ALGERIAN DEMOCRATIC AND POPULAR REPUBLIC

MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

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L.M.D

ACADEMIC LICENSE

2018–2019

Establishment	Faculty	Department
Djilali Bounaama University of Khemis Miliana	Faculty of Natural and Life Sciences and Earth Sciences	Biology

Field	Branch	Specialty
Natural and Life Sciences	Biological Sciences	Animal Biology and Physiology

الجمهورية الجزائرية الديمقراطية الشعبية

وزارة التعليم العالي والبحث العلمي

عرض تكوين

ل. م . د

ليسانس أكاديمية

2018-2019

المؤسسة	الكلية/ المعهد	القسم
جامعة الجيلالى بونعامة بخميس مليانة	كلية علوم الطبيعة و الحياة و علوم الارض	بيولوجيا

الميدان	الفرع	التخصص
علوم الطبيعة و الحياة	علوم بيولوجية	بيولوجيا و فيزيولوجيا حيوانية

SUMMARY

I. Identity sheet of the License

1. Location of the formation

- Faculty (or Institute) : F**aculty of Life and Nature Sciences and Earth Sciences**
- Department : **Biology**
- References of the decree of habilitation of the license (join copy of the decree) : **Order N°174 of July 1st, 2009**

2. External partners

Other partner institutions:

- University of Bab Ezzouar (USTHB)
- University of Algiers 1 - Benyoucef Benkhedda
- University of Blida (Saad Dahleb)
- University of Boumerdes (UMBB)
- University Hassiba Benbouali - Chlef
- INPV of Elharach
- ITGC of Khemis Miliana

Companies and other socio-economic partners :

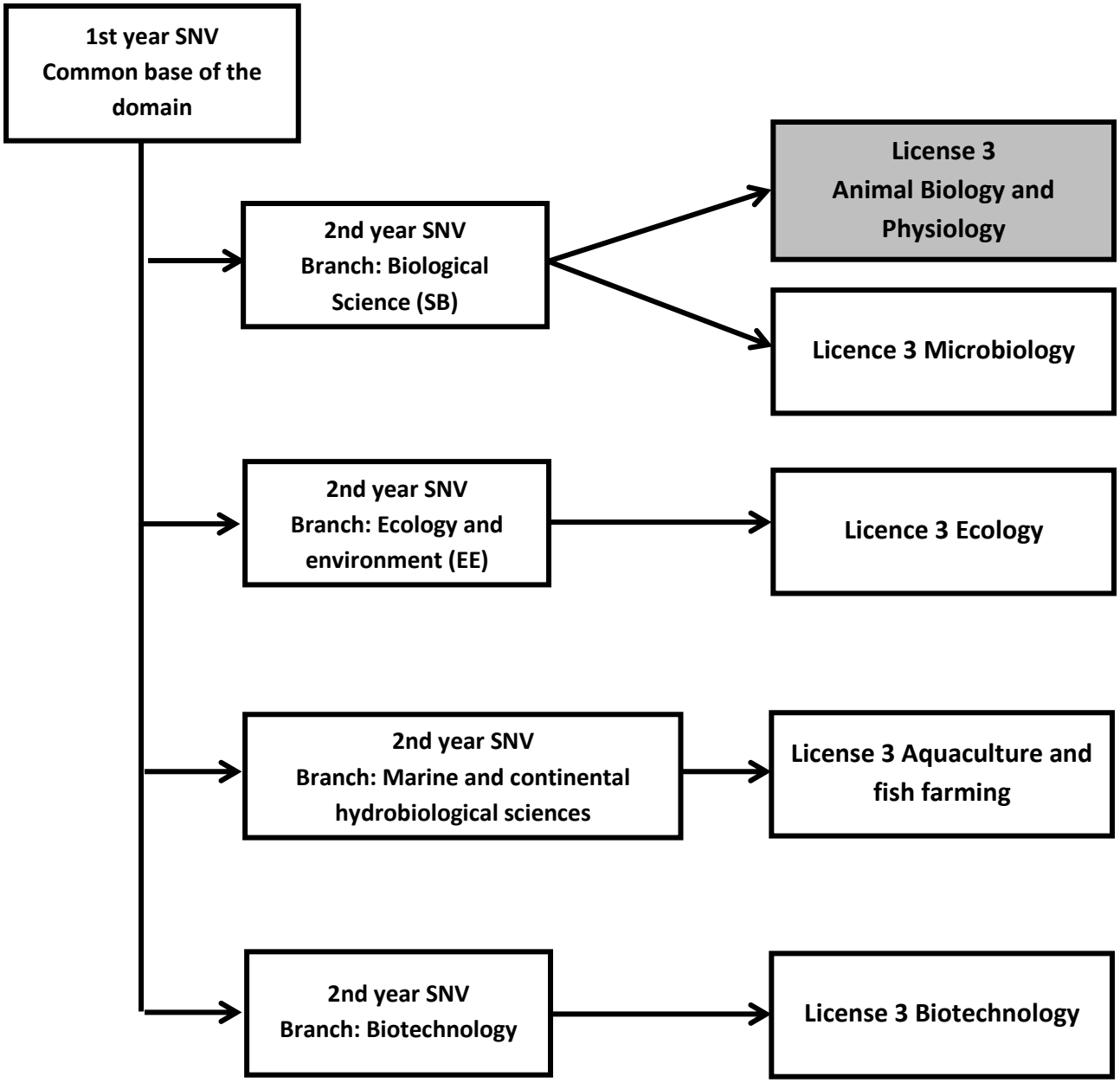
- ORLAC
- Dairy of Aribs
- Wanis Dairy
- OREVC
- ITEBO of Baba Ali

International partners: None

3. Context and objectives of the formation

A. General organization of the program: position of the project

If several licenses are offered or already taken care of at the level of the establishment (same formation team or other formation teams), indicate in the following diagram, the position of this project in relation to the other courses



B. Objectives of the training

This project concerns the implementation of a new training of level Bac+3 in the framework of the LMD. The essential objectives are listed as follows:

- To provide the university with a training that is part of its development plan, and translates one of its skills,

- To provide the user sector with efficient executives, able to integrate into teams in the fields of agri-food, medicine, biomedical, biological analysis, forensic science,..., and to be able to further develop their knowledge in the most diverse specializations.
- To encourage the acquisition of a general culture that will open the mind and make them adaptable in their professional life.
- To be able to integrate a training cycle preparing for a research or professional master's degree.

C. Profiles and competencies targeted

- On the level of training: The targeted training, which translates one of the competences of the university, is part of the global project of the development of the faculty of sciences. The launch of a Master's degree program in the medium term will provide teachers with the opportunity to exercise and further develop their theoretical and practical knowledge.
- On the economic level: The training of graduates in applied biology will offer the job market an additional opportunity by providing specialists in various sectors of activity.

The outlets are essentially:

- Medicine and health sector
- Agri-food sector.
- Research and teaching
- Pharmaceutical sector

D. Regional and national employability potential

The wilaya of Ain Defla has various potentialities in the field of agriculture. It practices various livestock (cattle, sheep, poultry and beekeeping ... etc.). It is a focal point for milk processing companies such as dairies (Aribs and Wanis) and many investors exploiting agricultural products (about ten farms).

The specialization in animal physiology will give a precision on animal nutritional physiology and will undoubtedly be a means to improve reproduction. This specialty will therefore create many jobs and open the doors for collaborations with agronomists and veterinarians.

E. Bridges to other specialties

At the end of their training, students who have graduated from the "Animal Physiology" degree program will have the possibility of continuing their studies in a Master's program in the same specialty or to move on to other Master's programs close to this one, such as the following:

Cellular Physiology and Physiopathologies, Endocrine Regulation, Microbiology and Health, Organismal Biology, Biochemistry, Quality Control and Biotechnology...

F. Expected performance indicators of the training

The objective of the system is the diversification of the control methods in order to evaluate the students' competences as widely as possible. Within this framework, we will evaluate: (1) the autonomy of the student; (2) the regular follow-up of the acquisition of knowledge; (3) the acquisition of oral expression; (4) the acquisition of teamwork and synthesis skills; (5) the control of the student's abilities and not to be satisfied with his knowledge.

The distribution between the different forms of evaluation is as follows:

- Knowledge control: 40%
- Oral expression: 20%
- Personal work: 20%
- Capacity for analysis and synthesis: 20%

4. Available human resources

A. Supervision capacity: 40 students

B. Internal teaching team mobilized for the specialization

Nom et prénom	Diplôme de post-graduation et spécialité	Diplôme de post-graduation et spécialité	Grade	Intervention	Emargement
CHAOUAD Billel	DES en Biologie et physiologie animale	Magister en Régulation endocrinienne et métabolique	MAA	Cours, TD, TP	
SAHRAOUI Abdel Hamid	DES en Biologie et physiologie animale	Doctorat en Régulation endocrinienne et métabolique	MCB	Cours, TD, TP	
BOUSSOUBEL Abdelkhader	DES en biologie du comportement	Magister en neurobiologie cellulaire et moléculaire	MAA	Cours, TD, TP	
BENKHROUF Amina	DES en Biologie et physiologie animale	Magister en Régulation endocrinienne et physiopathologie	MAA	Cours, TD, TP	
DAOUDI Ahlem	Ingénieur en sciences alimentaires	Magister en sciences alimentaires	MAA	Cours, TD, TP	
CHEURFA Mohamed	Master en nutrition humaine	Doctorat en sciences alimentaire et nutrition	MCB	Cours, TD, TP	
NABTI Djahida	Master en biologie animale et environnementale	Doctorat en Eco-toxicologie	MCB	Cours, TD, TP	
MAROK Mohamed Amine	Ingéniorat d'état en sciences agronomique	Doctorat en sciences en sciences agronomique	MCB	Cours, TD, TP	
GUETARNI Hacina	Ingéniorat en sciences alimentaires	Doctorat en microbiologie	MCB	Cours, TD, TP	

C. External teaching team mobilized for the specialty

Nom, prénom	Etablissement de rattachement
Hamlat NADJIBA	DE
Neggazi Samia	DE
Chabane Khahina	DE

Nom, prénom	Etablissement de rattachement
Menad Rafik	DE
Ousmaal Mohamed El fadel	DE
Maouche Maima	DE

Nom, prénom	Etablissement de rattachement
Benmouloud Abdeloufi	DE

D. Overall summary of human resources mobilized for the specialty

Grade	Internal Staff	External Staff	Total
Professor	-	-	-

Senior Lecturer A	-	02	02
Senior Lecturer B	05	05	10
Assistant Professor A	04	-	04
Assistant Professor B	-	-	-
Others	-	-	-
Total	09	07	16

5. Specific material means available

A. Teaching laboratories and equipment: Sheet of the existing pedagogical equipment for the practical work of the envisaged training (1 sheet per laboratory).

