Course directory 2022.2023

school of biology (FBM-BIO) master

> Master of Science (MSc) in Molecular Life Sciences

UNIL | Université de Lausanne

SUMMARY

NOTICE

This course catalogue was produced using data from the *SylviaAcad* information system of the University of Lausanne. Its database contains all information about courses proposed by the different faculties and their times. This data can also be consulted online at the address :
https://applicationspub.unil.ch/interpub/noauth/php/Ud/index.php.

Web site of the faculty : **http://www.unil.ch/ecoledebiologie/**

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LEGEND

NAME OF THE COURSE

Teacher

Type of course	Status	Hours per week	Teaching language	Hours per year
Semester	Credits			

N: Levels

P: Programme requirements

O: Objective

C: Content

B: Bibliography

I: Additional information

ABBREVIATIONS

TYPE OF COURSE

Attest.	Attestation
C	Course
C/S	Course - seminar
Cp	Camp
E	Exercises
Exc	Excursion
Lg	Guided lecture
S	Seminar
T	Fieldwork
TP	Practical work

STATUS

Fac	Facultative
Obl	Compulsory
Opt	Optional
Fac/Comp/Opt	Facultative, compulsory or optional (according to the study programme)

SEMESTER

Sp	Spring
A	Autumn

UNIL | Université de Lausanne
Ecole de biologie

Master of Science in Molecular Life Sciences
2022-2023

The Master program has a normal duration of 3 semesters and comprises 90 ECTS :

- 16 ECTS : Module 1 (Compulsory courses (7 ECTS) + Optional courses (9 ECTS))
- 14 ECTS : Module 2 (First Step Project)
- 15 ECTS : Module 3 (Compulsory courses (6 ECTS) + Optional courses (9 ECTS))
- 45 ECTS : Personal research project (Master Thesis)

Abbreviations
C = Course
E/S = Exercise/Seminar
PW = Practical Work

Training objectives are available in its programme regulations.

Specific training objectives: At the end of the course the students will be able to:

Specialisation in Integrative Biology
• Mobilise multidisciplinary knowledge to design experiments that can involve the various levels of structural and functional organisation of the living.
• Interpret data resulting from multiple phenomena: from the cell to the organism as a whole, in its normal and pathological states.

Specialisation in Bioinformatics
• Design experiments to analyse and understand genetic and genomic data.
• Mobilise in-depth knowledge of statistics and bioinformatics applied to biology.
• Use computer programming techniques.

Specialisation in Microbiology
• Mobilise in-depth knowledge in microbiology, genetics and genomics covering aspects of environmental microbiology, microbial ecology, biotechnology, cell microbiology, virology, microbial pathogenesis, bacteriology, fungal biology, yeast models, epidemiology or synthetic biology.
• Propose research approaches in fundamental, medical or applied microbiology.

Condition to obtain the specialisation / Condition pour obtenir une spécialisation

Specialisation Integrative Biology :
Obtain at least 18 ECTS credits in any field of study in Modules 1 and 3.
Free choice for the First Step Project (Module 2) and the Master Thesis (Module 4).

Specialisation Bioinformatics :
Obtain 9 ECTS credits in the field of Bioinformatics (marked in dark blue) in Module 1 and 9 ECTS credits in any field of study in Module 3
Carry out the First Step Project (Module 2) and the Master Thesis (Module 4) in the field of Bioinformatics.
Produce a significant computer program, in the context of any Module.

Specialisation Microbiology :
Obtain 12 ECTS credits in the field of Microbiology (marked in yellow) and 6 ECTS credits in any field of study in Modules 1 and 3.
Free choice for the First Step Project (Module 2).
Carry out the Master Thesis (Module 4) in the field of Microbiology.

Autumn Semester (semester 1)

MODULE 1

Courses / *Enseignements*	Hours per semester C	E/S	PW	Teaching Staff	ECTS Credits	Limited nb of students
General and common activities - Compulsory / ***Activités générales et communes - Obligatoires***						
Retreat and BIG Seminars *Retraite et séminaires BIG*	-	-	-	**Benton R., ...**		
Sequence a Genome I *Séquençage d'un génome I*	14	30	-	**Engel P.,** tutors	3	
Write a Review *Rédaction d'une revue*	15	-	42	**Benton R.,** tutors	4	
Critical Readings of Scientific Literature *Lectures critiques de la littérature scientifique*	-	-	56			
Subtotal	**29**	**30**	**98**		**7**	
Optional (at least 9 credits) ***Optionnel (minimum 9 crédits)***						
Biotechnology *Biotechnologie*	14	-	-	**Poirier Y.,** Resch G.	1.5	
CRISPR-Cas9 Genome Editing *Edition du génome par CRISPR-Cas9*	4	2	8	**van Leeuwen J.**	1.5	12
Development of the Nervous System *Développement du système nerveux*	14	-	-	**Braissant O.**	1.5	
Molecular Mechanisms of Evolution *Mécanismes moléculaires de l'évolution*	14	-	-	**Benton R.**, Geldner N.	1.5	
Plant Functional Genetics *Génétique fonctionnelle des plantes*	14	-	-	**Poirier Y.**	1.5	
Proteins : from Structural Determination to Molecular Dynamic Simulations *Protéines : de la détermination de la structure aux simulations de dynamique moléculaire*	16	-	-	**Santiago Cuellar J.,** Zoete V., Roehrig U., Cuendet M.	1.5	
Scientific Research in all its Forms (for Biology) (Sciences2 - in French only) *La recherche dans tous ses états (pour biologie) (Sciences2)*	14	-	-	**Preissmann D.**	1.5	
Introduction to R (optional support) *Introduction à R (mise à niveau optionnelle)*	-	-	-	**Schütz F.**	-	
Data Analysis (compulsory for Bioinformatics specialisation) *Analyses de données*	6	-	6	**Bergmann S.**	2	
Advanced Data Analysis (compulsory for Bioinformatics specialisation) *Analyses de données : niveau avancé*	6	-	6	**Ciriello G.,** Delaneau O.	2.5	
Theory and Practice in Gene Expression Analyses (compulsory for Bioinformatics specialisation) *Théorie et pratique dans l'analyse d'expression des gènes*	4	32	-	**Gfeller D.,** Delaneau O.	2.5	
Advanced Python Programming (compulsory for Bioinformatics specialisation) *Programmation avancée en Python*	7	14	-	**Salamin N.,** Delaneau O.	2	
Advanced Microbial Genetics *Génétique avancée des microbes*	14	-	-	**Collier J., Pelet S.**	1.5	
Bacterial Genomes and Genome Evolution *Génomes bactériens et évolution du génome*	14	-	-	**van der Meer J.**	1.5	
Fungal Virulence and Pathogenicity *Pathogénicité et virulence fongique*	14	-	-	**Lamoth F.**, Coste A., Hauser P.	1.5	
Immunology and Infectious Diseases *Immunologie et maladies infectieuses*	14	-	-	**Roger T.,** Perreau M., Di Domizio J.	1.5	
Plant Interactions with Microbes and Insects *Interactions des plantes avec les microbes et les insectes*	14	-	-	**Keel C.**, Reymond P.	1.5	
Virus-Host Interactions *Interactions virus-hôtes*	14	-	-	**Gouttenoire J.**	1.5	
Total					**16**	

