes based on customer / legal requirements.<br>2.6. Designs a complete strategy leading to the project aim. (project of about 3-4 months; see also: managing projects)<br>2.7. Identifies opportunities to patent products, results and strategies.<br>3.1. Designs experiments based on the required quality and quantity of the product or result.<br>4.2. Presents project plans and results in English to colleagues, other | *Depending on context of the (internship) workplace.* | • The student is able to collect relevant information concerning the project topic.<br>• The student is able to translate the obtained bulk of information into a meaningful review relevant for the project.<br>• The student defines a project aim, which is in line with the background information.<br>• The student indicates product or process requirements.<br>• The student describes a strategy that meet the project aim.<br>• The student comments on the IP situation (patent opportunities, freedom-to-operate).<br>• The student designs experiments that will result in the desired product.<br>• The student describes the project deliverables.<br>• The student describes the potential risks based on experimental approach and competitors.<br>• The student describes items that could be expected as deliverables but clearly states that these items are not included (exclusions) as |

| | | | |
|---|---|---|---|
| ***Period and resit:***<br>2 chances per study year;<br>Chance 1: 4 weeks after start Major Project<br>Chance 2: 4 weeks after assessment version 1<br><br>***Compensation:***<br>None | researchers in the field or to clients. The presentation is at a level equivalent to a presentation at an international symposium<br>5.1. Defines project deliverables based on the needed quality and quantity.<br>5.2. Identifies project risks based on the experimental approach and on (putative) competitors.<br>5.3. Defines project exclusions.<br>5.4.Organizes the project in phases and defines decision points.<br>5.5. Describes the project organisation including the responsibilities of all project members<br>5.6. Writes a communication plan concerning all project members and parties involved.<br>5.7. Describes a schedule based on the experimental plan.<br>5.8. Describes the required budget. | | deliverables.<br>• The project is well-defined in differents stages.<br>• The project organisation and project member responsibilities match with the project approach.<br>• The student describes who communicates when and in which way to whom.<br>• The project is set into a complete time frame.<br>• The student describes a realistic budget that includes both staff and materials.<br>• The student presents key aspects of the project proposal to convince the audience in a pitch of about 5 minutes:<br>- The presentation clearly refers to the deliverables and is scientifically sound.<br>- The presentation stays within the given time limit. Slides are clear with only occasional spelling and grammar mistakes. Figures and tables are clearly/correctly labelled.<br>- The presentation has an introduction-body- conclusion structure and is easy to understand.<br>- Is intelligible. Intonation is generally appropriate.<br>- Uses appropriate vocabulary to give and exchange views, on familiar topics<br>- Produces extended stretches of language despite some |

| | | | |
|---|---|---|---|
| | | | hesitation.<br>• The student answers questions about the project in a convincing but critical way and gives arguments and suggestions that are scientifically and project management-wise sound. |
| | | | |
| ***Code modular exam:*** **MMLS-GP-REP** | | | |
| ***Name modular exam:*** **Report**<br>***Type:*** Individual written professional product<br>***Number of examiners:*** 2 for construction and evaluation of assignment and assessment form, 2 for assessment<br>***Assessment:*** Grade<br>***Cut-off value:*** 55%<br>***Minimal result:*** 5.5<br>***Weighting:*** 25%<br>***Period and resit:*** 2 chances per study year;<br>Chance 1: End of Major Project<br>Chance 2: 4 weeks | 2.1. Is able to independently acquire knowledge in a new subject by consulting specific literature and other resources; is able to identify reliable and suitable sources; discriminates between major and side issues.<br><br>2.2. Combines information from different sources in the context of the own project.<br><br>3.2. Applies strict logical thinking to draw conclusions from the results and interprets them in the context of the experiments, in the context of the project aim (helicopter), and in comparison to other analyses, reference/theoretical values and quality requirements.<br><br>4.1.Reports project plans and results according to the standard format of scientific documents and meets the scientific international conventions criteria. | *Depending on context of the (internship) workplace.* | • The student is able to collect relevant information concerning the project topic.<br>• The student is able to translate the obtained bulk of information into a meaningful review relevant for the project.<br>• The student described the results according to the scientific conventions. The student discussed the results meaningfully in the light of the experimental procedure, the project aim and the literature.<br>• The report follows the (minimal) format: summary, introduction, materials and methods, results, discussion and conclusion, reference list and a summary for the public. Figures and tables are clearly labelled and self-explanatory. Literature is uniformly referenced to according to scientific conventions. There is coherence within, and in between, sections. The student used a correct scientific style. Structural feedback (maximally two times) was provided by the |