Laboratory name: **Biology and Zoology**

Capacity in students: **25**

N°	Title of the equipment	Number	observations
01	Water bath	01	Good condition
02	Analytical balance	02	Good condition
03	Dissecting box	09	Good condition
04	Blade holder box	12	Good condition
05	Insect box	11	Good condition
06	Cell of MALASSEZ	03	Good condition
07	Refrigerated centrifuge	01	Good condition
08	Box of prepared slides of zoology	01	Good condition
09	Histology prepared slide box	01	Good condition
10	Conductimeter	01	Good condition
11	Dissecting dish	02	Good condition
12	Decameter	01	Good condition
13	Oven	01	Good condition
14	Hygrometer for culture chamber	01	Good condition
15	Binocular magnifying glass	23	Good condition
16	Halogen lamp	01	Good condition
17	Hand magnifier	02	Good condition
18	Handle for scalpel blade	02	Good condition
19	DNA model (large format)	01	Good condition
20	Model of the organization of a flower	01	Good condition
21	Model of a mammalian DNA	01	Good condition
22	Model of cell division	12	Good condition
23	Color microphotography of biology	58	Good condition
24	Microscopes	14	Good condition
25	Micrometer	01	Good condition
26	Microtome	02	Good condition
27	Micropipette 1000µm	02	Good condition
28	Micro pipette 20-200ul	01	Good condition
29	Micro pipette 100ul	01	Good condition
30	Micro pipette 10ul	01	Good condition
31	Ph meter	01	Good condition
32	Vernier caliper	01	Good condition
33	Pedagogical board	23	Good condition
34	Dissecting cork plate	14	Good condition
35	Heating plate	02	Good condition
36	Vacuum pump	01	Good condition
37	Human skeleton	01	Good condition
38	Sieve	03	Good condition

Laboratory name: **Biochemistry**

Capacity in students: **25**

N°	Title of the equipment	Number	observations

01	Vortex mixer	01	Good condition
02	Chlorine analyzer (kit comparator)	01	Good condition
03	Water bath	02	Good condition
04	Sand bath	01	Good condition
05	Precision balance 1000g	01	Good condition
06	Precision balance10g	01	Good condition
07	Precision balance1200g	01	Good condition
08	Bunsen burner	07	Good condition
09	Dissecting box	01	Good condition
10	Centrifuge	01	Good condition
11	Balloon heater	03	Good condition
12	Stopwatch	03	Good condition
13	Conductivity meter	01	Good condition
14	Colorimeter	01	Good condition
15	Knife	01	Good condition
16	Desiccator	01	Good condition
17	Densimeter 1400/1500	02	Good condition
18	Densimeter 2000	02	Good condition
19	5ml dispenser	01	Good condition
20	Protein electrophoresis cell (vertical)	02	Good condition
21	Oven	01	Good condition
22	Elevator + heating flask support	02	Good condition
23	Hematocrit	01	Good condition
24	Ventilated hood	01	Good condition
25	Lactodensimeter	01	Good condition
26	Halogen lamp	01	Good condition
27	Protective glasses	02	Good condition
28	Mask + filter	03	Good condition
29	Micropipette 0-50µl	01	Good condition
30	Micropipette 20-200µl	02	Good condition
31	Microscopes	07	Good condition
32	Vernier caliper	01	Good condition
33	pH meter	03	Good condition
34	Heating plate + stirrer	02	Good condition

Laboratory name: **Microbiology**

Capacity in students: **25**

N°	Title of the equipment	Number	observations
01	Magnetic stirrer	01	Good condition
02	Vortex shaker	01	Good condition
03	Autoclave	03	Good condition
04	Magnetic rod	02	Good condition
05	Water bath	01	Good condition
06	Analytical balance	01	Good condition
07	Bunsen burner	30	Good condition
08	Dissecting box	02	Good condition
09	Centrifuge	01	Good condition
10	Pressure cooker	01	Good condition
11	Colony counter	01	Good condition
12	Vertical freezer -86°C	01	Good condition
13	Seramic digger	10	Good condition
14	Incubator	03	Good condition
15	Binocular magnifying glass	02	Good condition
16	Safety glasses	01	Good condition
17	Micro pipette 1000ul	01	Good condition
18	Micro pipette 10-100ul	02	Good condition
19	Micro pipette 5-50ul	01	Good condition
20	Motic microscope	06	Good condition
21	Mortar	02	Good condition
22	Vernier caliper	01	Good condition

Laboratory name: **Water Chemistry**

Capacity in students: **25**

N°	Title of the equipment	Number	observations
01	Apparatus for liquid expansion	01	Good condition
02	Melting point apparatus	01	Good condition
03	Apparatus for gas expansion	01	Good condition
04	Water bath	01	Good condition
05	Sand bath	01	Good condition
06	Electronic balance	01	Good condition
07	Analytical balance	01	Good condition
08	Bunsen burner	03	Good condition
09	Ammonium test box	01	Good condition
10	Calorimeter	01	Good condition
11	Balloon heater	03	Good condition
12	Stopwatch	02	Good condition
13	Benchtop conductivity meter	03	Good condition
14	Portable conductivity meter	02	Good condition
15	Distiller	01	Good condition
16	Oven	01	Good condition
17	Shaker	-	Good condition
18	Vernier caliper	01	Good condition
19	Benchtop PH meter	03	Good condition
20	Portable Ph-meter	01	Good condition
21	Heating plate	02	Good condition
22	Vacuum pump	01	Good condition
23	T-junction	01	Good condition
24	Mercury thermometer	09	Good condition
25	Electric thermometer	04	Good condition
26	Immersion heater	02	Good condition
27	Extractor	01	Good condition
28	Metal cylinder for soil analysis	10	Good condition
29	Multi parameter	01	Good condition
30	Pipette holder of robinson	01	Good condition
31	Box of different types of soil (18 vials)	02	Good condition
32	Auger	02	Good condition
33	Calcimeter of Bernard	02	Good condition
34	Sieves of 2 ; 0.25 ; 0.125 ; 0.045mm	-	Good condition

B. Internship sites and in-company training:

Place of the internship	Number of students	Duration of the internship
Pilot farms in the wilaya	04 by farm	15 days
ITEB of Baba Ali	10	15 days
CNIAAG of Baba Ali	10	15 days
Laboratory of the hospital of Khemis Miliana	10	15 days
House of diabetics in Khemis Miliana	10	15 days

C. Documentation available at the institutional level specific to the proposed training (Required field):

The university's central library is adequately stocked with books and other materials necessary for training in Animal Physiology

D. Personal work space and ICT available at the department and faculty level:

- Library of the Faculty of Natural and Life Sciences
- Central university library
- Department connected to the Internet
- Internet room of the Faculty for students.
- Pedagogical laboratories connected to the Internet network.
- Research laboratory: Water, Rock and Plant.
- Laboratory of agricultural production and valorization of natural resources.

II - Semester organization of the courses

(S1, S2, S3, S4, S5 and S6)

Common base « Natural and Life Sciences » domain

Semester 1

Teaching units	Matter		Credits	Coefficients	Hourly volume weekly			VHS (15 weeks)	Other *	Evaluation method			
	Code	Title			Course	DW	PW			CC*		Examination	
U E Fundamental Code: UEF 1. 1 Credits: 18 Coefficients: 9	F 1.1.1	General and organic chemistry	6	3	1h30	1h30	1h30	67h30	82h30	x	40%	x	60%
	F 1.1.2	Cellular biology	8	4	1h30	1h30	3h00	90h00	110h00	x	40%	x	60%
	F 1.1.3	Mathematics Statistics	4	2	1h30	1h30	-	45h00	55h00	x	40%	x	60%
U E Methodology Code: UEM 1.1 Credits: 9 Coefficients: 5	M 1.1.1	Geology	5	3	1h30	1h30	1h00	60h00	65h00	x	40%	x	60%
	M 1.1.2	Communication and Expression Techniques 1 (in French)	4	2	1h30	1h30	-	45h00	55h00	x	40%	x	60%
U E Discovery Code : UED 1.1 Credits: 2 Coefficients: 2	D 1.1.1	Working Methods and Terminology 1	2	2	1h30	1h30		45h00	5h00	x	40%	x	60%
U E Transversal Code: UET 1.1 Credits: 1 Coefficients: 1	T 1.1.1	Universal History of Biological Sciences	1	1	1h30	-	-	22h30	2h30	-	-	x	100
Total Semester 1			**30**	**17**	**10h30**	**9h00**	**5h30**	**375h00**	**375h00**				

Other* = Additional work in semester consultation; CC* = Continuous control.

Common base « Natural and Life Sciences » domain

Semester 2

Teaching units	Matter		Credits	Coefficients	Hourly volume weekly			VHS (15 weeks)	Other *	Evaluation method			
	Code	Title			Course	DW	PW			CC*		Examination	
U E Fundamental Code: UEF 2. 1 Credits: 18 Coefficients: 9	F 2.1.1	Thermodynamics and solution chemistry	6	3	1h30	1h30	1h30	67h30	82h30	x	40%	x	60%
	F 2.1.2	Plant Biology	6	3	1h30	-	3h00	67h30	82h30	x	40%	x	60%
	F 2.1.3	Animal Biology	6	3	1h30	-	3h00	67h30	82h30	x	40%	x	60%
U E Methodology Code: UEM 2.1 Credits: 9 Coefficients: 5	M 2.1.1	Physics	5	3	1h30	1h30	1h00	60h00	65h00	x	40%	x	60%
	M 2.1.2	Communication and Expression Techniques 2 (in English)	4	2	1h30	1h30	-	45h00	55h00	x	40%	x	60%
U E Discovery Code : UED 2.1 Credits: 2 Coefficients: 2	D 2.1.1	Life Sciences and Socio-Economic Impact	2	2	1h30	1h30	-	45h00	5h00	x	40%	x	60%
U E Transversal Code: UET 2.1 Credits: 1 Coefficients: 1	T 2.1.1	Working Methods and Terminology 2	1	1	1h30	-	-	22h30	2h30	-	-	x	100%
Total Semester 2			**30**	**17**	**10h30**	**6h00**	**8h30**	**375h00**	**375h00**				

Other* = Additional work in semester consultation; CC* = Continuous control.

