Course directory 2016.2017

school of Biology (FBM-BIO)
Master

* your selection

> Biology > Master of Science in Molecular Life Sciences

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/**

Generated on : 04.04.2017

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
2016-2017

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)

Autumn Semester (semester 1)

	Courses / *Enseignements*	Hours per semester C	E/S	PW	Teaching Staff	ECTS Credits	Limited nb of students
MODULE 1	**General and common activities - Compulsory /** ***Activités générales et communes - Obligatoires***						
	Retreat and BIG Seminars *Retraite et séminaires BIG*	-	-	-	**Fankhauser C., …**		
	Sequence a Genome I *Séquençage d'un génome I*	14	30	-	**van der Meer J.,** Robinson-Rechavi M., Engel P., tutors	3	
	Write a Review *Rédaction d'une revue*	15	-	42	**Fankhauser C.,** Sohrmann M., tutors	4	
	Critical Readings of Scientific Literature *Lectures critiques de la littérature scientifique*	-	-	56			
	Subtotal	**29**	**30**	**98**		**7**	
	Optional (choice -> 9 credits) / ***Optionnel (choix -> 9 crédits)***						
	Biotechnology *Biotechnologie*	14	-	-	**Poirier Y.,** Mermod N.	1.5	
	Development of the Nervous System *Développement du système nerveux*	14	-	-	**Braissant O.**	1.5	
	Human Molecular Genetics *Génétique moléculaire humaine*	14	-	-	**Rivolta C.**	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	
	Plant Interactions with Microbes and Insects *Interactions des plantes avec les microbes et les insectes*	14	-	-	**Keel C.**, Farmer E.	1.5	
	Protein Homeostasy and Adaptation of Organisms to Stress *Adaptation des organismes au stress et homéostasie des protéines*	14	-	-	**Goloubinoff P.**	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.**	-	
	Advanced Data Analysis in Biology I-II (compulsory for Bioinformatics specialisation) *Analyse de données en biologie I-II : niveau avancé*	12	-	12	**Schütz F.**	4.5	
	Case Studies in Bioinformatics (compulsory for Bioinformatics specialisation) *Etudes de cas en bioinformatique*	12	24	-	**Bergmann S.,** others	2.5	
	Programming for Bioinformatics (compulsory for Bioinformatics specialisation) *Programmation pour bioinformatique*	7	14	-	**Salamin N.**	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	-	-	**Sanglard D.**	1.5	
	Immunology with Relevance to Infectuous Diseases *Immunologie et maladies infectieuses*	14	-	-	**Nardelli D.**, Roger T.	1.5	
	Virus-Host Interactions *Interactions virus-hôtes*	14	-	-	**Kunz S.**, Meylan P.	1.5	
	Total					**16**	
MODULE 2	**Practical Project /** ***Travail pratique***						
	First Step Project *Travail d'initiation à la recherche*	-	-	250	**Fankhauser C.**	**14**	

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

Condition to obtain the specialisation / Condition pour obtenir une spécialisation

Specialisation Bioinformatics :
Obtain 9 ECTS credits in the field of Bioinformatics (marked in 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.

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).