MODULE 2

Practical Project / ***Travail pratique***						
First Step Project *Travail d'initiation à la recherche*	-	-	250	**Benton R.**	**14**	

The pandemic has shown us that circumstances beyond our control may require us to make the following adjustments / adaptations to study plans during the semester:

- possibility to switch from one mode of teaching to another (face-to-face <-> distance, synchronous <-> asynchronous, switch to co-modal teaching where it was not initially planned).
- change / modification of evaluation modalities, without inducing derogations from the Study Regulations (oral <-> written, exam <-> validation, individual work <-> group work, practical work <-> theoretical work, face-to-face evaluation <-> online evaluation, etc.)
- alternative or time-shifted modalities for teachings, internships, practical work, fieldworks and camps that could not take place or teachings that could no longer take place in the form initially planned.

Students are invited to consult this document regularly (Study Plan & Evaluation Procedure)

BIOLOGICAL SECURITY

Patrick Michaux

C	Obl		English	2
A				

N: Master

P: A basic knowledge of microbiology and vegetal science

O: To familiarise future researchers with legislation concerning genetic engineering. In addition, possible biological risks associated to different applications of this technology will be discussed with the help of examples.
This teaching is a mandatory prerequisite for First-Step.

C: * Legislation: article 24 of the Federal Constitution; law concerning environmental protection; law concerning epidemics; ordnance on protection against major accidents; Swiss commissions on biological security: notification and registration of projects.
* Biological security in the laboratory: containment; security equipment; technical measures: laboratory construction; standard laboratory (microbiological) practice; classification of biological material: plasmids, microorganisms, cell lines, primary cells; security levels 1-4.
* Release of genetically modified bacteria in the environment: monitoring, survival and dissemination, ecological impact, transfer of genes, containment systems.
* Potential biological risks associated with the use of transgenic plants: dissemination, cross-pollination, gene transfer.
* The problem of recombinant vaccines: vectors, DNA vaccines.
* Somatic genetic therapy I: Illnesses accessible to treatment by somatic genetic therapy, gene transfer methods.
* Somatic genetic therapy II: Evaluation of the biological risk for the patient and his environment.

RETREAT AND BIG SEMINARS

Richard Benton, Edward Elliston Farmer

CP	Obl	English	18
A			

S	Obl	English	3
A			

S		English	3
S			

N: Master

O: Research seminars are a very important mode of communication/information sharing in the scientific community. The goal is to get students exposed to this important part of life of a scientist.
The goal of the MLS Master Retreat is to inform students about courses, labs in which they can perform their experiments and other practical aspects related to the programme. Each year we also invite a speaker from the non-academic research world (e.g. Nestlé, Novartis). We also initiate the "Write-a-Review" course during the retreat.

C: BIG seminars: seminar series given by world-class scientists.
MLS retreat: 1 and a half days in the mountains for conferences, courses and discussions.

SEQUENCE A GENOME (PART I)

Philipp Engel

C	Obl	English	14
A	3		

E	Obl	English	30
A			

N: Master

O: The goals of this class are to understand and practice the road map of sequencing, assembly and annotating a (bacterial) genome.

C: The class is a combination of both practical aspects, theory, bioinformatics and presentation of genome analysis. We will work in small student groups.
The class starts with a short introduction on the biology of the microorganisms to be sequenced, introductions to high-throughput sequence technology and assembly.
After that a number of sessions in bioinformatics follow, first to learn to communicate in Unix, then to run assemblies on the sequence data sets produced by LGF.
We will teach and practice annotation and subsystems analysis.
In the second (8th) semester, the class is followed with another practical part, annotation of the major important functions in the genome and presentation of results.

I: http://www.unil.ch/sequenceagenome/

WRITE A REVIEW

Richard Benton

C	Obl	English	15
A	4		

TP	Obl	English	42
A			

N: Master

O: Establish the current state of the art in a chosen research field.
Formulate the current knowledge in the form of a review article.
Learn basic aspects of scientific writing.
Learn how to work as a team.

C: Students form groups of 2-3 and work under the guidance of an expert of the field (the tutor) to write a review article. Students have to follow precise guidelines regarding the review format.
Further information will be provided at the MLS Retreat and via the MLS Moodle.

BIOTECHNOLOGY

Yves Poirier

C	Opt		English	14
A	1.5			

N: Master

P: None

O: Get exposure to some themes in animal, plant and microbial biotechnologies as well as to aspects relating to patenting and the biotechnology business.

C: Some of the general topics discussed will be:
What is biotechnology, and what is it good for?
What is a patent and is it useful to submit one as a biologist?
How do universities and scientists valorize their research findings?
Some examples of themes in biotechnology will be:
Biopolymers
Pollutant remediation
Biofactories
Biosensors
Agriculture and transgenesis
Bacteriophage therapy
Red biotechnology (e.g. for medical use)
Gene drive and genome editing technology (CRISPR/Cas9)
External speakers with expertise in the field of patents, creating a start-up in biotechnology and working in the biotechnology industry, will be invited to share their knowledge and point-of-view.

B: Introduction to Biotechnology, 2nd edition
W.J. Thieman and M. A. Palladino
Pearson International Edition

CRISPR-CAS9 GENOME EDITING

Jolanda van Leeuwen

E	Opt	English	2
A			

C	Opt	English	4
A	1.5		

TP	Opt	English	8
A			

N: Master

P: Practical work performed during the bachelor (molecular biology, genetics, biochemistry, bioinformatics)

O: This course teaches both the practical as well as the theoretical aspects of CRISPR-based genome editing in cultured human cells

C: The course is a combination of theory, practical work in the lab, and practical work behind the computer. More specifically, topics covered in this course are:
- Theory: introduction to CRISPR-Cas9 genome editing, different types of CRISPR genome editing systems, CRISPR-fusion enzymes (CRISPRi, CRISPRa, base editing, methylation, precision editing, etc), and CRISPR screening
- Wet lab work: assembling CRISPR-Cas9 guide RNA particles, transfection into cultured human cells, monitoring the outcome of gene editing using fluorescence microscopy
- Dry lab work: guide RNA design, design of homologous recombination templates, predicting gene editing outcomes

DEVELOPMENT OF THE NERVOUS SYSTEM

Olivier Braissant

C	Opt	English	14
A	1.5		

N: Master

O: Molecular and cellular mechanisms of brain development in vertebrates, including the main pathologies affecting CNS development. Important accent on the various experimental models used to analyze vertebrate CNS development, both in vivo and in vitro.