Annex of the second year Bachelor's degree program

Natural and life sciences field « Biological Sciences » field

Semester 3

Teaching units	Matter	Credits	Coefficients	Hourly volume weekly			VHS (15 weeks)	Other *	Evaluation method			
	Title			Course	DW	PW			CC*		Examination	
U E Fundamental Code: UEF 2.1.1 Credits: 6 Coefficients: 3	Zoology	6	3	3h00	-	1h30	67h30	82h30	x	40%	x	60%
U E Fundamental Code: UEF 2.1.2 Credits: 12 Coefficients: 6	Biochemistry	6	3	3h00	1h30	-	67h30	82h30	x	40%	x	60%
	Genetics	6	3	3h00	1h30	-	67h30	82h30	x	40%	x	60%
U E Methodology Code: UEM 2.1.1 Credits: 4 Coefficients: 2	Communication and Expression Techniques (in English)	4	2	1h30	1h30	-	45h00	55h00	x	40%	x	60%
U E Methodology Code: UEM 2.1.2 Credits: 5 Coefficients: 3	Biophysics	5	3	1h30	1h30	1h00	60h00	65h00	x	40%	x	60%
U E Discovery Code : UED 2.1 Credits: 2 Coefficients: 2	Environment and Sustainable Development	2	2	1h30	1h30	-	45h00	5h00	x	40%	x	60%
U E Transversal Code: UET 2.1 Credits: 1 Coefficients: 1	University Ethics and Deontology	1	1	1h30	-	-	22h30	2h30	-	-	x	100%
Total Semester 3		**30**	**17**	**15h00**	**7h30**	**2h30**	**375h00**	**375h00**				

Other* = Additional work in semester consultation; CC* = Continuous control.

Annex of the second year Bachelor's degree program

Natural and life sciences field « Biological Sciences » field

Semester 4

Teaching units	Matter	Credits	Coefficients	Hourly volume weekly			VHS (15 weeks)	Other *	Evaluation method			
	Title			Course	DW	PW			CC*		Examination	
U E Fundamental Code: UEF 2.2.1 Credits: 6 Coefficients: 3	Botany	6	3	3h00	-	1h30	67h30	82h30	x	40%	x	60%
U E Fundamental Code: UEF 2.2.2 Credits: 12 Coefficients: 6	Microbiology	8	4	3h00	1h30	1h30	90h00	110h00	x	40%	x	60%
	Immunology	4	2	1h30	1h30	-	45h00	55h00	x	40%	x	60%
U E Methodology Code: UEM 2.2.1 Credits: 4 Coefficients: 2	Scientific methodology and techniques for studying life	4	2	1h30	-	1h30	45h00	55h00	x	40%	x	60%
U E Methodology Code: UEM 2.2.2 Credits: 5 Coefficients: 3	Biostatistics	5	3	1h30	1h30	1h00	60h00	65h00	x	40%	x	60%
U E Discovery Code : UED 2.2.1 Credits: 2 Coefficients: 2	General ecology	2	2	1h30	1h30	-	45h00	5h00	x	40%	x	60%
U E Transversal Code: UET 2.2.1 Credits: 1 Coefficients: 1	Computer tools	1	1	1h30	-	-	22h30	2h30	-	-	x	100%
Total Semester 4		**30**	**17**	**13h30**	**6h00**	**5h30**	**375h00**	**375h00**				

Other* = Additional work in semester consultation; CC* = Continuous control.

Annex of the teaching program of the third year of the licence
Licence « Biology and Animal Physiology »

Semester 5

Teaching units		VHS (15 weeks)	Hourly volume weekly				Coefficients	Credits	Evaluation method			
			Course	DW	PW	Other *			CC*		Examination	
UE Fundamental: UEF 3.2												
UEF 3.2.1(O/P) : General physiology												
Matter 1	Embryonic development	90h00	3h00	-	3h00	110h00	**4**	**8**	X	**40%**	X	**60%**
Matter 2	Functional histology	45h00	1h30	-	1h30	55h00	**2**	**4**	X	**40%**	X	**60%**
Matter 3	Comparative Anatomy of Vertebrates	67h30	1h30	-	3h00	82h30	**3**	**6**	X	**40%**	X	**60%**
UE Methodology: UEM 3.2												
Matter 1	Reproductive physiology	60h00	1h30	1h30	1h00	65h00	**3**	**5**	X	**40%**	X	**60%**
Matter 2	Structure and function of biological complexes	45h00	1h30	1h30	-	55h00	**2**	**4**	X	**40%**	X	**60%**
UE Discovery: UED 3.2												
Matter 1	Biostatistics	45h00	1h30	1h30	-	5h00	**2**	**2**	X	**40%**	X	**60%**
UE Transversal: UET 3.2												
Matter 1	Scientific English	22h30	1h30	-	-	2h30	**1**	**1**	-	-	X	**100%**
Total Semester 5		**375h**	**12h**	**4h30**	**8h30**	**375h**	**17**	**30**				

Other* = Additional work in semester consultation; CC* = Continuous control.

Annex of the teaching program of the third year of the licence
Licence « Biology and Animal Physiology »

Semester 6

Teaching units		VHS (15 weeks)	Hourly volume weekly				Coefficients	Credits	Evaluation method			
			Course	DW	PW	Other *			CC*		Examination	
UE Fundamental: UEF 3.2												
UEF 3.2.1(O/P) : General physiology												
Matter 1	Physiology of major functions	67h30	3h00	-	1h30	82h30	**3**	**6**	X	**40%**	X	**60%**
Matter 2	Functional Endocrinology	67h30	3h00	-	1h30	82h30	**3**	**6**	X	**40%**	X	**60%**
Matter 3	Cellular and molecular physiology	67h30	3h00	-	1h30	82h30	**3**	**6**	X	**40%**	X	**60%**
UE Methodology: UEM 3.2												
Matter 1	Nerve Physiology	60h00	1h30	1h30	1h00	65h00	**3**	**5**	X	**40%**	X	**60%**
Matter 2	Molecular Biology	45h00	1h30	1h30	-	55h00	**2**	**4**	X	**40%**	X	**60%**
UE Discovery: UED 3.2												
Matter 1	Bioinformatics	45h00	1h30	-	1h30	5h00	**2**	**2**	X	**40%**	X	**60%**
UE Transversal: UET 3.2												
Matter 1	Article Analysis	22h30	1h30	-	-	2h30	1	1	-	-	X	**100%**
Total Semester 6		**375h**	**15h**	**3h**	**7h**	**375h**	**17**	**30**				

Other* = Additional work in semester consultation; CC* = Continuous control.

5- Global summary of the training: (the global VH separated in courses, Dw, for the 06 semesters of teaching, for the various types of UE)

UE / Hourly volume	UEF	UEM	UED	UET	Total
course	607h30	270h	135h00	135h00	1147h30
DW	180h00	225h	112h30	/	517h30
PW	427h30	135h	22h30	/	585h00
Other personal work	1485h00	720h	30h00	15h00	**2250h00**
Memory	/	/	/	/	/
Total	2700h00	1350h00	300h00	150h00	**4500h00**
Credits	108	54	12	6	**180**
% in credits for each EU	60	30	6.67	3.33	**100%**

III. Detailed program by subject of the semesters S1, S2, S3, S4, S5 and S6

1st year Common base
Natural and Life Sciences" field

Semester 1

Semester: 1st Semester
UE: Fundamental Teaching Unit
Subject 1: GENERAL AND ORGANIC CHEMISTRY
Credits: 6
Coefficient: 3

Objectives of the course
This subject consists in teaching the fundamental bases of the organization and the chemical structure of the matter. It is a complement to the other subjects because it serves to facilitate the chemical understanding of biological phenomena.

Recommended prior knowledge
The student must master the basic notions of general and organic chemistry, namely the structure of the atom, atomic bonds and redox reactions.

Content of the course
1. General chemistry
1.1. Generalities
1.1.1. Atom, nucleus, isotopy,
1.1.2. Stability and cohesion of the nucleus, binding energy per nucleon,...
1.2. Radioactivity
1.2.1. Definition
1.2.2. Natural radioactivity: main types of radiation
1.2.3. Artificial radioactivity
1.2.4. Law of radioactive decay
1.2.5. Different types of nuclear reactions
1.3. Electronic Configuration of Atoms
1.3.1. Introduction of Quantum Numbers
1.3.2. Principles governing the electronic structure of an atom:
1.3.3. Energy rule (Klechkoweski rule)
1.3.4. Pauli's exclusion rule
1.3.5. Hund's rule
1.4. Periodic classification
1.4.1. Group (Column), Period (Line)
1.4.2. Evolution of physical properties within the periodic table: atomic radius, ionization energy, electronic affinity....
1.5. Chemical bonding
1.5.1. Introduction: strong and weak bonds
1.5.2. Representation of the chemical bond : Lewis diagram
1.5.3. Different types of strong bonds (covalent bond, ionic bond, and metallic bond)
1.5.4. Ionic character of a covalent bond

1.5.5. Geometry of molecules: V.S.E.P.R theory (Gillespie rule)

2. Organic chemistry

2.1. Organic compounds, formulas, functions, nomenclature

2.1.1. Formulas of organic compounds

2.1.2. Functions, functional groups and nomenclature

2.1.3. Study of the organic functions

- Saturated hydrocarbons, alkenes, alkanes, benzene hydrocarbons
- Halogen derivatives, halides
- Alcohols, thiols, thiothers, phenols, amine polyfunctional aldehydes
- Polyfunctional heterocycles

2.2. Reaction mechanisms in organic chemistry

2.2.1. Resonance and mesomerism

2.2.2. Conjugation

2.2.3. Stereochemistry

2.2.4. Electronic Effects

2.2.5. Nucleophilic Substitution

2.2.6. Eliminations

2.2.7. Radical Reactions

2.2.8. Reduction Reactions

2.2.9. Oxidation Reactions

Directed work

- DW N°1: Fundamentals of chemistry (atoms, molecules, gram atoms, moles, calculation of concentrations)
- DW N°2: Stability of the nucleus and radioactivity
- DW N°3: Electronic configuration and periodic classification of elements
- DW N°4: Chemical bonds
- DW N°5: Nomenclature and stereochemistry
- DW N°6: Reaction mechanisms

Practical work

- Practical work N°1: Principles of experimental chemistry
  Objective: To evaluate the knowledge of the student on the material used in the chemistry experiments and the safety rules to be respected in the laboratory.
- Practical work N°2: Determination of the quantity of matter.
  Objective: Determine the quantity of matter (expressed in number of moles) contained in a sample and to prepare a sample containing a fixed quantity of matter
- Practical work N°3: Preparation of solutions by dissolution and dilution
  Objective: To prepare a solution of sodium chloride (NaCl) of normality 0.1N and to prepare a solution of hydrochloric acid (HCl) of normality 0.1N by dilution of a solution of HCl of normality 1N.
- Practical work N°4: Measurement of the density of some molecules
  Objective: We try to determine the density of a saturated salt water solution and to determine the density of iron.
- Practical work N°5: Research of functional groups
  Objective: Identify the functional groups: alcohols and carbonyls.

Mode of evaluation
Continuous control and semester exams

References:

1. Elisabeth Bardez, 2014- Mini Manuel de Chimie générale : Chimie des Solutions. Ed. Dunod, Paris, 256 p.
2. Jacques Maddaluno, Véronique Bellosta, Isabelle Chataigner, François Couty, *et al.,* 2013- Chimie organique. Ed. Dunod, Paris, 576 p.
3. Jean-François Lambert, Thomas Georgelin, Maguy Jaber, 2014- Mini manuel de Chimie inorganique. Ed. Dunod, Paris, 272 p.
4. Jean-Louis Migot, 2014- Chimie organique analytique. Ed. Hermann, 180 p.