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Ecole de biologie

Master of Science in Molecular Life Sciences
2016-2017

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	-	**van der Meer J.,** Robinson-Rechavi M., Engel P., tutors	3	
Write a Fellowship *Rédaction d'une demande de bourse*	7	-	-	**Fankhauser C.,** Sohrmann M., tutors	3	
Subtotal	**21**	**28**	**-**		**6**	
Optional (choice -> 9 credits) * / ***Optionnel (choix -> 9 crédits)****						
Genomics, Proteomics and Quantitative Genetics *Génomique, protéomique et génétique quantitative*	24	-	-	**Franken P.**, Tafti M., Quadroni M., Harshman K., Hor C.	3	
Herbivory : Why is the Earth Green *Herbivorie : pourquoi la terre est verte*	24	-	-	**Farmer E.**	3	8
Plant and Animal Domestication : from History to Molecular Mechanisms II *Domestication des animaux et des plantes : de l'histoire aux mécanismes moléculaires II*	-	12	-	**Fankhauser C., Hardtke C.**	3	
Plant and Animal Domestication : from History to Molecular Mechanisms I (support course) *Domestication des animaux et des plantes : de l'histoire aux mécanismes moléculaires I (mise à niveau)*	12	-	-	**Hardtke C.,** Fankhauser C.	-	
Recombinant Proteins: Applications in Research and Medicine *Protéines recombinantes : application en recherche et en médecine*	12	-	-	**Corthésy B.**	1.5	
Scientific Mediation and Communication - Scientific Hands-on Workshop Module (in French only, MSc BEC) *Communication et médiation scientifique - module atelier scientifique (MSc BEC)*	8	-	20	**Michalik L., Kaufmann A.,** Ducoulombier D., Trouilloud S.	3	6
Seminars Biology and Integrative Genetics (BIG) *Séminaires Biologie et Génétique Intégratives (BIG)*	-	-	-	**Martin S.**	-	
Supplement : Sequence a Genome *Enseignement complémentaire : Séquençage d'un génome*	-	14	10	**van der Meer J., Sentchilo V.**	1.5	
Bioinformatic Algorithms *Algorithmes de bioinformatique*	15	15	-	**Dessimoz C.,** Gfeller D.	3	
Industrial Bioinformatics *Bioinformatique industrielle*	14	-	-	**Xenarios I.**	1.5	12
Phylogeny and Comparative Methods **(MSc BEC)** *Phylogénie et méthodes comparatives (MSc BEC)*	7	14	-	**Salamin N.**	1.5	
Anti-Infective Agents *Agents anti-infectieux*	14	-	-	**Sanglard D.**, Hauser P., Croxatto A., Ciuffi A.	1.5	
Bacterial Virulence and Pathogenesis *Virulence bactérienne et pathogenèse*	14	-	-	**Greub G.**, Hauser P., Jacquier N.	1.5	
Chromosome Organization and Dynamics *Organisation et dynamique des chromosomes*	-	14	-	**Gruber S., vacat**	1.5	
Environmental Microbiology *Microbiologie environnementale*	14	-	-	**van der Meer J.,** Sentchilo V.	1.5	
Epidemiology of Human Pathogens *Epidémiologie de pathogènes humains*	14	-	-	**Blanc D.**, Hauser P., Meylan P., Zanetti G., Sanglard D.	1.5	
Microbes as Tools in Experimental Biology *Les microbes comme outils de biologie expérimentale*	10	4	-	**Sanglard D.,** Ciuffi A.	1.5	
Microbial Cytoskeleton - A Scientific Writing Class *Cytosquelette microbien - écriture scientifique*	4	10	-	**Martin S.,** Collier J.	1.5	
Viral Pathogenesis and Emerging Viruses *Pathogenèse virale et virus émergents*	14	-	-	**Kunz S.,** Gouttenoire J., Ciuffi A.	1.5	
Total					**15**	

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

MODULE 4

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

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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.

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

* Students can choose some courses of the Master of Science (MSc) in Behaviour, Evolution and Conservation (max 3 ECTS credits)

BIOLOGICAL SECURITY

Patrick Michaux

C	Obl		french	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.

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

Christian Fankhauser, Jan Roelof Van Der Meer

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 program. Each year we also invite a speaker from the non-academic world (e.g. in the past we had speakers from Nestlé, Novartis,...). We also start the course "write a review" 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)

Marc Robinson-Rechavi, Jan Roelof Van Der Meer

C	Obl		english	14
A	3.00			

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

Christian Fankhauser

C	Obl	english	15
A	4.00		

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.

BIOTECHNOLOGY

Nicolas Mermod, Yves Poirier

C	Opt	english	14
A	1.50		

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?
Do I wish to pursue a career in biotechnology?
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
Cells as factories for medicine and industry
Gene engineering
Cell engineering
Red biotechnology (e.g. for medical use)
Agriculture and transgenesis

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

DEVELOPMENT OF THE NERVOUS SYSTEM

Olivier Braissant

C	Opt		english	14
A	1.50			

N: Master

HUMAN MOLECULAR GENETICS

Carlo Rivolta

C	Opt	english	14
A	1.50		

N: Master

P: - Knowledge of concepts of genetics and molecular biology

O: - Provide advanced knowledge on human molecular genetics
- Learn how to exploit the massive amounts of data stored in in silico repositories for specific experimental purposes
- Understand the bases of functional analyses of genes involved in inherited disease via the use of cellular and animal models

C: - The course will take monogenic hereditary conditions in humans as an example to describe the link between DNA variants and phenotypes
- Classes will follow the threads "from observation to the DNA", "from the DNA to the gene" and "from gene to function" to illustrate classical scenarios of genetic investigations in humans
- Several experimental strategies leading to the identification and the validation of DNA variants determining simple human phenotypes will be described
- The program will rely heavily on "hands-on" approaches, allowing the student to perform practical exercises by using the information present in on-line databases. All classes will be held in a room equipped with individual computers connected to the internet