C: The course is teached on 14 hours (3x 4h lecture, 1x 2h article presentations by students). the course is subdivided in 8 sub-chapters :
1 : CNS cell types & brain metabolism.
2 : Experimental models for the developing brain.
3 : Early development of vertebrate CNS.
4 : Neural crests and peripheral nervous system.
5 : Fundamental principles of CNS development.
6 : Molecular aspects of CNS development.
7 : Isolation and contacts between CNS and periphery.
8 : Pathologies of CNS development
Students have also to prepare and present recent articles on these thematics.

MOLECULAR MECHANISMS OF EVOLUTION

Richard Benton

C	Opt	English	14
A	1.5		

N: Master

P: Students should have a solid background in molecular genetics and developmental/cell biology.

O: To explore our current understanding of the molecular mechanisms underlying phenotypic differences between species, using examples from animals and plants.
What are the specific genetic loci underlying divergence of traits?
- how do you identify these loci and prove they are responsible?
What are the functional changes in these loci?
- what kinds of changes are possible?
What is the origin of the functional variation in natural populations?
- how do the properties of populations influence evolution?
Are there common principles in how evolution works across species and across traits?
- if so, why? If not, why not?

C: Four primary research articles (which will be made available on MyUNIL) will be read in advance by the students and discussed in detail during the course, spanning the larger scientific context and the experimental approaches used.

PLANT FUNCTIONAL GENETICS

Yves Poirier

C	Opt		English	14
A	1.5			

N: Master

P: Good understanding of molecular biology

O: Get an overview of the spectrum of genetic and genomic tools used to isolate and decipher the role of genes involved in various aspects of plant biology

C: A Gene expression and transgenesis
Agrobacterium and biolistic
Transient vs. stable transformation
Inducible promoters
Viral vectors
Transformation of plastids
B Tools used in forward and reverse genetics
Mutagenesis and gene mapping
T-DNA and transposon tagging
RNAi
Homologous recombination
Genome editing

PROTEINS : FROM STRUCTURAL DETERMINATION TO MOLECULAR DYNAMIC SIMULATIONS

Julia Santiago Cuellar

C	Opt		English	16
A	1.5			

N: Master

SCIENTIFIC RESEARCH IN ALL ITS FORMS

Delphine Preissmann

C	Opt	2	French	14
A	1.5			

N: Master

P: * Bachelor degree
* Passive knowledge of French

O: - Integrate technics & scientific methods from different academic fields
- Synthesize information from different disciplines
- Transpose knowledge & results from one academic field to another

C: This course offers a multidisciplinary perspective on decision making. While addressing this topic, speakers from different faculties will shed light on their own way of practicing research.

I: http://www.unil.ch/sciencesaucarre/page86487.html

DATA ANALYSIS

Sven Bergmann

C	Obl/Opt	English	6
A	2		

TP	Obl/Opt	English	6
A			

N: Master

P: We assume nothing more than the mathematics you would have obtained in your studies when you were 18.

O: In this course the goal is to be able to formulate hypotheses properly, design experiments, whether in the laboratory, in a clinic, or in the filed, that have sufficient power to test these hypotheses, conduct appropriate statistical tests of the data generated, generate clear figures, and interpret the results obtained.

C: We will cover:
1. Distributions and random variables
2. Variance, covariance and measures of association
3. Constructing statistical tests using distributions
4. Regression
5. Non-linear regression

ADVANCED DATA ANALYSIS

Giovanni Ciriello

C	Obl/Opt	English	6
A	2.5		

TP	Obl/Opt	English	6
A			

N: Master

P: You must have attended the first data analysis course, or convince me that you are competent at basic statistical analyses.

O: The aim of this course is to build upon the data analysis course, to prepare you to handle a range of different data and more complex analysis problems.

C: In this course we will cover:
1. Repeated measures models and mixed effects models.
2. Survival analyses
3. Bayesian statistical inference

THEORY AND PRACTICE IN GENE EXPRESSION ANALYSES

David Gfeller

C	Opt	English	4
A	2.5		

E	Opt	English	32
A			

N: Master

P: Basic programming skills (R or python).

O: Provide students with the analytical and computational tools for gene expression data analysis in many fields of biological sciences. A special focus will be on methodological/algorithmic aspects and their implementation. The students will have the opportunity to develop their analytical and computational skills, and will become familiar with standard tools for gene expression data analysis in different contexts.

C: Processing of RNA-Seq data / Visualization, Clustering, Differential expression / eQTL / Single-cell genomics. The course will feature short theoretical introductions of important concepts, followed by practical implementations of methods in the form of R/python scripts. The practical parts will be organized as problem-solving tasks to be implemented in programming languages.

ADVANCED PYTHON PROGRAMMING

Nicolas Salamin

C	Obl/Opt	English	7
A	2		

E	Obl/Opt	English	14
A			

N: Master

P: There are not prerequisites for this course.
The students are however expected to be familiar with computers. They should have a good understanding of the functioning of a computer (hardware components, operating system/file system). A basic knowledge of UNIX/LINUX would be good, although it is not essential.
It will be necessary to install the following software on your own laptop:
- python3 with the modules numpy and biopython
- a text editor with syntax highlighting (simple one or IDE)
- for windows user: a terminal environment (e.g. cygwin or MinGW)

C: We will cover the following aspects of programing in Python:
1) basic syntax
2) data types in Python

ADVANCED MICROBIAL GENETICS

Justine Collier Close, Serge Pelet

C	Opt	English	14
A	1.5		

N: Master

P: - Bachelor course "Génétique Moléculaire des Bactéries" - Bachelor course "Génétique des modèles eukaryotes"

O: - Think logically about experimental approaches.
- Illustrate how cleverly designed genetic experiments can provide answers to fundamental problems.
- Learn about new technology developments in genome-wide screens.
- Read the scientific literature critically.

C: - Lecture on prokaryotic genetics (JC)
- Lecture on eukaryotic genetics (SP)
- Assisted and critical reading of publications

BACTERIA GENOMES AND GENOME EVOLUTION

Jan Roelof van der Meer

C	Opt	English	14
A	1.5		

N: Master

O: Discover bacterial genome evolution at the example of life in the ocean, in particular that of the 'Prochlorococcus federation' of phototrophic bacteria.
Learn how to interpret genomic data and bacterial metabolism with the help of online databases.

C: The class is a mix of subjects that are introduced by the teacher, classical reading and self-working in class, notably by interrogating metabolic databases
1) Overview of utilities for interpretation of bacterial genomes (databases, online programs) - Self-learning and practise using specific examples
2) History of discoveries in bacterial genome evolution at the example of the Prochlorococcus federation of species in the oceans
3) Understanding bacterial genome evolution (literature reading)

B: Ad hoc research articles.