Semester: 1st Semester
UE: Fundamental Teaching Unit
Subject 2: CELLULAR BIOLOGY
Credits: 8
Coefficient: 4

Objectives of the course
The objectives of this course are to introduce the students to the living world at the cellular level, to acquire the basic notions of the cell, eukaryote and prokaryote, and to study the cellular constituents. These objectives are reinforced by practical sessions in the laboratory.

Recommended prerequisites
The student must have knowledge of general biology.

Content of the course
1. General
1.1. Classification and relative importance of kingdoms
1.2. Cell and cell theory
1.3. Origin and evolution
1.4. Cell types (Prokaryote, Eukaryote, Acaryote)
2. Methods of studying the cell
2.1. Optical and electronic microscopy methods
2.2. Histochemical methods
2.3. Immunological methods
2.4. Enzymological methods
3. Plasma membrane: structure and function
4. Cytoskeleton and cell motility
5. Cell adhesion and extracellular matrix
6. Chromatin, chromosomes and cell nucleus
7. Ribosome and protein synthesis
8. The endoplasmic reticulum-golgi apparatus system
9. The interphase nucleus
10. The endosomal system: endocytosis
11. Mitochondria
12. Chloroplasts
13. Peroxisomes

14. Extracellular matrix
15. Plant wall

Directed work / Practical work

1. Methods of studying cells
   1.1. Separation of cellular components
   1.2. Observation of cellular constituents
   1.3. Identification of cellular components
   1.4. Plant wall
2. Cell cultures
3. Testing of physiological functions
   3.1 Reconstitution of the function from isolated constituents
   3.2. Anatomical tests: autoradiography, fluorescence labeling, green fluorescent proteins
   3.3. Physiological tests: control of protein expression, mutation, overexpression

Evaluation method

Continuous assessment and semester exam

References:

1. B. Albert, A. Johnson, J. Lewis, M. Raff, K. Roberts et P. Walter, 2011- Biologie moléculaire de la cellule. Ed. Lavoisier, Paris, 1601p.
2. Abraham L. Kierszenbaum, 2006- Histologie et biologie cellulaire: Ed De Boeck, 619p.
3. Thomas Dean Pollard et William C. Earnshaw, 2004- Biologie cellulaire. Ed. Elsevier Masson, Paris, 853p.
4. Marc Maillet, 2006- Biologie cellulaire. Ed. Elsevier Masson, Paris, 618p.

Semester: 1st Semester
UE: Fundamental Teaching Unit
Subject 3: MATHEMATICS, STATISTICS
Credits: 4
Coefficient: 2

Objectives of the course

This subject allows the student to integrate the statistical and computer tools in the biological field, and to use numerical analysis, probability and calculation by the computer tool.

Recommended prior knowledge

The student must have knowledge of functions, integrals and random variables.

Content of the course

1. Mathematical analysis

1.1. Functions of one variable, derivatives and integrals.
1.2. Approximation method.
1.3. Series, positive term series, Rieman series.
1.4. Functions in several variables, partial derivatives, differentials
1.5. Double and triple integrals.
1.6. Calculation of surfaces and volumes.

2. Probabilities

2.1. Random variables, BERNOULLI variables
2.2. Statistical laws and bio-statistical applications
  2.2.1. Discrete laws (Binomial and Poisson)
  2.2.2. Continuous law (Gaussian law, normal law, chi-square law, Fischer law)
2.3. Parameters and properties
  2.3.1. Position parameters (median, mode, mean ...etc)
  2.3.2. Dispersion parameters (variance, standard deviation ...etc)
  2.3.3. Shape parameters (symmetry, kurtosis ...etc)

2.4. Distribution function and density function

Evaluation method
Continuous assessment and semester exam

References

1. Jean Bouyer, 2000- Méthodes statistiques : médecine-biologie. Ed. Estem.
2. Gilles Stoltz et Vincent Rivoirard, 2012- Statistique mathématique en action. Ed. Vuibert, Paris, 448p.
3. Maurice Lethielleux, 2013- Statistique descriptive. Ed. Dunod, Paris, 160p.
4. Maurice Lethielleux et Céline Chevalier, 2013- Probabilités : Estimation statistique. Ed. Dunod, Paris, 160p.

Semester: 1st Semester
TU: Methodological Teaching Unit 1
Subject: GEOLOGY
Credits: 5
Coefficient: 3

Objectives of the course
The subject allows the students to see the constituents and the structure of the earth, the interactions between these constituents, the external and internal geodynamics.

Recommended prerequisites: No prerequisites

Content of the subject
1. General geology
   1.1. Introduction
   1.2. The terrestrial globe
   1.3. The Earth's crust
   1.4. Structure of the earth
2. External geodynamics
   2.1. Erosion
      2.1.1. The action of water
      2.1.2. The action of the wind
   2.2. Deposits
      2.2.1. Study methods
      2.2.2. Sedimentary rocks
      2.2.3. Concept of stratigraphy
      2.2.4. Concept of paleontology
3. Internal geodynamics

3.1. Seismology
3.1.1. Study of earthquakes
3.1.2. Origin and distribution
3.1.3. Soft and brittle tectonics (folds and faults)
3.2. Volcanology
3.2.1. Volcanoes
3.2.2. Magmatic rocks
3.2.3. Study of magmas
3.3. Plate tectonics

Practical work
Practical work N°1: Topography
Practical work N°2: Geology (Sections)
Practical work N°3: Rocks and minerals

Evaluation method
Continuous assessment and semester exam

References:

1. Jean Dercourt, 1999- Géologie : cours et exercices. Ed. Dunod, Paris,
2. Denis Sorel et Pierre Vergely, 2010- Initiation aux cartes et aux coupes géologiques. Ed. Dunod, Paris, 115p.
3. Jean Tricart, 1965- Principes et méthodes de la géomorphologie. Ed. Masson, Paris, 496p.

Semester: 1st Semester
UE: Methodological Teaching Unit
Subject 2: Communication and Expression Techniques 1 (in French)
Credits: 4
Coefficient: 2

Objectives of the course
This subject aims at understanding and writing scientific documents in French as well as the use and translation of scientific terms.

Recommended prerequisites
No prerequisite

Content of the subject
1. Scientific Terminology
2. Study and understanding of texts
3. Written and oral expression techniques (report, synthesis, use of modern means of communication)
4. Expression and communication in a group. Study of proposed texts (observation, analysis, review, written expression)

Directed work
Proposal of exercises related to the most important language points.

Evaluation method

Continuous assessment and semester exam

References:
Scientific articles and thesis

Semester: 1st Semester
UE: Discovery Teaching Unit
Subject: Working Method and Terminology 1
Credits: 2
Coefficient: 2

Objectives of the course
To help the students to conceive the methods of research and synthesis of works according to the scientific rules.

Recommended prior knowledge
The student is expected to have some knowledge of bibliographic research.

Content of the subject
1. Introduction to bibliographic research
2. Writing a scientific report
3. Introduction to reading and understanding a scientific article

Evaluation method
Continuous assessment and semester exam

Semester: 1st Semester
UE: Transversal Teaching Unit
Subject: UNIVERSAL HISTORY OF BIOLOGICAL SCIENCES
Credits: 1
Coefficient: 1

Objectives of the course
This program should emphasize the history of biology and the question of life through the eras and civilizations. It should highlight the place of technical progress in the evolution of biology.

Recommended prior knowledge
No prerequisite.

Content of the subject
1. Prehistory
2. Antiquity
3. Middle ages
   3.1. In the West
   3.2. In the East (Muslim civilization)
4. Sixteenth and seventeenth centuries:
5. Eighteenth century: Darwin

6. Nineteenth century: Cell theory (microscopy), Sexuality Embryology, Biology
7. Molecular (DNA) Genetics
8. Twentieth century: gene therapy and cloning

Evaluation method

Semester exam

Reference

1. Denis Buican, 2008- Darwin dans l'histoire de la pensée biologique. Ed. Ellipses, 232p.
2. Christophe Ronsin, 2005- Histoire de la biologie moléculaire. Ed. De Boeck, 106p.
3. Jean Théodoridès, 2000- Histoire de la biologie. Ed. Puf, 127p.

1st year Common base

Natural and Life Sciences" field

Semester 2

Semester: 2nd Semester
UE: Fundamental Teaching Unit
Subject 1: THERMODYNAMICS AND CHEMISTRY OF MINERAL SOLUTIONS
Credits: 6
Coefficient: 3

Objectives of the course
This course provides an understanding of the principles governing transformations and interactions of matter, the principle of thermodynamics, energy equilibrium, and the kinetics of chemical reactions.

Recommended Prerequisites
The student should have knowledge of redox reactions.

Content of the course
1. Chemical equilibria
1.1. Acid-base equilibrium

1.1.1. Definition according to: Arrhenius; Bronsted; Lewis
1.1.2. Equilibrium constant: dissociation of water, acidity and basicity
1.1.3. The pH: of water, of a strong monobasic acid, of a strong monobasic acid, ...
1.2. Redox equilibrium
1.2.1. Redox reaction: electron transfer
1.2.2. Oxidation number
1.2.3. Writing redox reactions
1.2.4. Electrochemical Cells
1.2.5. Redox Potential
1.3. Precipitation Equilibrium: Solubility and Solubility Product
1.3.1. Definition
1.3.2. Effect of the addition of an ion on the solubility
1.3.3. Effect of pH

2. Chemical kinetics

2.1. Definition
2.2. Reaction rate
2.3. Expression of the rate law and order of a reaction
2.4. Factors influencing the speed of reaction

3. Thermodynamics

3.1. Thermodynamic systems and quantities: thermodynamic functions and transformations
3.2. First principle of thermodynamics
3.2.1. Expression of work and heat
3.2.2. Expression of internal energy and enthalpy
3.3. Second principle of thermodynamics
3.3.1. Expression of the entropy
3.3.2. Expression of the free energy and the free enthalpy
3.4. Thermochemistry
3.4.1. Heat of reactions
3.4.2. Enthalpy of reactions
3.4.3. Calculation of the internal energy of a reaction
3.4.4. Kincgoff's law
3.4.5. Hess's law
3.5. Prediction of the direction of reactions
3.5.1. Isolated systems
3.5.2. Calculation of reaction entropies
3.5.3. Reactions at constant temperature
3.5.4. Calculation of the free enthalpy and free energy of a system.