B: In principle, no textbook is needed. However, additional information related to the course can be found in:
- Strachan & Read, Human Molecular Genetics, 3rd issue. Garland Science Ed. ISBN 0-8153-4184-9

MOLECULAR MECHANISMS OF EVOLUTION

Richard Benton

C	Opt	english	14
A	1.50		

N: Master

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

O: To acquire an understanding of the genetic, molecular and cellular mechanisms underlying major developmental processes in insects and plants.
To appreciate the evolutionary similarities and differences in these processes between closely- and distantly-related organisms.
To acquire skills in reading, analysis, criticism, oral presentation and written summary of scientific research articles.

C: "Mechanisms of evolution of plant structure and function":
- How do differences in leaf shape arise?
- How is flower morphology changed and selected for?
- Adaptations of plants to differences in growth environments
- Mechanisms driving speciation
These topics will be introduced through 2 hours lectures, and 6 hours of student paper presentations.
"Germline and sex determination in insects and beyond":
- Genetic basis of germline specification and development in Drosophila and comparison with other invertebrates and vertebrates.
- Genetic basis of sex determination in Drosophila and comparison with other invertebrates and vertebrates.
These topics will be introduced through 2 hours lectures, and 6 hours of student paper presentations.

PLANT FUNCTIONAL GENETICS

Yves Poirier

C	Opt	english	14
A	1.50		

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
Tilling
RNAi
Homologous recombination

PLANT INTERACTIONS WITH MICROBES AND INSECTS

Christoph Keel

C	Opt	english	14
A	1.50		

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.

PROTEIN HOMEOSTASY AND ADAPTATION OF ORGANISMS TO STRESS

Pierre Goloubinoff

C	Opt		english	14
A	1.50			

N: Master

O: Study of the physiology and biochemisty of the response to abiotic stresses in bacteria, animals and plants.

C: Introduction. Definitions of stress. The concept of dose.
The study of various types of abiotic stress : high/low temperatures, excess or lack of water, excess or lack of ions, salt,. Oxydative stress.
How are these stresses perceived? Transduction of the signal. Defense and repair mechanisms in animals and higher plants.
Molecular chaperones. Proteases.
Osmolites.
The ROS detoxification enzymes.
Conclusion the role of abiotic stress in the evolution of species.

SCIENTIFIC RESEARCH IN ALL ITS FORMS

Delphine Preissmann

C	Opt	2	french	14
A	1.50			

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 emotions. 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

ADVANCED DATA ANALYSIS IN BIOLOGY I

Frédéric Schütz

C	Obl/Opt	english	6
A	2.00		

TP	Obl/Opt	english	6
A			

N: Master

ADVANCED DATA ANALYSIS IN BIOLOGY II

Frédéric Schütz

C	Opt	english	6
A	2.50		

TP	Opt	english	6
A			

N: Master

CASE STUDIES IN BIOINFORMATICS

Sven Bergmann

C	Opt	english	12
A	2.50		

E	Opt	english	24
A			

N: Master

PROGRAMMING FOR BIOINFORMATICS

Nicolas Salamin

C	Opt	english	7
A	2.00		

E	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

C	Opt		english	14
A	1.50			

N: Master

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

O: - Appreciate the history and founding principles of microbial genetics.
- 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 the design of genetic screens using bacteria (JC)
- Lecture on eukaryotic genetics (SP)
- Assisted and critical reading of historical (example: discovery of the genetic code) and modern publications (examples: identification of all the essential genes of a bacteria, global analysis of protein localization in yeast, or synthesis of a complete eukaryotic chromosome)

BACTERIA GENOMES AND GENOME EVOLUTION

Jan Roelof Van Der Meer

C	Opt	english	14
A	1.50		

N: Master

O: Discover and understand the variety and diversity in global energy metabolism among bacteria
Interpret bacterial metabolism with the help of genomic data

C: The class is a mix of subjects that are introduced by the teacher, classical reading and questioning, and metabolic database practicing
1) Overview of utilities for interpretation of bacterial genomes (databases, online programs) - Self-learning and practise using specific examples
2) Selected examples of bacterial genomes in relation to their energy metabolism (phototrophs, hydrogen producers, electricity producers, alkane degradation)
3) Understanding bacterial genome evolution (literature reading)

B: Ad hoc research articles.