FUNGAL VIRULENCE AND PATHOGENICITY

Frédéric Michel Lamoth

C	Opt	English	14
A	1.5		

N: Master

O: The lecture will illustrate the importance of different human fungal pathogens and give their principal characteristics. General principles of fungal pathogenesis will be given with illlustrative examples

C: **General considerations about pathogenic fungi and fungal infections (2h): Prof. Frédéric Lamoth**

- The course describes the main fungal pathogens and goes through the epidemiology, clinical presentation, diagnosis and treatment of invasive fungal infections in humans.

Candida and other pathogenic yeasts (2h): PD Dr. Alix Coste

- The course goes through virulence factors that promote yeast colonization and infection of the host.

Aspergillus and other pathogenic molds (2h): Prof. Frédéric Lamoth

- The course goes through the mechanisms of pathogenicity of invasive mold infections in immunocompromised hosts.

Pneumocystis and dimorphic fungal pathogens (2h): PD Dr. Philippe Hauser

- The course presents the medical aspects, epidemiology, virulence factors, and pathogenicity of Pneumocystis jirovecii and dimorphic fungal pathogens such as Histoplasma.

Journal club (4h): PD Dr. Alix Coste, PD Dr. Philippe Hauser and Prof. Frédéric Lamoth

- Selected research articles of medical mycology are presented by the students and are discussed with the teachers.

Practical part (2h): PD Dr. Philippe Hauser

- Demonstration of the methods used for identification and drug susceptibility testing of clinically important fungi

IMMUNOLOGY AND INFECTIOUS DISEASES

Thierry Roger

C	Opt	English	14
A	1.5		

N: Master

B: Lecture 1-3:
- Janeway's Immunobiology 9th Edition, Kindle Edition. Chapters 1, 2 and 3. Disponible at UNIL athttps://renouvaud.hosted.exlibrisgroup.com/permalink/f/gt86ri/41BCU_ALMA71113136200002851
- The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D, Bauer M, Bellomo R, Bernard GR, Chiche JD, Coopersmith CM, Hotchkiss RS, Levy MM, Marshall JC, Martin GS, Opal SM, Rubenfeld GD, van der Poll T, Vincent JL, Angus DC. JAMA. 2016 Feb 23;315(8):801-10. PMID: 26903338
- Sepsis and septic shock. Hotchkiss RS Moldawer LL, Opal SM, Reinhart K, Turnbull IR, Vincent JL et al. Nat Rev Dis Primers. 2016 Jun 30;2:16045. PMID: 28117397
- The immunopathology of sepsis and potential therapeutic targets. van der Poll T, van de Veerdonk FL, Scicluna BP, Netea MG. Nat Rev Immunol. 2017 Jul;17(7):407-420. PMID: 28436424
- Host-directed therapies for bacterial and viral infections. Kaufmann SHE, Dorhoi A, Hotchkiss RS, Bartenschlager R. Nat Rev Drug Discov. 2018 Jan;17(1):35-56. PMID: 28935918

Lecture 4 :
- Wherry et al., Molecular and cellular insights into T cell exhaustion, Nature Reviews in Immunology 2015
- Pitman et al., Barriers and strategies to achieve a cure for HIV, The Lancet, 2018

Lecture 5 :
- The NIH Human Microbiome Project http://commonfund.nih.gov/hmp/
- Gensollen T, How colonization by microbiota in early life shapes the immune system, Science. 2016 Apr 29;352(6285):539-44.
- Advances in the understanding and treatment of sepsis-induced immunosuppression. Venet F, Monneret G. Nat Rev Nephrol. 2018 Feb;14(2):121-137. PMID: 29225343
- https://www.world-sepsis-day.org/

PLANT INTERACTIONS WITH MICROBES AND INSECTS

Christoph Keel

C	Opt	English	14
A	1.5		

N: Master

O: to provide students with knowledge on how intricate interactions between plants and beneficial or detrimental organisms are operating at the molecular level

C: Part C. Keel
"Molecular basis of host specificity in phytopthogenic bacteria"
The course illustrates the sophisticated molecular mechanisms by which plant pathogenic bacteria subvert plant defense mechanisms, focusing on bacterial injection devices (type III secretion systems) and virulence and avirulence proteins delivered directly into the plant host cell. The effector injection machinery of the plant pathogens is compared to that of human pathogenic bacteria to highlight the conservation of the virulence strategy.
Part P. Reymond
"Molecular study of plant-insects interactions"
The course describes the molecular mechanisms by which a plant detects the presence of an herbivore attack and responds to it by inducing hundreds of genes. It presents recent findings on the suppression of plant defense responses by insects. Finally, examples of insects that are useful for defending plants against other enemies are provided.
Exercise: Students designing research
In a final part of the course, students will design research approaches based on the topics presented during the three lecture parts and on questions provided by the lecturers. Student inputs will be discussed collectively, with the aim to highlight common and contrasting aspects occurring during interaction of microbes and insects with plants.

VIRUS-HOST INTERACTIONS

Jérôme Gouttenoire

C	Opt	English	14
A	1.5		

N: Master

P: Virology course 5th semester (20 h)

O: <p style="margin: 0px; font-stretch: normal; line-height: normal; font-family: Verdana;">Understanding virus-host cell interaction (advanced level)
Understand the principles of viral pathogenesis at the organismal level

Understand the basic principles of viral pathogenesis at the molecular and cellular level

Understand the molecular mechanisms of innate viral defence, including viral pathogen recognition, signalling and the interferon response

Be able to analyse data dealing with virus-host interaction and place the findings in a broader context

C: <p style="margin: 0px; font-stretch: normal; line-height: normal; font-family: Verdana;">Teacher: Jérôme Gouttenoire

Basic principles of pathogenesis

--> Viral pathogenesis at the cellular level

--> Viral pathogenesis at the organism level

Innate defence against viruses

--> Receptors and signalling in innate antiviral defence, including the interferon response

<p style="margin: 0px; font-stretch: normal; line-height: normal; font-family: Verdana;">--> Means used by viruses to counteract the cell's antiviral response

Viral infection of the nervous system

--> Viral invasion of the central nervous system

--> Antiviral defence in the nervous system

Teaching: Combination of lectures and interactive exercises based on article analysis

B: Sera donnée lors du cours

FIRST STEP PROJECT

Richard Benton, Marie-Christine Broillet, Antoine Guisan, Tadeusz Kawecki, Laurent Lehmann, Marc Robinson-Rechavi

TP	Obl	English	224
A	15.0		

TP	Obl	English	280
A	15.0		

TP	Obl	English	250
A	14.0		

TP	Obl	English	224
A	15.0		

TP	Obl	English	224
A	15.0		

TP	Obl	English	224
A	15.0		

N: Master

P: Practicals performed during the bachelor (molecular biology, genetics, biochemistry, bioinformatics)

O: - An initiation to the work of a scientist
- Conduct experimental work in research lab (wet bench or in silico)
- Interpretation of research results
- Implement basic principles in experimental design (e.g. include the appropriate controls, statistical significance of the results etc...)
- Present your experimental work in a written report which will be organized like a typical research article (intruduction, results, discussion, materials and methods)
- present your work orally (seminar style)

C: Perform laboratory work for about 12 weeks during the time when the student does not follow theoretical classes. This research project will typically be performed under the guidance of a PhD student or a post-doc from the host laboratory.