4. Inorganic Chemistry

Directed work

1. DW N°1: Chemical kinetics
2. DW N°2: Acid-base equilibria and precipitation equilibria
3. DW N°3: Oxidation-reduction equilibria
4. DW N°4: Thermodynamics and thermochemistry
5. DW N°5: Organic chemistry (Reaction mechanisms)

Practical work

TP N°1: Chemical kinetics
Part 1: Experimental determination of the order of the reaction
Objective: Determination of the order of the reaction with respect to sodium thiosulfate ($Na_2S_2O_3$) using the method of initial velocities.
Part 2: Influence of temperature on the reaction rate
Objective: Determination of the reaction rates for the same concentration of the reagents but for different temperatures.

TP N°2: Acid-base titrimetric analysis method. The acid-base neutralization
Part 1: Determination by colorimetry
Objective: Determination of a strong acid solution (HCl) by a strong base (NaOH) - Determination of the concentration of a weak acid solution (CH_3COOH) by a strong base solution (NaOH).
Part 2: Determination of the concentration of a weak acid (CH_3COOH) by a strong base solution (NaOH)
Objective: Determination of the concentration of a weak acid solution (CH_3COOH) by a strong base solution (NaOH).

TP N°3: Titration by the redox method. Manganimetric determination of Fe^{2+}.
Objective: Determination of the normality of a given solution of $KMnO_4$ -Determination of the concentration of Fe^{2+} contained in a solution of $FeSO_4$.

TP N°4: Identification of ions and separation of precipitates by centrifugation
Objective: Identify the ions present in a solution - Write the chemical formulas of an ionic compound in solution - Write the precipitation reactions - Express the relation between the equilibrium constant and the solubility.

Evaluation method
Continuous assessment and semester exam

References:

1. John C. Kotz et Paul M. Treichel, 2006- Chimie des solutions. Ed. De Boeck, 376p.
2. René Gaborriaud et al., Thermodynamique appliquée à la chimie des solutions. Ed. Ellipses, 335p

Semester: 2nd Semester
UE: Fundamental Teaching Unit
Subject 2: PLANT BIOLOGY
Credits: 6
Coefficient: 3

Objectives of the course
The objective of this subject is to teach the students the fundamental principles of the tissue organization of plants and their development.

Recommended prior knowledge

The student must have some knowledge of the different parts of a plant

Content of the course

1. Introduction to plant biology

2. Different types of tissues

2.1. Primary meristem (root and cell)

2.1.1. Primary tissues

2.1.2. Protective tissues (epidermis)

2.1.3. Filling tissues (parenchyma)

2.1.4. Support tissues (collenchyma and sclerenchyma)

2.1.5. Conductive tissues (primary xylem, primary phloem)

2.1.6. Secretory tissues

2.2. Secondary (lateral) meristems (cambium and phellogen)

2.2.1. Secondary tissues

2.2.2. Conductive tissues (secondary xylem and secondary phloem)

2.2.3. Protective tissues (suber or cork, phelloderma)

3. Anatomy of higher plants

3.1. Study of the root

3.2. Study of the stem

3.3. Study of the leaf

3.4. Comparative anatomy between mono- and dicotyledons

4. Morphology of higher plants and adaptation

4.1. Roots

4.2. Leaves

4.3. Stems

4.4. Flowers

4.5. Seeds

4.6. Fruits

5. Gametogenesis

5.1. Pollen grain

5.2. Ovule and embryo sac

6. Fertilization

6.1. Egg and embryo

6.2. Notion of development cycle

Practical work

- PW N°1: Morphological study of Angiosperms (roots-stems-leaves-flowers)
- PW N°2: Morphological study of Gymnosperms (roots-stems-leaves-flowers)
- PW N°3: Primary meristems (root and stem)
- PW N°4: Covering tissues : epidermis - piliferous base - suberous base - suberoid
- PW N°5: Parenchyma (chlorophyll-reserve-air-aquiferous)
- PW N°6: Supporting tissues (collenchyma-sclerenchyma)
- PW N°7: Secretory tissues (hairs-glands-tannin cells-laticifers)
- PW N°8: Primary conductive tissues (phloem-xylem)

Evaluation mode

Continuous assessment and semester exam

Reference

1. Alain Raveneau et al., 2014- Biologie végétale. Ed. De Boeck, 733p.
2. Jean François Morot-Gaudry et al., 2012- Biologie végétale. Ed. Dunod, Paris, 213p.

Semester: 2nd Semester
UE: Fundamental Teaching Unit
Subject 3: ANIMAL BIOLOGY
Credits: 6
Coefficient: 3

Objectives of the course
This module consists in introducing students to the particularities of the developmental biology of some animal species.

Recommended prerequisites
No prerequisite

Content of the subject
1. Embryology
1.1. Introduction
1.2. Gametogenesis
1.3. Fertilization
1.4. Segmentation
1.5. Gastrulation
1.6. Neurulation: fate of the leaflets
1.7. Delimitation: annexes of the birds
1.8. Particularities of human embryology (Cycle, nidation, evolution of annexes, placenta)
2. Histology
1.1. Coating epithelium
1.2. Glandular epithelium
1.3. Connective tissues
1.4. Blood tissues
1.5. Cartilaginous tissues
1.6. Bone tissue
1.7 Muscle tissues
1.8. Nervous tissues

Practical work
PW N°1: Gametogenesis
PW N°2: Fertilization and segmentation in sea urchins
PW N°3: Gastrulation in amphibians and birds
PW N°4: Exercises on gastrulation and neurulation
PW N°5: Neurulation in birds
PW N°6: Human embryology

Evaluation method
Continuous assessment and semester exam

References
Paul Richard W. FUNCTIONAL HISTOLOGY

Semester: 2nd Semester
UE: Methodological Teaching Unit
Subject 1: PHYSICS
Credits: 5

Coefficient: 3

Objectives of the course
The objective of this course is to enable students to acquire knowledge related to the basic notions of physics that can be used in the field of SNV.

Recommended prior knowledge
Students should have basic knowledge in mathematics and mechanics.

Content of the course
1. Mathematical background
1.1. Physical quantities and dimensional analysis
1.2. Calculation of errors (different types of errors, calculation of uncertainties and significant figures).
2. Optics
2.1.1. Introduction (objective of optics)
2.1.2. Nature of light (spectrum of electromagnetic waves, photons, waves...)
2.2. Geometrical optics
2.2.1. Principles of geometrical optics and propagation of light.
2.2.2. Refraction (Snell-Descarte's laws, limit angle and total reflection)
2.2.2.1. Plane diopters, conjugation formula, parallel blade and prism.
2.2.2.2. Spherical diopters (convergent, divergent), conjugation formula and geometrical construction (image construction).
2.2.2.3. Thin lenses (converging, diverging), conjugation formula, magnification, association of two thin lenses and geometric construction (image construction).
2.2.3. Reflection
2.2.3.1. Plane mirror (image construction)
2.2.3.2. Spherical mirror (image construction, conjugation formula)
2.2.4. Optical Instruments
2.2.4.1. The eye
2.2.4.2. The magnifying glass and the optical microscope
3. Fluid Mechanics
3.1. Definition and characteristics of a fluid.
3.2. Hydrostatics (Fundamental relation of hydrostatics, buoyancy, float)
3.3. Hydrodynamics (deed, continuity equation, Bernoulli's theorem)
4. Notion of crystallography
5. Notions of spectral analysis

Practical work:
PW N°1: Exercises on dimensional analysis and error calculation.
PW N° 2: Exercises on the propagation of light, plane diopters and the prism
PW N° 3: Exercises on spherical diopters and thin lenses.
PW N° 4: Exercises on plane and spherical mirrors and the reduced eye.
PW N° 5: Exercises on Pascal's law and Archimedes' thrust (Hydrostatics)
PW N° 6: Exercises on Bernoulli's law (hydrodynamics)

Evaluation method
Continuous assessment (presentation + test) and semester exam.

References:

1. Christophe Texier, 2015- Mécanique quantique. Ed. Dunod, Paris.
2. Eugene Hecht, 1998- Physique. Ed. De Boeck, 1304p.
3. Michel Blay, 2015- Optique. Ed. Dunod, Paris, 452p.

Semester: 2nd Semester

UE: Methodological Teaching Unit
Subject 2: COMMUNICATION AND EXPRESSION TECHNIQUES 2 (English)
Credits: 4
Coefficient: 2

Objectives of the course
This subject completes the learning of understanding and writing scientific documents in English.

Recommended prerequisites
No prerequisite

Content of the subject:
1. Scientific Terminology
2. Study and understanding of texts
3. Written and oral expression techniques (report, synthesis, use of modern means of communication)
4. Expression and communication in a group. Study of proposed texts (observation, analysis, review, written expression)

Practical work:
Proposed exercises related to the language points considered most important.

Evaluation method:
Continuous assessment and semester exam

References:
Scientific articles

Semester: 2nd Semester
UE: Discovery Teaching Unit
Subject: LIFE SCIENCES AND SOCIO-ECONOMIC IMPACTS
Credits: 2
Coefficient: 2

Objectives of the course
To help the students to conceive the professions directly or indirectly linked to the different specialties of the natural and life sciences.

Recommended prior knowledge
No prerequisite

Content of the subject
1. Animal and plant production (breeding, transformation, production...)
2. Toxicology and environmental health (effect of pollutants on plant and animal life and on human health)
3. Biology and health (talk about the interest of biology in the diagnosis of animal and plant diseases),
4. Biotechnology and molecules of interest (pharmaceutical and food industry),
5. Biology and forensics
6. Terrestrial and marine ecosystems (park management...)
7. Technical-commercial biology (e.g.: commercial delegate).

Evaluation method
Continuous assessment and semester exam

References:
Scientific articles

Semester: 2nd Semester
UE: Transversal Teaching Unit
Subject: WORKING METHODS AND TERMINOLOGY 2
Credits: 1
Coefficient: 1

Objectives of the course
To help the students to conceive the methods of research and synthesis of works according to the scientific rules.

Recommended prior knowledge
The student is expected to have some knowledge of bibliographic research.

Content of the subject
1. Terminology
2. Writing a scientific report
3. Introduction to reading and understanding a scientific article

Evaluation method
Semester exam

References:
Scientific articles

2nd year / "Biological Sciences" field

Semester 3

Semester: 3rd Semester
UE: Fundamental Teaching Unit 1
Subject: ZOOLOGY
Credits: 6
Coefficient: 3

Objectives of the course
To know the main groups of living organisms in terms of: general architecture, characteristics (systematics, morphology, anatomy, reproduction, and ecology), constraints, adaptations, and evolution. Particular emphasis will be placed on the updating of classification and on zoological groups of agricultural, medical, veterinary, fisheries or environmental interest.

Recommended prerequisites
The student should have an idea of the different classes of the animal kingdom.