| | | | |
|---|---|---|---|
| after assessment version 1<br><br>***Compensation:***<br>None | 6.3. Advises about follow-up projects. | | supervisor.<br>• The report contains advices about useful follow-up projects and is based on the outcome of the project. |
| ***Code modular exam:***<br>**MMLS-GP-WPA** | | | |
| ***Name modular exam:***<br>**Workplace assessment**<br><br>***Type:***<br>Individual assessment of professional performance, written products<br><br>***Number of examiners:***<br>2 for construction and evaluation of criteria, 1-2 for assessment considering advice of workplace supervisor<br><br>***Assessment:***<br>Grade<br><br>***Cut-off value:***<br>55%<br><br>***Minimal result:***<br>5.5<br><br>***Weighting:***<br>25% | 1.1. Shows a professional, pro-active, curious, scientific and entrepreneurial attitude: adapts quickly, motivates him/herself, shows initiative, is goal-oriented, and acts honestly and efficiently.<br>1.2. Works efficiently in a team (colleagues, project leader, client) during all phases of the project through open communication and by considering the needs of others.<br>2.5. Designs different approaches that could lead to the project aim. Evaluates these possibilities and justifies the choice based on scientific arguments and practical parameters such as time, costs, quality and personnel.<br>2.7. Identifies opportunities to patent products, results and strategies.<br>3.1. Designs experiments based on the required quality and quantity of the product or result.<br>3.3. Solves practical problems if | Depending on context of the (internship) workplace. | • The student showed a professional, pro-active, curious, scientific and entrepreneurial attitude during his/her Major Project.<br>• The student communicated clearly, kept the project goals in mind and showed that he/she considers the needs of others.<br>• The student discussed different experimental strategies prior to and during the project. The choices he/she had made were based on scientific and/or practical arguments.<br>• The student discussed different business (IP) opportunities during the project. The choices he/she had made were based on scientific and/or practical arguments.<br>• The student designed experiments that will lead to the desired product or result.<br>• The student was able to solve experimental problems. |

| | | | |
|---|---|---|---|
| ***Period and resit:***<br>2 chances per study year;<br>Chance 1: End of Major Project<br>Chance 2: 4 weeks after assessment version 1<br>***Compensation:***<br>None | experiments do not work as planned (trouble shooting). Couples back to the theory or consults colleagues if necessary. Suggests alternative experiments.<br>4.2. Presents project plans and results in English to colleagues, other researchers in the field or to clients. The presentation is at a level equivalent to a presentation at an international symposium.<br>4.4. Organises and moderates meetings.<br>4.5. Contributes to the efficiency of meetings by being prepared and actively participating.<br>4.6. Keeps client and project members informed about project progress at all stages, especially when the project is not progressing as planned.<br>4.7. Shows initiative to adapt communication styles to the others and the situation at hand.<br>5.9. Performs his/her responsibilities.<br>5.10. Approaches others if they do not perform their responsibilities.<br>5.11. Sets priorities and works efficiently towards the defined project aim.<br>5.12. Is in control of the project during all phases by being pro-active if the project does not run according to the plans and initiating an alternative strategy.<br>5.13. Is flexible with changing circumstances by adapting the experimental, project and/or communication strategy. | | • The presentation is structured in such way that it tells a story. The slide content is understandable. The verbal presentation is understandable; the student speaks clearly and in correct English. The student speaks freely, in an open pose and makes contact with the audience. The presentation stays within time frame.<br>• The student organised useful meetings.<br>• The student was prepared for meetings and made contributions that had minor impact on the course of the project.<br>• The student kept client/project members informed according to the communication plan and informed other properly when its project did not progress as planned. Some encouragement to report was required from the supervisor.<br>• The student showed effort to adapt communication styles to the communication partner and the situation.<br>• The student holds to his/her responsibilities during the project.<br>• If other project members do not perform their responsibilities, the student called this person to account. |

| | | | |
|---|---|---|---|
| | 5.14. Obtains the deliverables in time and with the described resources; if not, reasons and justifies the decisions that have been taken in the course of the project.<br>6.1. Actively involves different specialist to collect advise contributing to the progress of the project.<br>6.2. Actively participates in a discussion about related projects by asking critical questions and suggesting follow-up experiments.<br>6.4. Integrates own project results in the multidisciplinary defined goals and advises to other departments.<br>6.5. Gives advice about choosing new equipment or methods based on project goals, overall goals and available resources. | | • The student used his/her days efficiently in view of the project. He/she prioritised properly.<br>• The student showed awareness whether the project was on schedule.<br>• In response to changing circumstances, the student adapted to the situation by changing the project strategy and the communication strategy.<br>• The student obtained the deliverables. If not, he/she changed towards alternative strategies in the course of the project.<br>• The student involved different specialists to collect advise contributing to the progress of the project.<br>• The student actively contributed to work discussions.<br>• The student was able to communicate with other experts in a constructive way during the project.<br>• The student chose suitable methods and equipment based on scientific requirements and practical aspects. |
| | | | |
| ***Code modular exam:*** **MMLS-GP-PA** | | | |
| ***Name modular exam:*** **Portfolio Assessment** | 1.3. Pro-actively contributes to setting up and maintaining a professional network. | Depending on context of the (internship) workplace. | • The student demonstrates the ability to develop a professional network |