FUNGAL VIRULENCE AND PATHOGENICITY

Dominique Sanglard

C	Opt	english	14
A	1.50		

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: A first part of the lecture will be given by D. Sanglard (8h)
1) Characteristics of principal fungal pathogens
Candida, Cryptococcus, Aspergillus, Pneumocystis, Dermatophytes
2) Fungal cell walls: interface with the environment
3) Host/pathogen interactions, virulence and dimorphism
4) Strategies of fungi used for host survival
5) Papers discussions
A second part will be given by P. Hauser:
Pneumocystis and dimorphic fungal pathogens
1) Presentation of the medical aspects, epidemiology, virulence factors, and pathogenicity of Pneumocystis jirovecii and dimorphic fungal pathogens (2 h).
2) Analysis of a research related article (1 h)
3) Demonstration in the laboratory of the methods used for identification and drug sensitivity measurement of clinically important fungi (1 h).
A third part will be given by M. Monod:
1) Aspergilli
2) Relevance of aspasrtic proteases in virulence (2h)
3) Demonstration in the laboratory of the methods used for identification of clinically important fungi (1 h)
4) Analysis of a research related article (1 h).

IMMUNOLOGY WITH RELEVANCE TO INFECTUOUS DISEASES

Denise Nardelli Haefliger

C	Opt	english	14
A	1.50		

N: Master

VIRUS-HOST INTERACTIONS

Stefan Kunz

C	Opt	english	14
A	1.50		

N: Master

P: Cours virologie générale 5th semester (20 hours) Kunz

O: To understand fundamental principles of virus-host interaction at an advanced level.
To understand basic principles of virus cell pathology.
To understand the molecular and cellular mechanisms of innate anti-viral immunity, including pathogen recognition, signaling, and the cellular interferon response.
To understand the basic principles of viral pathogenesis at the systemic level.

C: Teaching: Pascal Meylan, Jérôme Gouttenoire, Stefan Kunz
Innate defense against viruses (S. Kunz)
Receptors and signaling of innate anti-viral defense
The interferon response
Virus infection and anti-viral defense in the nervous system (S. Kunz)
Virus invasion of the central nervous system
Anti-viral defense in the nervous system
Basic principles of cellular and molecular viral pathogenesis (J. Gouttenoire)
Viral pathogenesis at the level of the organism (P. Meylan)
Lectures combined with discussion of key papers in the course

B: Sera donnée lors du cours

FIRST STEP PROJECT

Christian Fankhauser, Jérôme Goudet, Olivier Staub

TP	Obl	english	224
A	15.00		

TP	Obl	english	282
A	15.00		

TP	Obl	english	250
A	14.00		

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.

SEQUENCE A GENOME (PART II)

Marc Robinson-Rechavi, Jan Roelof Van Der Meer

C	Obl	english	14
S	3.00		

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 and complete the annotation process of the bacterial genome, and to specifically relate the annotation to the biology of the organism in question

C: Again different sessions that follow up on the first semester:
- Combinatorial and multiplex PCR to detect contig linkages
- PCR sequencing to finish segments between contigs
- Introduction to GenDB
- Automated and manuel annotation of relevant parts of the genome under scrutiny
- Linkages to KEGG database for metabolic interpretations
- Evolutionary comparisons
- Writing and presenting the results

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

WRITE A FELLOWSHIP

Christian Fankhauser

C	Obl	english	7
S	3.00		

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 master project. The research proposal has to follow precise guidelines. The student is closely supervised by his master supervisor who serves as the tutor for this course. The written proposal and a short oral presentation are both is evaluated.

GENOMICS, PROTEOMICS AND QUANTITATIVE GENETICS

Paul Franken

C	Opt	english, french	24
S	3.00		

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 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.
Genomic technologies and applications
- Advanced techniques in microarray analysis: Tiling arrays, SNP detection, ChIP on chip experiments.
- Biology of non-coding RNAs and their detection
- qPCR, theory and applications.
Epigenetics and Chromatin structure
-What is epigenetics?
-Dynamics of chromatin structure
-Pros and cons of the techniques utilized to quantify/identify chromatin modifications
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.
Analysis of Quantitative Traits
- Introduction into quantitative genetics.
- How to map quantitative traits in model organisms (mice, fruitfly)?
- Mapping strategies in humans and in non-model organisms.
- Introduction to the use of Quantitative-Trait-Loci mapping tools using WebQTL and statistical issues in QTL mapping.