Content of the course
1. Introduction to the animal kingdom
- 1.1. Basics of classification
- 1.2. Zoological nomenclature
- 1.3. Evolution and phylogeny
- 1.4. Numerical importance of the animal kingdom

2. Subdomain Protozoa
- 2.1. General information on protozoa.
- 2.2. Classification
  - 2.2.1. Phylum Sarcomastigophora
  - 2.2.2. Phylum Ciliophora
  - 2.2.3. Phylum Apicomplexa
  - 2.2.4. Phylum Cnidosproridia

3. Subdomain of Metazoa
- 3.1. Embranchment Spongiaria
- 3.2. Phylum Cnidaria
- 3.3. Phylum Ctenaria
- 3.4. Phylum Plathelminthes
- 3.5. Phylum Nemathelminthes.
- 3.6. Phylum Annelidae
- 3.7. Phylum Molluscs
- 3.8. Phylum Arthropoda

3.9. Phylum Echinoderms
3.10. Phylum Chordates

Practical work

- PW N°1: Study of some typical species of Protozoa: Trypanosoma rhodesiense, Leishmania major, Leishmania infantum, Trypanosoma gambiense, Entamoeba histolytica, Paramecium sp.
- PW N°2: Study of some Plathelminthes species: Moniezia expansa, Taenia hydatigena, Taenia pisiformis, Fasciola hepatica.
- PW N°3: Study of some typical Annelid species: Lumbricus terrestris, Hirudo officinalis.
- PW N°4: Study of some typical species of Arthropods: Crustaceans (Royal shrimp, Squilla, morphology and biramed appendages), Chelicerata (Scorpion), Insects (Cricket, Bee).
- PW N°5: Study of the mouth parts of Insects: The different mouthparts and their adaptation to the diets, the mouthparts of the crusher type (Orthoptera, Locust).
- PW N°6: Study of some typical species of Echinoderms: Echinids (Sea Urchin), Asteroids (Sea Star).
- PW N°7: Study of some typical species of Vertebrates: Fishes (Carp), Birds (Pigeon), Mammals (Rat, Mouse)

Film projection

- Turtles.
- Birds
- Amphibians.

Evaluation method

Continuous assessment and semester exam

References

1. ARAB A., CHERBI M., KHERBOUCHE-ABROUS O., Amine F., BIDI AKLI S., HADDOU SANOUN G., 2013: Zoologie Tome 1. Polycopié, OEuvres et Publications Universitaires. Algérie. 152 p.

2. ARAB A., CHERBI M., KHERBOUCHE-ABROUS O., Amine F., BIDI AKLI S., HADDOU SANOUN G., 2013 : Zoologie Tome 2 : Travaux Pratiques. Polycopié, OEuvres et Publications Universitaires. Algérie. 224 p

Semester: 3rd Semester
UE: Fundamental Teaching Unit 2
Subject 1: BIOCHIMY
Credits: 6
Coefficient: 3

Objectives of the course
This subject consists in teaching the fundamental bases of biochemistry and the notions of enzymology, and to familiarize the students with biochemical techniques.

Recommended prior knowledge
The student must have some knowledge of chemical bonds (weak and strong) and of the physicochemical properties of organic molecules.

Content of the course
1. Chemical bonds
   1.1. Strong bonds
   1.2. Weak bonds
2. Structure and physicochemical properties of carbohydrates
   2.1. Simple bones
   2.2. Oligosides
   2.3. Polyholosides, heterosides.
3. Structure and physicochemical properties of lipids
   3.1. Simple lipids
   3.2. Complex lipids
4. Structure and physicochemical properties of amino acids, peptides and proteins
   4.1. Amino acids, peptides, proteins
   4.2. Structure (primary and secondary, tertiary and quaternary)
   4.3. Properties and effect of treatments (solubility, electro-phoretic behavior, denaturation.)
   4.4. Separation of proteins

5. Concepts of enzymology

5.1. Definition, classification
5.2. Mechanisms of action
5.3. Active site
5.4. Enzymatic kinetics and types of representation
5.5. Enzymatic inhibition
5.6. Allostery phenomenon

6. Concepts of bioenergetics

6.1. Types of chemical reactions
6.2. The respiratory chain and energy production
6.3. Phosphorylation and redox reaction

7. Carbohydrate metabolism

7.1. Catabolism (glycolysis, glycogenolysis, pentose phosphate pathway, Krebs cycle, energy balance)
7.2. Anabolism (neoglucogenesis and glycogenesis)
7.3. Regulation

8. Lipid metabolism

8.1. Catabolism of fatty acids (Beta-oxidation)
8.2. Catabolism of sterols
8.3. Biosynthesis of fatty acids and triglycerides
8.4. Sterol biosynthesis
8.5. Regulation

9. Peptide and protein metabolism

9.1. Catabolism of amino groups
9.2. Catabolism of carboxyl groups
9.3. Catabolism of the side chain
9.4. Glucoforming and ketogenic acids
9.5. Biosynthesis of essential amino acids
9.6. Nitrogen elimination, urea cycle
9.7. Example of peptide biosynthesis (case of peptides with biological activity)
9.8. Example of protein biosynthesis
9.9. Regulation

10. Structure and metabolism of other compounds of biological interest

10.1. Vitamins
10.2. Hormones

Evaluation method

Continuous assessment and semester exam

References:

1. Cathérine Baratti-Elbaz et Pierre Le Maréchal, 2015- Biochimie. Ed. Dunod, Paris, 160p.
2. Norbert Latruffe, Françoise Bleicher-Bardelett, Bertrand DucloS et Joseph Vamecq, 2014- Biochimie. Ed. Dunod, Paris.
3. Serge Weinman et Pierre Méhul, Toute la biochimie. Ed. Dunod, Paris, 464p.
4. Françoise Lafont et Christian Plas, 2013- Exercices de biochimie. Ed. Doin, Paris, 410p.

Semester: 3rd Semester
UE: Fundamental Teaching Unit 2
Subject 2: GENETICS
Credits: 6
Coefficient: 3

Objectives of the course
This subject allows the student to acquire the notions and terminology of genetics, the transmission of traits, the structure of DNA, replication, transcription, alterations and the mechanisms of regulation of gene expression.

Recommended Prerequisites
The student should have knowledge of nucleic acids and Mendelian genetics.

Content of the course
1. Genetic material
- 1.1. Chemical nature of genetic material
- 1.2. Structure of nucleic acids (DNA-RNA)
- 1.3. DNA replication: in prokaryotes and eukaryotes
- 1.4. Organization into chromosomes

2. Transmission of genetic characters in eukaryotes
3. Genetics of haploids
- 3.1. Independent genes
- 3.2. Linked genes
- 3.3. Genetic mapping

4. Genetics of diploids
- 4.1. Independent genes
- 4.2. Linked genes
- 4.3. Genetic mapping

5. Bacterial and viral genetics
- 5.1. Conjugation
- 5.2. Transformation
- 5.3. Transduction
- 5.4. Mixed infection in viruses

6. Protein synthesis
- 6.1. Transcription
- 6.2. Genetic code
- 6.3. Translation

7. Genetic mutations

8. Chromosomal mutations
- 8.1. Structural variation
- 8.2. Numerical variation (human example)

9. Gene structure and function: biochemical genetics

10. Regulation of gene expression
- 10.1. Lactose operon in prokaryotes
- 10.2. Example in eukaryotes

11. Notions of extra-chromosomal genetics

12. Notion of population genetics

Directed work:
- DW N°1: Genetic material
- DW N°2: Transmission of traits
- DW N°3: Mono and di hybridism (Special cases)
- DW N°4: Linked genes
- DW N°5: Genetic maps
- DW N°6: Protein synthesis (genetic code)
- DW N°7: Fine structure of the gene (intragenic recombination)
- DW N°8: Conjugation and factorial map
- DW N°9: Population genetics
- DW N°10: DNA extraction
- DW N°11: DNA assay
- DWN°12: BARR corpuscle

Mode of evaluation

Continuous assessment and semester exam

References:

1. Pasternak J.J., 2003- Génétique moléculaire humaine. Ed. De Boek, 522 p.
2. Harry M., 2008- Génétique moléculaire et évolutive. Ed. Maloine.
3. Watson J., Baker T., Bell S., Gann A., Levine M. et Losick R., 2010- Biologie moléculaire du gène. Ed. Pearson.
4. Henry J.P. et Gouyon P.H., 2003- Précis de Génétique des Populations. Ed. Dunod.

Semester: 3rd Semester
UE: METHODOLOGICAL TEACHING UNIT 1
Subject: Communication and Expression Techniques (in English)
Credits: 4
Coefficient: 2

Objectives of the course
To learn and apply research methods and the collection of useful and indispensable information for the synthesis and the written formatting (report, oral, defense). Application of English grammar in a scientific context.

Recommended prior knowledge
Some notions of terminology and research methodology acquired in L1.

Content of the course
1. Study of proposed texts (observation, analysis, review, written expression)
2. Terminology
3. Methodology of bibliographic research.
4. Methods of writing scientific reports.

Evaluation methods
Continuous assessment and semester exam

References:
Research article.

Semester: 3rd Semester
UE: Methodological Teaching Unit 2
Subject: BIOPHYSICS
Credits: 5
Coefficient: 3

Objectives of the course
The general objective of the teaching of the biophysics course is to allow the students in SNV to acquire the basics in physics.

Recommended prior knowledge

Content of the subject
1. The states of matter
1.1. Gases: elements of kinetic theory, equation of state of perfect or real gases, changes of state
1.2. Liquids: structure of water, dissolution
1.3. Solids: different structures

1.4. Intermediate states: glasses, liquid crystals, granular states, deformable polymers

2. Generalities on aqueous solutions

2.1. Study of solutions: classification of solutions

2.2. The concentrations: molar fraction, molarity, molality, weight concentration, osmolarity, equivalent concentration.

2.3. Solubility

2.4. Electrolyte solutions: electrical conductivity, physical and chemical properties of electrolytes

3. Surface phenomena

3.1. Surface tension: definition, measurements and biological applications

3.2. Capillarity phenomenon: definition, measurements and biological applications

3.3. Adsorption

4. Diffusion phenomenon

4.1. Diffusion

4.2. Osmosis phenomenon and osmotic pressure: definition, measurements and biological applications

4.3. Permeability: definition, measurements and biological applications

5. Study of the viscosity

5.1. Laminar and turbulent flow

5.2. Viscous resistance and viscosity measurements

5.3. Sedimentation

6. Sound and ultrasonic waves

6.1. The sound wave and its properties: production, nature and classification of sound waves.

6.2. The Doppler effect: definition, measurements and biological applications.

6.3. Ultrasound: definition, measurements and biological applications.

Practical work: (do 3 practical exercises at least)

- PW N°1: Surface tension
- PW N°2: Conductimetric titration
- PW N°3: Titration by PH-meter
- PW N°4: Viscosity measurement
- PW N°5: Spectrophotometer
- PW N°6: Refractometer

Evaluation mode

Continuous control (presentation + test) and semester exam.