UNIL | Université de Lausanne
Ecole de biologie

Master of Science in Molecular Life Sciences
2022-2023

Spring Semester (semester 2)

MODULE 3

Courses / Enseignements	Hours per semester C	E/S	PW	Teaching Staff	ECTS Credits	Limited nb of students
General and common activities - Compulsory / ***Activités générales et communes - Obligatoire***						
Sequence a Genome II *Séquençage d'un génome II*	14	28	-	**Engel P.**, tutors	3	
Write a Fellowship *Rédaction d'une demande de bourse*	7	-	-	**Benton R.,** tutors	3	
Subtotal	**21**	**28**	**-**		**6**	
Optional (choice -> 9 credits) * / ***Optionnel (choix -> 9 crédits)****						
Epigenetics and Cell Differentiation *Epigénétique et différenciation cellulaire*	8	6	-	**Gasser S.**	1.5	
Epitranscriptomics and RNA Dynamics *L'épitranscriptomique et la dynamique de l'ARN*	6	-	8	**Roignant J.-Y.**	1.5	
Genomics, Proteomics and Quantitative Genetics *Génomique, protéomique et génétique quantitative*	24	-	-	**Franken P.**, Tafti M., Quadroni M., Marquis J., Gambetta M.C.	3	
Herbivory : Why is the Earth Green ? *Herbivorie : pourquoi la terre est verte ?*	24	-	-	**Farmer E.**	3	6
Metabolic Signaling Pathways in Health and Disease *Les voies de signalisation métabolique dans des conditions normales et pathologiques*	6	8	-	**Fajas L**, Ziegler D., Geller S.	1.5	
Plant and Animal Domestication : from History to Molecular Mechanisms *Domestication des animaux et des plantes : de l'histoire aux mécanismes moléculaires*	12	12	-	**Soyk S.**	3	
Scientific Communication - Scientific Hands-on Workshop Module (in French only, MSc BEC) *Médiation scientifique - module atelier scientifique (MSc BEC)*	14	14	-	**Kaufmann A., Reymond P.,** Ducoulombier D., Trouilloud S., Ythier M.	3	8
LTK1 Module : Training in Animal Experimentation ** *Module LTK1 : expérimentation animale* **	20	-	20	**Broillet M.-C.,** Berthonneche C.	1.5	
Seminars Biology and Integrative Genetics (BIG) *Séminaires Biologie et Génétique Intégratives (BIG)*	-	-	-	**Farmer E.**	-	
Design and Build a Synthetic Biological System II (iGEM Project) *Concevoir et construire un système biologique synthétique II (projet iGEM)*	8	16	-	**Schaerli Y.**	-	
Advanced Population Genetics *Génétique des populations avancée*	14	6	-	**Malaspinas A.-S.**	3	20
Bioinformatic Algorithms *Algorithmes de bioinformatique*	15	15	-	**Dessimoz C.,** Gfeller D.	3	
Comparative Genomics : from Thousands of Genomes to Single Cells (MSc BEC) *Génomique comparative : des milliers de génomes aux cellules individuelles (MSc BEC)*	7	7	-	**Arguello R.**	1.5	
Industrial Bioinformatics *Bioinformatique industrielle*	14	-	-	**Xenarios I.**	1.5	15
Phylogeny and Comparative Methods (MSc BEC) *Phylogénie et méthodes comparatives (MSc BEC)*	14	14	-	**Salamin N.**	3	
Anti-Infective Agents *Agents anti-infectieux*	14	-	-	**Lamoth F.** Hauser P., Croxatto A., Ciuffi A.	1.5	
Bacterial Virulence and Pathogenesis *Virulence bactérienne et pathogenèse*	12	2	-	**Greub G.**, Hauser P., Jacquier N.	1.5	
Chromosome Organization and Dynamics *Organisation et dynamique des chromosomes*	4	10	-	**Gruber S.**	1.5	
Epidemiology of Human Pathogens *Epidémiologie de pathogènes humains*	14	-	-	**Blanc D.**, Manuel O., Lamoth F., Senn L., Opota O.	1.5	
Microbes as Tools in Experimental Biology *Les microbes comme outils de biologie expérimentale*	10	4	-	**Coste A., Ciuffi A.**	1.5	
Microbiome Analysis *Analyse du microbiome*	8	16	-	**van der Meer J.**	1.5	
Microbiomes *Microbiomes*	14	-	-	**van der Meer J.**	1.5	10
Viral Pathogenesis and Emerging Viruses *Pathogenèse virale et virus émergents*	8	6	-	**Ciuffi A.**, Gouttenoire J., Cagno V.	1.5	
Total					**15**	

*	Students can choose some courses of the Master of Science (MSc) in Behaviour, Evolution and Conservation (max 3 ECTS credits)
**	Only students who choose a master project with animal experimentation are allowed to select this course

Spring Semester (semester 2) and Autumn Semester (semester 3)

MODULE 4

Course / *Enseignement*		ECTS Credits	
Master Thesis **Travail de Master**	**Thesis Director**	**45**	

The pandemic has shown us that circumstances beyond our control may require us to make the following adjustments / adaptations to study plans during the semester:

- possibility to switch from one mode of teaching to another (face-to-face <-> distance, synchronous <-> asynchronous, switch to co-modal teaching where it was not initially planned).
- change / modification of evaluation modalities, without inducing derogations from the Study Regulations (oral <-> written, exam <-> validation, individual work <-> group work, practical work <-> theoretical work, face-to-face evaluation <-> online evaluation, etc.)
- alternative or time-shifted modalities for teachings, internships, practical work, fieldworks and camps that could not take place or teachings that could no longer take place in the form initially planned.

Students are invited to consult this document regularly (Study Plan & Evaluation Procedure)

SEQUENCE A GENOME (PART II)

Philipp Engel

C	Obl	English	14
S	3		

E	Obl	English	28
S			

N: Master

P: Sequence a genome I (compulsory)

O: The goals of the second part of this class are to learn how to carry out a comparative genome analysis. Groups of three students will work on different analysis project. At the end of the course the students will present their results to the other groups, try to integrate the different results and relate it to the biology of the organisms in question.