HERBIVORY : WHY IS THE EARTH GREEN

Edward Elliston Farmer

C	Opt	english	24
S	3.00		

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

B: Fourni sur MyUNIL avant et durant le cours

PLANT AND ANIMAL DOMESTICATION : FROM HISTORY TO MOLECULAR MECHANISMS II

Christian Fankhauser, Christian Hardtke

E	Opt	english	12
S	3.00		

N: Master

P: BSc level understanding of genetics.

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 master & bachelor 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.

RECOMBINANT PROTEINS : APPLICATIONS IN RESEARCH AND MEDICINE

Blaise Corthésy

C	Opt		english	12
S	1.50			

N: Master

SCIENTIFIC MEDIATION AND COMMUNICATION - SCIENTIFIC HANDS-ON WORKSHOP MODULE

Alain Kaufmann, Liliane Michalik

C	Opt	french	8
S	3.00		

TP	Opt	french	20
S			

N: Master

SUPPLEMENT : SEQUENCE A GENOME

Vladimir Sentchilo, Jan Roelof Van Der Meer

E	Opt	english	14
S	1.50		

TP	Opt	english	10
S			

N: Master

BIOINFORMATIC ALGORITHMS

Christophe Dessimoz

C	Opt	english	16
S	3.00		

E	Opt	english	16
S			

N: Master

INDUSTRIAL BIOINFORMATICS

Ioannis Xenarios

C	Opt		english	14
S	1.50			

N: Master

PHYLOGENY AND COMPARATIVE METHODS

Nicolas Salamin

C	Opt	english	7
S	1.50		

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

Dominique Sanglard

C	Opt		english	14
S	1.50			

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
Learning outcomes:
- to learn about the mode of actions of anti-infective agents
- to learn about molecular resistance mechanisms developing in microbial pathogens.

C: Part Ciuffi: Antiviral agents (2h)
Part Greub and Hauser: antibacterial agents (4 each); paper discussion and presentation
Part Sanglard: Antifingal agents (3h)

BACTERIAL VIRULENCE AND PATHOGENESIS

Gilbert Greub

C	Opt		english	14
S	1.50			

N: Master

CHROMOSOME ORGANIZATION AND DYNAMICS

Stephan Gruber

E	Opt	english	14
S	1.50		

N: Master

ENVIRONMENTAL MICROBIOLOGY

Jan Roelof Van Der Meer

C	Opt	english	14
S	1.50		

N: Master

EPIDEMIOLOGY OF HUMAN PATHOGENS

Dominique Blanc

C	Opt	english	14
S	1.50		

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. Molecular typing in epidemiology. Bacterial population genetics.
Viral infections: relation between the host range, timing of infection, mode of infection and the resulting epidemiology.
Epidemiology of Staphylococcus aureus.
Epidemiology of Pneumocystis.
Epidemiology of Candida.

MICROBES AS TOOLS IN EXPERIMENTAL BIOLOGY

Dominique Sanglard

C	Opt	english	10
S	1.50		

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
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.

MICROBIAL CYTOSKELETON - A SCIENTIFIC WRITING CLASS

Sophie Martin

E	Opt	english	10
S	1.50		

C	Opt	english	4
S	1.50		

N: Master

P: A good knowledge of molecular and cellular biology Bachelor-level courses.
Curiosity for cellular processes.

O: The objectives of this course are to:
1) gain general knowledge on the organisation and function of the cytoskeleton in prokaryotes and eukaryotes
2) learn to read scientific articles in a critical manner, by discussing the strong and weak points of each article.

C: The course will introduce the following topics:
- general principles of the actin and microtubule cytoskeleton
- cytoskeletal dynamics (dynamic instability and treadmilling)
- motor proteins
- organisation and role of the cytoskeleton in bacteria
- organisation and role of the cytoskeleton in eukaryotic cells (several themes will be covered, depending on the choice of the articles to be discussed, for instance: mitotic spindle, cell division, cell polarity,...)

B: Les papiers à lire et discuter seront annoncés lors du premier cours

VIRAL PATHOGENESIS AND EMERGING VIRUSES

Stefan Kunz

C	Opt	english	14
S	1.50		

N: Master

P: Cours Virologie BSc. 5th semester (S. Kunz)

O: To understand fundamental principles of viral pathogenesis at the cellular, systemic, and population level.
To cover the pathogenesis of major human viruses and emerging viral diseases.
To discuss the basic concepts of viral pathogenesis in the context of landmark papers in the field.

C: Teaching: Angela Ciuffi, Jérôme Gouttenoire, Stefan Kunz
Basic concepts in viral pathogenesis (S. Kunz)
Major human pathogenic viruses and emerging viral diseases (S. Kunz)
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.