References :

1. F. Grémy et J. Perin. Eléments de Biophysique. Tome 1 et 2. Flammarion. Paris.
2. C. Bénézech et J. Llory. Physique et Biophysique. Masson et Cie. Paris, 1973.
3. Y.THOMAS, 2000, Biophysique à l'usage des étudiants en sciences biologique, Bréal, Paris.
4. Bertrand, D. Ducassou et JC. Healy. Biophysique. Utilisation médicale des rayonnements -Vision - Audition.

Semester: 3rd Semester
UE: Discovery Teaching Unit
Subject 1: Environment and sustainable development
Credits: 2
Coefficient: 2

Objectives of the course

The aim of this course is to make students aware of the issues, contents and actions of sustainable development. The aim is to make them aware that it is possible to act for the

preservation of the environment, through their education, as well as at their level, on their consumption, their daily activities and their society. During their university education, whatever their specialization and their ambition for their future career, students will have the opportunity to learn and experience their knowledge of sustainable development. Sustainable development is currently one of the responses emerging worldwide, to face the current conjunction of major ecological, economic and societal issues in the world.

Recommended prerequisites: No prerequisites

Content of the subject

1. Definitions: Environment, components of an environment, sustainable development.

2. Meaning of development?

2.1. The main dimensions of the environmental crisis: human demography, global warming, fossil fuels (non-renewable), depletion of natural resources, drinking water, biodiversity and agriculture

2.2. Sustainable development, why?

2.3. The concept of sustainable development

2.4. The fields of sustainable development

2.5. SD principles and their origins: precaution, prevention, responsibility, solidarity, equity, polluter pays

2.6. Some indicators of sustainable development: ecological footprint and bio capacity, environmental impact, environmental performance index, human development index, GDP: gross domestic product (economic) and school enrolment rate boys/girls (societal), accessibility to healthcare (societal).

2.7. Environmental education, nature awareness and animation, environmental communication,

Program for personal work

1. Find examples in the press (international and national) illustrating the principles of sustainable development (precaution, responsibility for example). Presentation and discussion.
2. Test ecological reflexes
3. Comparison of the life cycle of a biodegradable and non-biodegradable product
4. To illustrate the polluter pays principle by taking an example of a polluting company in Algeria, taking into account the national legislation.
5. To give examples of the implementation of preservation, conservation or restoration of the environment

Mode of evaluation

Continuous assessment and semester exam

References:

Semester: 3rd Semester
UE: Transversal Teaching Unit
Subject: ETHICS AND UNIVERSITY DEONTOLOGY
Credits: 1

Coefficient: 1

Objectives of the course

The general objective of this course is to enable students in VNS to acquire the resources of professional deontology and ethics.

Recommended prerequisites: No prerequisites

Content of the subject

1. INTRODUCTION: Context of the Algerian university

2. CONCEPTS

2.1. Moral
2.2. Ethics
2.3. Deontology
2.4. Law
2.5. Professional values
2.6. Learning and teaching
2.7. Didactics and pedagogy

3. THE CHARTER OF ETHICS AND UNIVERSITY DEONTOLOGY

3.1. Fundamental principles
3.2. Rights
3.3. Obligations and duties

4. APPLICATIONS

4.1. Teaching: courses, evaluation of knowledge and behavior.....
4.2. Scientific research: research methodology, plagiarism, copyright, scientific writing.....

Evaluation method

Semester exam

References:

1. Bergadaà, M., Dell'Ambrogio, P., Falquet, G., Mc Adam, D., Peraya, D., & Scariati, R. (2008). La relation éthique-plagiat dans la réalisation des travaux personnels par les étudiants.
2. Charte de l'éthique et de la déontologie universitaires, Alger, mai 2010 www.mesrs.dz
3. Gilbert Tsafak, Ethique et déontologie de l'éducation *Collection Sciences de l'éducation* Presses universitaires d'Afrique, 1998
4. Gohier, C., & Jeffrey, D. (2005). *Enseigner et former à l'éthique*. Presses Université Laval.
5. Jaunait, A. (2010). Éthique, morale et déontologie. *Poche-Espace éthique*, 107-120.

2nd year / "Biological Sciences" field

Semester 4

Semester: 4th Semester
UE: Fundamental Teaching Unit 1
Subject: Botany
Credits: 6
Coefficient: 3

Pedagogical objectives of the course
This subject aims at introducing the classification and anatomical characterization of the main groups of the plant kingdom. The teaching also attempts to provide students with the modalities of reproduction.

Recommended prior knowledge
The student must have knowledge of plant biology (morphology, anatomy, physiology).

Content of the course
Introduction to botany: definitions, concepts and classification criteria. Systematics of the major groups of the plant kingdom

PART ONE: Algae and Fungi

1. The algae
   1.1. Prokaryotic algae (Cyanophytes / Cyanobacteria)
   1.2. The eukaryotic algae
      1.2.1. Morphology
      1.2.2. Cytology
      1.2.3. Reproduction (notion of gamie, development cycle)
   1.3. Systematics and particularities of the main groups
      1.3.1. The Glaucophyta
      1.3.2. The Rhodophyta
      1.3.3. Chlorophyta and Streptophyta
      1.3.4. Haptophyta, Ochrophyta, Dinophyta, Euglenozoa, Crytophyta, Cercozoa
2. Fungi and lichens
   2.1. Problems in the classification of fungi
   2.2. Structure of the thallus (mycelia, stroma, sclerotia)
   2.3. Reproduction
   2.4. Systematics and characteristics of the main groups of fungi
      2.4.1. The Myxomycota
      2.4.2. The Oomycota
      2.4.3. Eumycota (Chrytridiomycota, Zygomycota, Glomeromycota, Ascomycota, Basidiomycota)
   2.5. A particular alga-fungus association: the lichens
      2.5.1. Morphology
      2.5.2. Anatomy
      2.5.3. Reproduction

PART TWO: Embryophytes

1. Bryophytes: Morphology and reproduction of the different phyla
   1.1. Marchantiophytes
   1.2. Anthocerotophytes

1.3. Bryophytes s. str.

2. Pteridophytes: Morphology and reproduction of the different phyla

2.1. Lycophytes

2.2. Sphenophytes (= Equisetinae)

2.3. Filicophytes

3. Gymnosperms sensu lato

3.1. Cycadophytes: notion of ovule

3.2. Ginkgophytes

3.3. Coniferophytes: notion of flower, inflorescence and seed

3.4. Gnetophytes: pivotal group

4. Angiosperms

4.1. The vegetative apparatus and the notion of morphogenesis: growth of stems, leaves and roots

4.2. Floral morphology (organization of the flower, inflorescences)

4.3. Floral biology: microsporogenesis and macrosporogenesis

4.4. Seeds and fruits

4.5. Concept of modern systematics, cladogenesis and main taxa. Presentation of classifications (Engler 1924, APG II)

Practical work (3h weeks):

- **PW N° 1. Algae (Phycophytes):** Morphology and reproduction of some species like Ulva lactuca and Cystoseiramediterranea.
- **PW N°2. Mushrooms (Fungi):** Morphology and reproduction of Rhizopus nigricans (Zygomycetes), Agaricus campestris (Basidiomycetes)
- **PW N°3. Lichens:** Morphology of different types of lichens and study of Xanthoria parietina
- **PW N° 4. Bryophytes:** Morphology and reproduction of Bryum sp.
- **PW N°5. Pteridophytes:** Morphology and reproduction of Polypodium vulgare and Selaginella denticulata
- **PW N°6. Cycadophytes:** Morphology and reproduction of Cycas revoluta
- **PW N°7. Coniferophytes (Gymnosperms sensu stricto):** Morphology and reproduction of Pinus halepensis and Cupressus sempervirens
- **PW N°8 and 9: Angiosperms Monocotyledons and Eudicotyledons:** Illustration of the notion of trimery and pentamery, of the notion of actinomorphy and zygomorphy; dialypetaly, gamopetaly, hypogynous flower, epigynous flower...
- **PW N°8.** Floral morphology of Angiosperms Monocotyledons on examples like Asphodelus (or Allium)
- **PW N°9.** Floral morphology of Eudicotyledonous Angiosperms on examples like Lathyrus or Vicia
- **PW N°10.** Sexual reproduction in Angiosperms: Pollen grain, pollination and fertilization in Angiosperms - Types of fruits and types of seeds.

Evaluation method

Continuous assessment and semester exam

References:

1. APG II. 2003. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG II. *Bot. J. Linnean Society* 141:399–436.

2. APG III. 2009. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG II. *Bot. J. Linnean Society* 161:105–121.
3. Lecointre G. et Le Guyader H. 2001. Classification phylogénétique du vivant. Ed. Belin.
4. Reviers de B. 2002. Biologie et Phylogénie des algues. Tome 1 et 2. Ed. Belin.
5. Meyer S., Reeb C. et Bosdeveix R. 2004. Botanique: Biologie et Physiologie végétales.
6. Ed. Maloine. Dupont F., Guignard J.L. 2012. Botanique Les familles de plantes. Ed. Elsevier-Masson

Semester: 4th Semester
U.E: Fundamental Teaching Unit 2
Subject 1: MICROBIOLOGY
Credits: 8
Coefficient: 4

Aim of the course
The student must acquire the notions of the microbial world, the techniques used to observe microorganisms, bacterial growth and classification.

Recommended prior knowledge
The student must have a global notion of pathogens.

Content of the course
1. The microbial world
- 1.1. Historical background
- 1.2. Place of microorganisms in the living world
- 1.3. General characteristics of the prokaryotic cell

2. The bacterial cell
- 2.1. Observation techniques of the bacterial cell
- 2.2. Cell morphology
- 2.3. The cell wall
  - 2.3.1. Chemical composition
  - 2.3.2. Molecular structure
  - 2.3.3. Functions
  - 2.3.4. Gram staining
- 2.4. The plasma membrane
  - 2.4.1. Chemical composition
  - 2.4.2. Structure
  - 2.4.3. Functions
- 2.5. The cytoplasm
  - 2.5.1. Ribosomes
  - 2.5.2. The reserve substances
- 2.6. The chromosome
  - 2.6.1. Morphology
  - 2.6.2. Composition
  - 2.6.3. Chemical replication
  - 2.6.4. Structure
- 2.7. Plasmids

2.7.1. Structure
2.7.2. Replication
2.7.3. Properties
2.8. Pilli
2.8.1. Structure
2.8.2. Function
2.9. The capsule
2.9.1. Morphology
2.9.2. Chemical composition
2.9.3. Functions
2.10. Cilia and flagella
2.10.1. Identification of the cilia and flagella
2.10.2. Structure
2.10.3. Functions
2.11. The spore
2.11.1. Morphology
2.11.2. Structure
2.11.3. Sporulation phenomena
2.11.4. Properties
2.11.5. Germination

3. Bacterial classification

3.1. Phenetic classification
3.2. Phylogenic classification
3.3. Bergey's classification

4. Bacterial nutrition

4.1. Basic needs
4.2. Growth factors
4.3. Trophic types
4.4. Physico-chemical parameters (temperature, pH, O2 and aW)

5. Bacterial growth

5.1. Measurement of growth
5.2. Growth parameters
5.3. Growth curve (batch culture)
5.4. Bacterial culture
5.5. Antimicrobial agents.