C: Following up on the first semester, students will carry out a comparative genome analsyis covering various aspects such as:
- Comparison of genome structures
- Inferring genome-wide phylogenetic trees
- Identifying clade-specific gene families
- Assessing gene family evolution
- Identifying mobile genetic elements
- Inferring gene functions by homology and literature search
- Working in a team and integrating results with other groups
- Writing and presenting the results

I: http://www.unil.ch/sequenceagenome/

WRITE A FELLOWSHIP

Richard Benton

C	Obl		English	7
S	3			

N: Master

O: - Construct meaningful hypotheses in the context of a particular open question in the field (typically related to the master project of the student)
- Develop an experimental strategy that tests these hypotheses
- Formulate this experimental strategy in the form of a grant application
- Present your work in a concise oral presentation
- Appreciate the granting system used to fund biological research

C: The student writes a research proposal that is typically addressing questions in the research area related to his/her master project. The research proposal has to follow precise guidelines. The student is closely supervised by his/her master supervisor who serves as the tutor for this course. The written proposal and a short oral presentation are both evaluated.

EPIGENETICS AND CELL DIFFERENTIATION

Susan Gasser

C	Opt	English	8
S	1.5		

E	Opt	English	6
S			

N: Master

O: Epigenetics in Development: Regulation of gene expression and of chromatin function is pivotal for the understanding of developmental programs, cellular homeostasis and many disease states. The transcription process is critically linked to the regulation of chromatin function. Epigenetic mechanisms such as histone modifications can transmit active/inactive states of a gene through cellular divisions, which are particularly relevant during early mammalian development. Epigenetic states also respond to stress and environmental factors. The study of transcription, chromatin regulation and early development received a great impetus through the availability of whole genome sequences, and novel high-throughput sequencing technologies. The integration of biochemistry, molecular biology, genomics, proteomics and cell biology now provides unprecedented insight into transcription and chromatin regulation in health and disease.

C: This course will cover the crucial concepts of regulation of gene expression by chromatin focusing on concepts derived from developmental and stress-response states. Epigenetics, chromatin and genome organization will be discussed. The themes we will discuss: genome/gene organization, chromatin remodeling and chromatin modifications, epigenetic inheritance, nuclear organization, C. elegans development and cell lineage specification. Even if you are only peripherally interested in the mechanisms of gene expression, epigenetics and development, this course is for you.

EPITRANSCRIPTOMICS AND RNA DYNAMICS

Jean-Yves Roignant

C	Opt	French	6
S	1.5		

TP	Opt	French	8
S			

N: Master

P: The student should already have some notions in gene regulation

O: The main goal of this module is to learn about a new player of gene regulation termed Epitranscriptomics. Epitranscriptomics is the study of RNA modifications and their role in the regulation of gene expression. Similar to modifications found on DNA and histones an extensive layer of base decorations was recently discovered in mRNAs and shown to undergo cell modulation. These modifications produce programmable fluctuations in mRNA levels, translatability and subcellular compartmentalization, affecting primary cell programs such as cell differentiation and response to stress. RNA modifications is as important as chromatin dynamics in shaping cell phenotypes and impairment of RNA modifications has been associated with numerous diseases including neurodegenerative diseases and cancers. This emerging field is hence crucial for both basic science and application to human disease. After completing this module the students will be able to detect a specific modification on the RNA and understand its implication on gene expression.

C: The content of this module includes four lectures of 90 minutes, two of which will be presented by invited international leaders in their field. In addition there will be a practical work of two afternoons where the students will learn how to detect a specific RNA modification on RNA. The techniques used include RNA extraction, primer ligation, reverse transcription and PCR.

B: https://www.sciencedirect.com/science/article/pii/B9780128236840000049

GENOMICS, PROTEOMICS AND QUANTITATIVE GENETICS

Paul Franken

C	Opt	English, French	24
S	3		

N: Master

O: Get acquainted with the various experimental approaches and technologies to address fundamental principles of gene and genome function

C: This course consists of four main components. Together these components introduce and give an overview of functional genomics from gene transcription to the protein, and, finally, the phenotype. Besides providing a background, the techniques applied in the various approaches will be emphasized.
1. Genomic technologies and applications:
- Sequencing technologies; from Sanger to Gattaca (history, technical principles, limitations, evolution, and future)
- Technical discussion about genomics applications, their interests and limitations
2. Epigenetics and chromatin structure:
- Currently used methods to study histone modifications, transcription factor occupancy, 3D genome folding, and nascent RNA transcription - in bulk and in single cells
- Pros and cons of each technique, and their suitability to answer specific biological questions
3. Proteomics:
- Introduction to expression proteomics (analysis of protein expression levels and their changes) and functional proteomics (functional relationships between proteins)
- Introduction to separation techniques (liquid chromatography, 2D electrophoresis, mass spectrometry), typical workflows in which these techniques can be applied, and bioinformatics analysis
- Discussion of the potential and limitations of the proteomics approach to study complex biological systems
4. Analysis of Quantitative Traits:
- Introduction into quantitative genetics and statistical issues related to mapping of Quantitative Trait Loci (QTL)
- Mapping strategies in humans and in model and non-model organisms
- Introduction to Systems Genetics
- Introduction to the use of a QTL mapping tool; WebQTL

HERBIVORY : WHY IS THE EARTH GREEN ?

Edward Elliston Farmer

C	Opt		English	24
S	3			

N: Master

P: Admission into the Masters programme and Bachelors in biology or a related subject

O: Understand why leaves are so abundant on earth

C: Leaf energetics and herbivore diets, physical defenses, coevolution of leaves and stomachs, molecular targets of leaf defense chemicals, the growth/defence dilemma
Note: this is an interactive, question-based course requiring active participation
May involve some field trips depending on weather, Covid etc.

B: Fourni sur MyUNIL avant et durant le cours

METABOLIC SIGNALING PATHWAYS IN HEALTH AND DISEASE

Lluis Fajas Coll

C	Opt	French	6
S	1.5		

E	Opt	French	8
S			

N: Master

PLANT AND ANIMAL DOMESTICATION : FROM HISTORY TO MOLECULAR MECHANISMS

Sebastian Soyk

E	Opt	English	12
S			

C	Opt	English	12
S	3		

N: Master

P: Bachelor-level knowledge in genetics, genomics, molecular biology, and/or development is recommended. Having passed one or more bachelor level lectures in genetics, genomics, or developmental biology is of advantage.

O: Provide an overview of the genetic diversity present in species and how this was used by mankind in the process of domestication.
Learn how to orally present a scientific paper about this topic to your fellow students.

C: - A brief history of agriculture
- Genetic basis underlying the diversity in species
- Methods used by humans to select plant and animal varieties used in agriculture
- How can major domestication traits be identified?
- Examples of domestication traits such as behaviour, seed shattering, taste (e.g. bitterness in cucumber), altitude adaptation, latitude adaptation, requirement for vernalization.

