

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)**

	Courses / Enseignements	Hours per semester			Teaching Staff	ECTS Credits	Limited nb of students	
		C	E/S	PW				
<b>General and common activities - Compulsory / Activités générales et communes - Obligatoires</b>								
	Retreat and BIG Seminars <i>Retraite et séminaires BIG</i>	-	-	-	Benton R., ...			
	Sequence a Genome I <i>Séquençage d'un génome I</i>	14	30	-	Engel P., tutors	3		
	Write a Review <i>Rédaction d'une revue</i>	15	-	42	Benton R., tutors	4		
	Critical Readings of Scientific Literature <i>Lectures critiques de la littérature scientifique</i>	-	-	56				
	Subtotal	29	30	98		7		
<b>Optional (at least 9 credits) Optionnel (minimum 9 crédits)</b>								
MODULE 1	Biotechnology <i>Biotechnologie</i>	14	-	-	Poirier Y., Resch G.	1.5		
	CRISPR-Cas9 Genome Editing <i>Edition du génome par CRISPR-Cas9</i>	4	2	8	van Leeuwen J.	1.5	12	
	Development of the Nervous System <i>Développement du système nerveux</i>	14	-	-	Braissant O.	1.5		
	Molecular Mechanisms of Evolution <i>Mécanismes moléculaires de l'évolution</i>	14	-	-	Benton R., Geldner N.	1.5		
	Plant Functional Genetics <i>Génétique fonctionnelle des plantes</i>	14	-	-	Poirier Y.	1.5		
	Proteins : from Structural Determination to Molecular Dynamic Simulations <i>Protéines : de la détermination de la structure aux simulations de dynamique moléculaire</i>	16	-	-	Santiago Cuellar J., Zoete V., Roehrig U., Cuendet M.	1.5		
	Scientific Research in all its Forms (for Biology) (Sciences2 - in French only) <i>La recherche dans tous ses états (pour biologie) (Sciences2)</i>	14	-	-	Preissmann D.	1.5		
	Introduction to R (optional support) <i>Introduction à R (mise à niveau optionnelle)</i>	-	-	-	Schütz F.	-		
	Data Analysis (compulsory for Bioinformatics specialisation) <i>Analyses de données</i>	6	-	6	Bergmann S.	2		
	Advanced Data Analysis (compulsory for Bioinformatics specialisation) <i>Analyses de données : niveau avancé</i>	6	-	6	Ciriello G., Delaneau O.	2.5		
	Theory and Practice in Gene Expression Analyses (compulsory for Bioinformatics specialisation) <i>Théorie et pratique dans l'analyse d'expression des gènes</i>	4	32	-	Gfeller D., Delaneau O.	2.5		
	Advanced Python Programming (compulsory for Bioinformatics specialisation) <i>Programmation avancée en Python</i>	7	14	-	Salamin N., Delaneau O.	2		
	Advanced Microbial Genetics <i>Génétique avancée des microbes</i>	14	-	-	Collier J., Pelet S.	1.5		
	Bacterial Genomes and Genome Evolution <i>Génomés bactériens et évolution du génome</i>	14	-	-	van der Meer J.	1.5		
	Fungal Virulence and Pathogenicity <i>Pathogénicité et virulence fongique</i>	14	-	-	Coste A., Lamoth F., Hauser P.	1.5		
	Immunology and Infectious Diseases <i>Immunologie et maladies infectieuses</i>	14	-	-	Roger T., Perreau M., Di Domizio J.	1.5		
	Plant Interactions with Microbes and Insects <i>Interactions des plantes avec les microbes et les insectes</i>	14	-	-	Keel C., Reymond P.	1.5		
	Virus-Host Interactions <i>Interactions virus-hôtes</i>	14	-	-	Gouttenoire J.	1.5		
	<b>Total</b>						<b>16</b>	
	MODULE 2	<b>Practical Project / Travail pratique</b>						
First Step Project <i>Travail d'initiation à la recherche</i>		-	-	250	Benton R.		14	

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- 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)

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

\* 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

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<b>Spring Semester (semester 2) and Autumn Semester (semester 3)</b>							
<b>Course / Enseignement</b>							
MODULE 4	Master Thesis <i>Travail de Master</i>				Thesis Director	45	

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