

## Genome Analysis (I002616)

**Course size** *(nominal values; actual values may depend on programme)*

**Credits 5.0** **Study time 150 h**

**Course offerings in academic year 2024-2025**

A (semester 2) English Gent

**Lecturers in academic year 2024-2025**

De Meyer, Tim	LA26	lecturer-in-charge
Coussement, Louis	LA26	co-lecturer

**Offered in the following programmes in 2024-2025**

	crdts	offering
<a href="#">Master of Science in Bioscience Engineering: Cell and Gene Biotechnology</a>	5	A
<a href="#">Exchange Programme in Bioscience Engineering: Cell and Gene Biotechnology (master's level)</a>	5	A

**Teaching languages**

English

**Keywords**

Genome analysis, high-throughput data analysis, omics, next-generation sequencing, microarrays, RNA-seq

**Position of the course**

Many recent methods in molecular biology generate huge amounts of data. This course aims at familiarizing students with these data, how to process and statistically analyze them using state-of-the-art methods, and where/how to find or deposit this type of data. Ethical implications, including scientific integrity and sustainability, are discussed. We'll particularly focus on transcriptomics data for in depth analysis (both in theory and practical sessions), yet we'll also touch upon several other omics techniques, data types and analytical considerations.

**Contents**

The following methods and concepts will be discussed and illustrated for common omics data, such as microarrays, RNA-seq, ChIP-seq, bisulfite sequencing, single-cell methods, ...

- Omics data repositories and databases, ethical considerations/sustainability
- Multiple hypothesis testing: family-wise error rate / false discovery rate
- Data preprocessing for omics data: alignment (conceptual), background correction, summarization, data normalization, quality control
- Relevant data formats, bv. FASTQ, GTF/GFF, SAM/BAM, ...
- Moderated statistical methods for hypothesis testing
- Gene set analysis / pathway analysis
- Evolution of omics technologies and their (dis)advantages for specific applications
- Capita selecta (may vary from year to year): bulk-seggregant analysis, GWAS, data integration and visualization, genotyping

The course focuses on conceptual insight in concrete problems and solutions and their application rather than the statistical/mathematical/software implementation.

**Initial competences**

Genetics and molecular biology, solid knowledge of basic data analytical methods (e.g. ANOVA, regression, GLM, PCA)

**Final competences**

- 1 able to find relevant omics datasets
- 2 able to solve common research questions with appropriate data-analytical methods, using the R and Bioconductor software environment

- 3 have basic insight in several important methods for preprocessing and analysis of omics datasets
- 4 have insight in different omics technologies and their (dis)advantages, also from an ethical point of view
- 5 report scientifically on omics data analysis
- 6 work in a team in a constructive and responsible manner

#### **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**

Group work, Seminar, Lecture

#### **Study material**

Type: Syllabus

Name: Notes practical sessions

Indicative price: Free or paid by faculty

Optional: no

Language : English

Number of Pages : 200

Oldest Usable Edition : 2024

Available on Ufora : Yes

Online Available : No

Available in the Library : No

Available through Student Association : No

Type: Slides

Name: Slides genome analysis

Indicative price: Free or paid by faculty

Optional: no

Language : English

Number of Slides : 500

Available on Ufora : Yes

Online Available : No

Available in the Library : No

Available through Student Association : No

#### **References**

#### **Course content-related study coaching**

During the practical sessions students are coached by one or more assistants. Q&A sessions are organized to solve practical problems with the assignment. For non-assignment related questions, students may communicate with the lecturer/assistant by E-mail, which may lead to an appointment if required.

#### **Assessment moments**

end-of-term and continuous assessment

#### **Examination methods in case of periodic assessment during the first examination period**

Written assessment open-book

#### **Examination methods in case of periodic assessment during the second examination period**

Written assessment open-book

#### **Examination methods in case of permanent assessment**

Oral assessment, Peer and/or self assessment, Assignment

#### **Possibilities of retake in case of permanent assessment**

examination during the second examination period is possible

#### **Extra information on the examination methods**

The final examination consists of a written examination (open book). Most of the questions aim to assess the insight of the student in omics data-analysis and how this results in conclusions. The assignment relates to a real life problem and students may work together in groups. The result of the assignment will be reported by means of a written report and a presentation, upon

which both results and used methods will be further discussed ("oral examination"). Depending on the group size, peer-evaluation may be used. This may lead to a score modification of at most two points for the assignment, unless a student did clearly insufficiently contribute (should be reported by fellow group members during semester), in which case a more severe penalty is possible.

#### **Calculation of the examination mark**

The total mark is a weighted average of:

- Assignment (10/20)
- Open book examination (10/20)