SCIENTIFIC COMMUNICATION - SCIENTIFIC HANDS-ON WORKSHOP MODULE

Alain Kaufmann, Philippe Reymond

C	Opt	French	14
S	3		

E	Opt	French	14
S			

N: Master

LTK1 MODULE : TRAINING IN ANIMAL EXPERIMENTATION

Marie-Christine Broillet

C	Opt	English	20
A S	1.5		

TP	Opt	English	20
S			

N: Master

O: Learning outcomes
To acquire the practical and theoretical skills with laboratory animals as requested by legislation (Swiss ordinance N° 455.171.2, October 1998) to get the accreditation to perform animal experimentation delivered by the Federal Veterinary Office.
This course (20h theory + 20h practical) will be recognized by the Swiss federal veterinary office to undertake animal experiments.

C: What is animal experimentation?
Any interventions in which live animals are used to :
- Test a scientific hypothesis in various fields (behavior, neurology, metabolism, immunology, cardiovascular...)
- Verify the effects of a particular procedure on an animal
- Test a substance (pharmacology, toxicology...)
- Collect or examine cells, organs or body fluids
- Education, training and continuing education

Choosing an appropriate animal model
- Before an animal model is chosen, investigators must consider alternatives to the use of live animals (3Rs)
- Investigators must consider all factors when selecting the best model for research

Who is concerned by this module?
This training module is relevant to all students working with animals during their master project.
Conditions for registration to this module:
- The host laboratory must have permission to work with animals
- Students must be announced to the cantonal veterinary office

ADVANCED POPULATION GENETICS

Anna Sapfo Malaspinas

C	Opt	English	14
S	3		

E	Opt	English	6
S			

N: Master

B: Textbooks and relevant articles:
Mark Stoneking, An introduction to Molecular Anthropology
John Wakeley, Coalescent theory, an introduction
Nielsen, R. et al. Tracing the peopling of the world through genomics. Nature 541, 302-310 (2017).
Novembre, J. et al. Genes mirror geography within Europe. Nature 456, 98-101 (2008).
Green, R. E. et al. A complete Neandertal mitochondrial genome sequence determined by high-throughput sequencing. Cell 134, 416-426 (2008).
Nordborg, M. On the probability of Neanderthal ancestry. Am J Hum Genet 63, 1237-1240 (1998) (theoretical paper)
Green, R. E. et al. A Draft Sequence of the Neandertal Genome. Science 328, 710-722 (2010)

BIOINFORMATIC ALGORITHMS

Christophe Dessimoz

C	Opt	English	15
S	3		

E	Opt	English	15
S			

N: Master

P: The course assumes familiarity with basic programming concepts (variable and function declaration, arrays, for-loops, conditional statements, etc.). Algorithms are introduced from a practical angle so the mathematical formalism is kept at a minimum.

O: The course aims at improving the student's programming skills by gaining a deep understanding of some of the key algorithms in bioinformatics, with a special emphasis on sequence and graph algorithms. Students will learn widely applicable concepts, such as asymptotic time complexity, binary search, dynamic programming, hashing. Practicals and home assignments are essential parts of the course. The language of the course is Python, though the concepts covered in the course are applicable to all computer languages.
More info, including dates, rooms, and link to Moodle page:
https://lab.dessimoz.org/teaching/bioinfalgo/

COMPARATIVE GENOMICS: FROM THOUSANDS OF GENOMES TO SINGLE CELLS

Roman Arguello

C	Opt	English	7
S	1.5		

E	Opt	English	7
S			

N: Master

O: An introduction to central topics and questions in comparative genomics and molecular evolution

C: 1. Intro
A. what is a genome and the concept of heredity?
B. broad differences in the tree of life
C. principle factors influencing genome architecture
D. are genomes optimized? (early thoughts on selection)
2. Population Variation vs. Divergence: how do genetic changes arise?
3. Evolution of Genome Architecture
4. Origin of New Genes
5. Evolution of Gene Families
6. Evolution of Transcriptomes
7. Single Cell Transcriptomics
8. (depending on time) Ancient DNA and Evolution

INDUSTRIAL BIOINFORMATICS

Ioannis Xenarios

C	Opt	English	14
S	1.5		

N: Master

PHYLOGENY AND COMPARATIVE METHODS

Nicolas Salamin

C	Opt	English	14
S	3		

E	Opt	English	14
S			

N: Master

P: none

O: Phylogenetic reconstruction methods and their application in evolutionary biology. To know and understand phylogenetic reconstruction methods in order to test the processes leading to genes and organisms evolution.

C: The subjects will be presented during lectures as well as practicals.
I. Reconstruction methods
- What is a phylogenetic tree and how to interpret it?
- Tree reconstruction:
a) optimisation criteria and models of evolution
b) search for the optimum tree
c) Bayesian methods
- Can we trust the inferred tree?
II. Uses for phylogenetic trees
- Detecting positive selection in a coding gene
- Testing coevolution and cospeciation
- Macroevolution:
a) dating evolutionary events
b) tempo and mode of evolution
c) testing for key innovations
- Phylogeny and conservation

B: Felsenstein, J. 2003. Inferring phylogenies. Sinauer Associates.
Page, R. 2003. Tangled trees: Phylogeny, cospeciation, and coevolution. University of Chicago Press.
Purvis, A., Gittleman, J.L. and Brooks, T. 2005. Phylogeny and conservation. Cambridge University Press.
Swofford, D.L., Olsen, G.K., Waddell, P.J. and Hillis, D.M. 1996. Phylogeny reconstruction. Pages 407-514 In Molecular Systematics (D.M. Hillis, C. Moritz, B.K. Mable, eds.). Sinauer Associates.
Yang, Z.H. 2006. Computational Molecular Evolution. Oxford University Press.

I: http://www.unil.ch/phylo/teaching/pmc.html

ANTI-INFECTIVE AGENTS

Frédéric Michel Lamoth

C	Opt	English	14
S	1.5		

N: Master

O: Description:
The aims of this class is to understand the mode of action and resistance to principal anti-infective agents used for the therapy of infectious diseases. Diverse classes of agents will be discussed which are used to combat bacterial, viral, fungal and parasitic infections. The molecular basis of resistance to these agents will be also illustrated by several examples.
The class is also associates with paper reading and presentations

The practical part consists of a visit of the laboratory of clinical microbiology with a demonstration of the phenotypic and genotypic testing for the the detection of antimicrobial resistance.
Learning outcomes:
- to learn about the mode of actions of anti-infective agents
- to learn about molecular resistance mechanisms developing in microbial pathogens.

