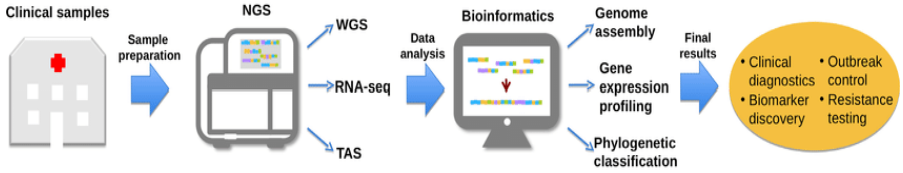
Genomics:
DNA analysis from start to finish

2023-2024

Term
Spring semester: February 2024 – July 2024

General information
This minor is organised by the Bioinformatics program at UAS Leiden and is aimed at students in the third of fourth year of a bachelor program in biology, biomedicine or biotechnology. A good background in molecular biology is desired. The minor is taught in English and has a study load of 15 ECTS.



Adapted from: Consortium OPATHY1 and Toni Gabaldon, 2019; doi: 10.1093/femsre/fuz015

The Genomics program
Genome biology has become central to many areas of molecular biology research. Applications are found in the fields of medicine, plant breeding, pharmaceutics, forensics, food industry and production, ecosystem monitoring, and virology. This success is driven by continuing development of DNA sequencing technologies in the lab and of analysis tools for the vast amounts of data produced. These technologies become increasingly more available in these fields and professionals with genomics expertise are highly sought. You will learn to apply a complete DNA analysis *workflow* from start to finish. Before you do, we will focus on each individual step in the workflow so you can learn the basics and the most popular applications.

To start, you will sequence DNA from a biological sample using Nanopore technology. You will learn about this platform and many others. The output data takes some specific forms that you need to know and work with. You will learn to evaluate quality and quantity of the data produced and why it matters. Then, you will perform the analysis that will give meaning to your data. We mostly apply identification analysis that will tell you what species are in your biological sample, or we try to find genes or genomic areas with a particular pattern of DNA.

We want you to use the computer to do the work for you! The large amount of data and its structure requires such an approach. You will learn the power of the unix command line language and the organisation of a computer server. Most importantly, you will experience fun in coding and develop computational thinking. With such skills, you can start to think about using virtually any software tool you want, on any type of data. Even in genomics, there are many analyses to choose from. You will learn theory about a lot of them and apply some to your own sequence data.

To use the computer is to use algorithms. You will get familiar with some basic algorithms, such as alignment and BLAST. Many of the more advanced algorithms used in scientific research are based on the same principles. You will apply algorithms by hand like solving logical puzzles.

Courses
The program is split in four separate courses:

- laboratory skills MinION (BMIN, 3 EC)
- Linux and sequencing (BLIN, 2 EC)
- Sequence analysis theory (BTS, 4 EC)
- Next Generation Sequencing Analysis (BNGSAP, 6 EC)

University of Applied Sciences Leiden

Zernikedreef 11
2333 CK Leiden

Postbus 382
2300 AJ Leiden

The Netherlands

University of Applied Sciences Leiden (hsleiden.nl)

Practical details

Entry requirements / level
The program is at undergraduate level, but you will need at least two years of training in a biomedical or a biological study to be able to follow the tuition. Bachelor (BSc) and Master (MSc) students in such fields are welcome to apply. Furthermore, basic knowledge of molecular biology and the English language is required.

Literature
Relevant and recent scientific literature, to be announced later.

Examination
Examination of the courses will be based on individual tests: in writing and computer tests, written assignments (in groups and individually), and general performance for the laboratory work.

Application form
Interested? Please fill in the required application form, which can be downloaded from our website: http://www.hsleiden.nl/english

Application deadline
15 November 2023

Tuition fees
There are no tuition fees required for students from partner institutions.

Accommodation
Our university does not have its own student accommodation. A local student housing corporation offers temporary, furnished rooms and apartments to international students. You can find more information about accommodation on our website.

Contact
If you have questions about the content or the organization of this minor, please contact: Jeroen Pijpe, PhD
E-mail: pijpe.j@hsleiden.nl
Phone: +31 6 3882 9735

For information about the application procedure or accommodation please contact: Lisette Oosterhuis
E-mail: international.office@hsleiden.nl
Phone: +31 6 4813 3930

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