Course Specifications
Valid as from the academic year 2017-2018

Microbial (meta)genomics (I001956)

Course offerings and teaching methods in academic year 2019-2020
A (semester 2)  English  guided self-study  3.75 h
lecture  23.75 h
group work  7.5 h

Lecturers in academic year 2019-2020
Van Bogaert, Inge  LA25  lecturer-in-charge

Offered in the following programmes in  2019-2020
Master of Science in Bioscience Engineering: Cell and Gene Biotechnology

Teaching languages
English

Keywords
metagenomics, genome, de novo sequencing, microorganism, industrial biotechnology, novel enzymes, metatranscriptomics, metaproteomics

Position of the course
The importance of microbial (meta)genomics is rapidly growing within the field of industrial biotechnology. The emphasis is placed on the practical aspects of microbial (meta)genomics and their practical applications in industrial biotechnology.

Contents
Due to the continuous evolution of the DNA sequencing technology, the genome of an organism and even of an entire microbial consortium can be resolved extremely fast. However, there is still a long way between obtaining the sequence and the targeted metabolic engineering of a microorganism, and this process is covered in the course. The course discusses several sequencing techniques, sample preparation, as well as assembly and annotation techniques and their respective advantages and disadvantages, with the mean focus on metagenomes and how to tackle the specific challenges.

Metagenomics refers to the study of genomic sequences obtained from samples taken directly from nature. This technology allows sequencing of numerous genes from an entire ecosystem, while the precise origin of the genes is irrelevant. The big advantage over traditional genome sequencing techniques is the absence of a cultivation step, which even allows sequencing of genomes of difficult or non-cultivable organisms. Moreover, DNA sequences of already extinct species can be elucidated as well (paleogenomics).

Finally, the application domains of microbial (meta)genomics are discussed. Microbial (meta)genomics provides a wealth of information for fundamental science and biology, but this course also looks at the applications in other fields: degradation of toxic compounds by microbial consortia, medicine where the interaction of the human microbiome in the human body plays an important role in our overall health, and the exploitation of hitherto unknown enzymes and biosynthetic pathways in industrial biotechnology, leading to the production of industrially relevant molecules and pharmaceuticals. These latter applications are dealt with in detail, including numerous practical examples that illustrate the potential of microbial metagenomics.

Initial competences
Microbial (meta)genomics builds on certain learning outcomes of course

(Approved)
units "Biochemistry and Molecular Biology", 'Microbiology', 'Bio-informatics', 'Industrial Biotechnology' and 'Molecular Microbial Techniques'; or the learning outcomes were achieved differently.

Final competences
1. Students will gain knowledge on the general principles of microbial (meta)genomics and their application
2. Insights in the application potential of metagenomics for industrial biotechnology
3. Writing of a scientifically sound project proposal with metagenomics as a research method
4. Formulate a sound opinion on scientific publications and methods used in metagenomics
5. Perform and understand fundamental laboratory work regarding metagenomics

Conditions for credit contract
Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract
This course unit cannot be taken via an exam contract

Teaching methods
Guided self-study, group work, lecture

Learning materials and price
Slides

References
Metagenomics for Microbiology, 2015, ISBN 978-0-12-410472-3

Course content-related study coaching
The students can always ask questions to the teachers, either personally or by e-mail.

Evaluation methods
end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period
Written examination

Examination methods in case of periodic evaluation during the second examination period
Written examination

Examination methods in case of permanent evaluation
Participation, assignment, job performance assessment, report

Possibilities of retake in case of permanent evaluation
not applicable

Calculation of the examination mark
Students who eschew period aligned and/or non-period aligned evaluations for this course unit may be failed by the examiner.

Wet lab exercise: 2/20
Project: 4/20
Exam: 14/20