| | | | |
|---|---|---|---|
| ***Type:***<br>Individual performance including assignments<br>***Number of examiners:***<br>2 for construction and evaluation of criteria, 1-2 for assessment considering advice of workplace supervisor<br>***Assessment:***<br>Grade<br>***Cut-off value:***<br>55%<br>***Minimal result:***<br>5.5<br>***Weighting:***<br>35%<br>***Period and resit:***<br>2 chances per study year;<br>Chance 1: End of Major Project<br>Chance 2: 4 weeks after assessment version 1<br>***Compensation:***<br>None | 1.4. Critically reflects on the project with respect to scientific project management approach and results.<br>1.5. Critically reflects on the own role in the course of the project.<br>1.6.Critically reflects on the own personality and how this influences professional conduct.<br>1.7. Defines personal learning goals (based on project/work requirements) and guides personal development to reach learning goals.<br>2.5. Designs different approaches that could lead to the project aim. Evaluates these possibilities and justifies the choice based on scientific arguments and practical parameters such as time, costs, quality and personnel.<br>2.7. Identifies opportunities to patent products, results and strategies.<br>4.2. Presents project plans and results in English to colleagues, other researchers in the field or to clients. The presentation is at a level equivalent to a presentation at an international symposium<br>4.3. Describes the key message of the project relevant for patenting, registration, and/or business development. Uses terminology that is understandable for experts from different departments.<br>4.4. Organises and moderates meetings.<br>4.5. Contributes to the efficiency of meetings by being prepared and actively | | meeting the needs for the project; with a clear organisational structure diagram.<br>• Can articulate what could have been done better.<br>• Includes lessons learned.<br>• Has documented goals and shows reflection.<br>• Has a final project version and shows / can demonstrate why this is the best approach.<br>• The student comments on patent opportunities of the project and potential business development. The student does this in a way that is understandable to experts from different departments.<br>• "Evidence of meetings - timelines and agenda.<br>• Does not show any evidence of follow up, does not record issues and actions.<br>• No evidence or incomplete evidence of minutes and distribution of them."<br>• The student was prepared in the meetings.<br>• Has a communication strategy and executes this. Communication is one way and is reactive - only showing what is happening but not what will happen.<br>• Maintains a limited risk and issues log. Typically logs risks/issues |

| | | | |
|---|---|---|---|
| | participating.<br>4.6. Keeps client and project members informed about project progress at all stages, especially when the project is not progressing as planned.<br>5.2. Identifies project risks based on the experimental approach and on (putative) competitors.<br>5.4.Organizes the project in phases and defines decision points.<br>5.11. Sets priorities and works efficiently towards the defined project aim.<br>5.13. Is flexible with changing circumstances by adapting the experimental, project and/or communication strategy.<br>5.14. Obtains the deliverables in time and with the described resources; if not, reasons and justifies the decisions that have been taken in the course of the project.<br>6.1. Actively involves different specialists to collect advise contributing to the progress of the project.<br>6.4. Integrates own project results in the multidisciplinary defined goals and advises to other departments. | | during planning phases, but no further. Limited to no migitation plans<br>• Has a plan with distinct phases, but may not show integration and dependencies. May have resources assigned, but may not resource balance. Will not have distict milestones and space between phases for failure. Plan often assumes 100% success at all times<br>• Shows evidence that risks and issues have been managed by recording in a risk/issues log.<br>• Shows evidence that timelines and delivery dates have been tracked (e.g. via reporting). Indicates risk / actual failure to deliver.<br>• Shows evidence of using experts to support the development, execution, analysis and reporting of research.<br>• The student outlines the social-economic context of the project.<br>• The student presents key aspects and results of the project in a pitch of about 5 minutes:<br>- The presentation clearly refers to the deliverables and is scientifically sound.<br>- The presentation stays within the given time limit. Slides are clear with only occasional spelling and grammar mistakes. Figures and tables are clearly/correctly labelled. |

| | | | |
|---|---|---|---|
| | | | - The presentation has an introduction-body- conclusion structure and is easy to understand.<br>- Is intelligible. Intonation is generally appropriate.<br>- Uses appropriate vocabulary to give and exchange views, on familiar topics<br>- Produces extended stretches of language despite some hesitation.<br><br>The student answers questions about the project in a convincing but critical way and gives arguments and suggestions that are scientifically and project management-wise sound. |

**** Note: Adjustments in the <u>exact description</u> of the assessment criteria can be made based on experiences with previous students groups with the aim to improve relevance, reliability and transparency of the assessment.***