C:

- Antiviral agents (4h): Prof. Angela Ciuffi

- Antibacterial agents (4h): PD Dr. Sylvain Meylan

- Antiparastic agents (2h): PD Dr. Philippe Hauser

- Antifungal agents (3h): Prof. Frédéric Lamoth

- Practical part (1h): Dr. Damien Jacot

BACTERIAL VIRULENCE AND PATHOGENESIS

Gilbert Greub

C	Opt	English	12
S	1.5		

E	Opt	English	2
S			

N: Master

CHROMOSOME ORGANIZATION AND DYNAMICS

Stephan Gruber

E	Opt	English	10
S			

C	Opt	English	4
S	1.5		

N: Master

P: None

O: 1) Getting to know a new technology for chromosome and genome biology: «chromosome conformation capture»
2) Familiarize with main «chromosome architecture proteins» in theory and practice (TP)

C: 1) Basis of chromosome conformation capture and applications (Hi-C)
a) From single bacterial chromosomes to complex genomes
b) Gene regulation, genome evolution & human disease
2) From proteins and DNA towards folded chromosomes
a) SMC protein complexes: Architecture, action, function
b) Advanced protein purification on ÄKTA systems (hands-on)
Research on chromosome dynamics has made excellent progress in recent years driven by a technological revolution ('conformation capture' or 3C or Hi-C) with implications for our understanding of fundamental processes as well as disease-related mechanisms. This module aims to provide an overview of these recent advances.
6 hr lectures (on Zoom)
3 hr paper discussion (on Zoom)
8 hr TP (protein purification on äkta purifier) (in real life - in small groups of max. 3 students to get hand-on experience)

I: see my.unil.ch/cours

EPIDEMIOLOGY OF HUMAN PATHOGENS

Dominique Blanc

C	Opt	English	14
S	1.5		

N: Master

O: Acquire principles of epidemiology by the study of several examples of pathogens. Knowledge on molecular typing methods and their applications. Knowledge on bacterial population genetics.

C: General concepts. Introduction to epidemiology of infectious diseases. Molecular and genomic typing in epidemiology. Bacterial population genetics.
Epidemiology of bacteria.
Epidemiology of virus.
Epidemiology of tuberculosis.
Epidemiology of fungi.

MICROBES AS TOOLS IN EXPERIMENTAL BIOLOGY

Angela Teresa Ciuffi, Alix Coste

C	Opt	English	10
S	1.5		

E	Opt	English	4
S			

N: Master

O: The general aim of this class is to get detailed knowledge on the use of microbial systems (including viruses, bacteria and yeast) as tools in several fields of experimental biology (microbial pathogenesis, genetic engineering applications, gene therapy).
The class is associated with reading and presentations of paper related to this topic.

C: Part Ciuffi
Description :
The aim of this class is to open up your mind and make you think out of the box, thereby making you look at viruses beyond their pathogenicity and more as potential tools that can be used for many diverse applications.
To appreciate the potential of viruses as tools in molecular biology, this class will give you a non-exhaustive list of applications in which viruses are used as tools.
Examples will include the use of viruses as pesticides, gene delivery vehicles, vaccines, tools in gene expression studies and in cellular biology studies.
Learning outcomes :
- To realize that viruses are not only pathogens.
- To realize that viruses can be used as tools in multiple applications.
- To understand that fundamental knowledge about viruses can be useful for secondary applications.
- To appreciate the diversity of viruses and their differences in replication, and thus the diversity of applications in which they can be exploited.
- To identify the viral steps that can be manipulated. To know how to manipulate these viral steps and why.
- To appreciate impact of viruses in the current society.
Part Sanglard/Coste
Description:
The aims of this class is to show the importance of genetic screens for the identification of novel biological functions related to microbial virulence and to therapeutic targets. Specifically, the aims are the following:
- To understand how genetic screens can contribute to identify virulence factors in bacteria and yeast.
- To show how genetic screens can serve the identification of genes involved in the recognition of fungal PAMP by the immune system.
- To show how genetic screens can contribute to identify novel therapeutic targets in pathogenic yeast.
Learning outcomes:
- To appreciate how methodologies can be employed in genetic screens.
- To realize how bacterial and yeast genetics can address and solve biological problems.

MICROBIOME ANALYSIS

Jan Roelof van der Meer

C	Opt	French	8
S	1.5		

E	Opt	French	16
S			

N: Master

P: None. Practicals will involve working with R.

O: The goal of this class is to give an overview of different host-related and environmental microbiomes, of theory on microbiome development and community growth, and to explain a number of regular microbiome analysis tools. This really cool class will involve different teachers and collaborators working within the National Centre of Competence in Research on Microbiomes. It will consist both of frontal presentations, questions and discussion sessions, and practical work.
Teachers are: Pascale Vonaesch, Jordan Vacheron, Joanito Liberti, Senka Causevic, Helena Todorov, Maxime Batsch, Jeanne Tamarelle, Daniel Garrido and Jan van der Meer (all from UNIL); Joao Matias Rodriguez (UNIZH), Guillem Salazar, Alessio Milanese and Sebastian Pfeilmeier (ETHZ).

C: Content is still open to last-minute changes, but will likely consist of the following lectures:
- General overview on microbiomes: what are they, how do they function?
- Diversity analysis techniques
- High-througput functional techniques
- Meta-omics techniques
- The soil microbiome
- The rhizosphere microbiome
- The plant leaf microbiome
- The human and animal gut microbiome
- Gut-brain axis

The following practicals are being prepared:
- soil microbiome diversity
- metatranscriptomic data analysis
- microbeAtlas

B: Course material will be uploaded on Moodle shortly before the classes.

MICROBIOMES

Jan Roelof van der Meer

C	Opt		English	14
S	1.5			

N: Master

P: none.

O: The goal of this class is to develop a small literature project independently on a topic of choice in microbiome microbiology.
Maximum number of participants: 10

C: The topics of this class are chosen by the students individually, in discussion with the class tutor.

VIRAL PATHOGENESIS AND EMERGING VIRUSES

Angela Teresa Ciuffi

C	Opt	English	8
S	1.5		

E	Opt	English	6
S			

N: Master

P: Virologie BSc Course. 5th semester
Virus-Host Interactions Course, Master MLS 7th semester

O: The course will cover fundamental principles of viral pathogenesis at the molecular, systemic, and population level. Individual teaching blocks will be given by experts in the field that cover the pathogenesis of major human viral diseases, including viral hepatitis (Gouttenoire), human retroviruses (Ciuffi), and respiratory viruses (Cagno), and discussing landmark papers in the field. A last block will illustrate the power of genome screening approaches to identify host factors that confer susceptibility to viral infection and play a role in pathogenesis (Ciuffi).

C: Teaching: Angela Ciuffi, Jérôme Gouttenoire, Valeria Cagno
Respiratory viruses: Influenza, Rhinoviruses, Coronaviruses (V. Cagno)
Viral hepatitis (J. Gouttenoire)
Human retroviral infections (A. Ciuffi)
Genome screening approaches in viral infectious diseases (A. Ciuffi)
Introductory lectures will be given by the teachers.
Landmark papers will be presented by students and discussed in the group.

B: Viral Pathogenesis and Immunity. Nathanson, N. (Ed), 2nd Ed. 2007, Academic Press.