6. Concepts of mycology and virology

6.1. Mycology (yeast and mould)
6.1.1. Taxonomy
6.1.2. Morphology
6.1.3. Reproduction
6.2. Virology
6.2.1. Morphology (capsid and envelope)
6.2.2. Different types of virus

Practical work:

- PW N°1: Introduction to the microbiology laboratory
- PW N°2: Method of study of microorganisms and the different processes of sterilization
- PW N°3: Inoculation methods;

- PW N°4: Microscopic study of bacteria, simple staining
- PW N°5: Morphological study of different bacterial colonies on culture medium
- PW N°6: Gram staining
- PW N°7: Culture media
- PW N°8: Study of bacterial growth
- PW N°9: Criteria of biochemical identification of bacteria
- PW N°10: Yeasts and cyanobacteria
- PW N°11: Growth inhibitors, antibiogram
- PW N°12: Isolation of the total and specific flora of some products (water, milk...).

Mode of evaluation

Continuous assessment and semester exam

References

1. Henri Leclerc, Jean-Louis Gaillard et Michel Simonet, 1999- Microbiologie générale. Ed. Doin, Paris, 535p.
2. Jerome Perry, James Staley et Stephen Lory, 2004- Microbiologie-Cours et questions de révision. Ed. Dunod, Paris, 889p.
3. Jean-Pierre Dedet, 2007- La microbiologie, de ses origines aux maladies émergentes. Ed. Dunod, Paris, 262p.

Semester: 4th Semester
U.E: Fundamental Teaching Unit 2
Subject 2: IMMUNOLOGY
Credits: 4
Coefficient: 2

Objective of the course
The objective of this course is to introduce students to the role of immunity, immune defense systems, types of immune response and dysfunctions of the immune system.

Recommended prerequisites
The student should have a basic understanding of the immune system.

Content of the course
1. Introduction to immunology.
1.1. Role of immunity
1.2. Relationship to daily life and major discoveries
2. Ontogenesis of the immune system
2.1. B cells and lymphoid organs
2.2. T cells
2.3. Education of B cells within the marrow
2.4. Education of T cells inside the thymus
2.5. Other cells (myeloid cells)
3. MHC
4. The non-specific immune response: intervening cells and complement
5. The specific immune response
5.1. Cellular
5.2. Humoral
6. Cellular and humoral cooperation
6.1. Cooperation between different cells
6.2. Cytokines
7. Dysfunction of the immune system
8. The main tests in immunology
8.1. Agglutination

8.2. Immunoprecipitation
8.3. Immunoelectrophoresis
8.4. Immunofluorescence
8.5. Elisa Techniques

Directed work

- DW N°1: Ag-Ac reaction (precipitation: immunodiffusion, ELISA, RIA....)
- DW N°2: Preparation of lymphocytes and monocytes from whole blood
- DW N°3: Separation of T and B lymphocytes
- DW N°4: Lymphomicrocytotoxicity test

Evaluation mode

Continuous assessment and semester exam

References

1. Marie-Christine Bené, Yvon Lebranchu, François Lemoine et Estelle Seillès, 2013- Immunologie fondamentale et immunopathologie. Ed. Elsevier Masson, Paris, 260p.
2. Judy Owen, Jenni Punt et Sharon Stranford, 2014- Immunologie. Ed. Sciences de la vie, 832p.
3. Abul-K Abbas et Andrew-H Lichtman, 2013- Les bases de l'immunologie fondamentale et clinique. Ed. Elsevier Masson, Paris, 284p.

Semester: 4th Semester
UE: Methodological Teaching Unit 1
Subject: SCIENTIFIC METHODOLOGY AND LIFE STUDY TECHNIQUES
Credits: 4
Coefficient: 2

Objectives of the course
This subject allows the students to have notions on the methods applied to the study of living organisms: cytological methods, methods of study of the biochemical composition of cells and techniques of approach to living organisms.

Recommended prior knowledge

Content of the subject
Different scientific practices on observation (descriptive methods), manipulation (analytical methods) and exploration (synthetic methods) of animal and plant life.

PART ONE: METHODS OF STUDYING CELL MORPHOLOGY
I. Cytological methods
1. Microscopy
  1.1. Light microscopes or photonic microscopes
    1.1.1. Transmission microscopes
    1.1.2. Other photonic microscopes
    - The phase contrast microscope
    - Darkfield microscope
    - Polarized light microscope
    - UV microscope (= fluorescence microscope)
    - The scanning microscope
  1.2. Electron microscopes
    1.2.1. The transmission electron microscope

1.2.2. The scanning electron microscope

II. Methods for studying the biochemical composition of cells

1. Cellular materials
   1.1. Whole cells or cell sections
   1.2. Cellular shreds = cellular homogenates (different techniques can be used)
   1.3. Cellular fractions
      - Principle of the separation of cellular organelles
      - Differential ultracentrifugation
      - Ultracentrifugation on density gradient
2. The methods
   2.1. Electrophoresis
   2.2. Biochemical analysis and dosage methods
   2.3. Cytochemical methods.
   2.4. Cytology / immunology technique

III. Genetic engineering techniques (DNA sequencing)

PART TWO: METHODS AND TECHNIQUES OF APPROACHING THE LIVING.

1. THE HERBARY: Collection of dry plants, indispensable basis for research.
2. Techniques of approach to the living.
   2.1. Breeding.
   2.2. Cultures.
   2.3. Collections.
   2.4. Dissections.
3. Access to demographic parameters of animal and plant populations.

Evaluation method

Continuous assessment and semester exam

References

Semester: 4th Semester
U.E: Methodological Teaching Unit 2
Subject: BIO STATISTICS
Credits: 5
Coefficient: 3

Objective of the course
The objective of this course is to provide some methodological tools classically used to describe and test biological phenomena.

Recommended prior knowledge
The student must have notions on probabilities and numerical analysis seen in the first year.

Content of the subject
1. Reminders
- 1.1. Reminders on descriptive statistics
  - 1.1.1. Parameters of positions
  - 1.1.2. Parameters of dispersion
  - 1.1.3. Shape parameters

2. Recall the main distribution laws: normal and log normal, Student, Pearson, Fischer-Snedecor
3. Statistical Inference: Hypothesis Testing
- 3.1. Conformity test
- 3.2. Comparison test
- 3.3. Test of independence

4. Correlation study and Regression

4.1. Correlation coefficient
4.2. Significance test of the correlation
4.3. Simple linear regression
4.3.1. Regression line (least squares method)
4.3.2. Confidence interval of the regression estimate
4.3.3. Significance test of the regression coefficients

5. One and two factor analysis of variance

The use of software such as Statistica or SAS as a TP for each chapter that will be covered in detail in the third year.

Directed work:
Series of exercises on each chapter of the course

Evaluation method
Continuous assessment and semester exam

References:

1. BENZEON J.P., 1984- L'analyse des données. Ed. Bordas, Tomes I et II.
2. HUET S., JOLIVET E. et MESSEON A., 1992- La régression non linéaire : méthodes et applications en biologie. Ed. INRA.
3. TROUDE C., LENOUR R. et PASSOUANT M., 1993- Méthodes statistiques sous Lisa - statistiques multi variées. CIRAD-SAR, Paris, PP : 69-160.

Semester: 4th Semester
DU: Discovery Teaching Unit
Subject: GENERAL ECOLOGY
Credits: 2
Coefficient: 2

Teaching objective
The objective of the subject is to make the students understand the notion of ecosystem, the abiotic and biotic factors and the interactions between these factors, the components of the ecosystem and its functioning.

Recommended prior knowledge

Content of the subject
Chapter I
1. Definition of the ecosystem and its components (Notions of biocenosis and ecological factors)
2. Areas of intervention

Chapter II: Environmental factors
1. Abiotic factors
2. Climatic
3. Edaphic

4. Hydric
5. Biotic factors
   5.1. Competitions
   5.2. Pests and Predators
   5.3. Cooperative and symbiotic interactions
   5.4. Parasitism
6. Interaction of environments and living beings
   6.1. Role of ecological factors in the regulation of populations
   6.2. Notion of ecological optimum
   6.3. Ecological valence
   6.4. Ecological niche.

Chapter III: Structure of ecosystems

1. Food chain structure; relationships between producers (autotrophs) and their dependence on nutrients and light or chemical energy.
2. Consumers (Heterotrophs) who are linked to the producers and finally the decomposers who ensure the recycling and mineralization of organic matter.

Chapter IV: Ecosystem Functioning

1. Energy flows in the biosphere:
2. Notions of ecological pyramids, production, productivity and bioenergy yield
3. Circulation of matter in ecosystems and main biogeochemical cycles
4. Influence of human activities on biological equilibrium and particularly on the disruption of bio-geochemical cycles (consequences of pollution of aquatic environments and atmospheric pollution (eutrophication, greenhouse effect, ozone, acid rain.)

Chapter V: Summary description of the main ecosystems

1. Forest, grassland, surface water, ocean
2. Evolution of ecosystems and notion of climax

Directed work:
The tutorials concern the methods applied for the study of the environment.

Evaluation method
Continuous assessment and semester exam

References:

1. DAJET P. et GORDAN M., 1982- Analyse fréquentielle de l'écologie de l'espèce dans les communautés. Ed. Masson.
2. RAMADE F., 1984- Eléments d'écologie : Ecologie fondamentale. Ed. Mc Graw-Hill.

Semester: 4th Semester
TU.: Transversal Teaching Unit
Subject: COMPUTER TOOLS
Credits: 1
Coefficient: 1

Teaching objective
Initiation to the basic definitions of the operating system of computer resources. At the end of this course, the student will be able to design documents and tables in Word and Excel.

Recommended prior knowledge

Content of the subject
1. Introduction to the operating system
1.1. Definition of an OS
1.2. Different existing OS: Windows, Linux and Mac OS.
2. Discovery of the office suite
2.1. Designing documents with WORD.
2.2. Designing tables with EXCEL.

2.3. Designing a presentation with Powerpoint.
2.4. Introduction to Latex.

3. Software and algorithms

3.1. Definition of a software.
3.2. Definition of algorithmic.
3.3. Use of algorithms in biology.

Evaluation method

Semester exam

References:

3rd year / "Animal Biology and Physiology" course

Semester 5

UEF 3.1.1(O/P) : Descriptive Biology		**Embryonic Development**
Semester: 5		
Global hourly volume of the subject in the unit Global hourly volume of personal work: **110h00** Global hourly volume of classroom work (courses/PW): **90h00**		
Course: **45h00**	DW: **0h00**	PW: **45h00**
Nature of PW : Manipulation, microscopic observation, realization of models		
Credits: 08		
Prerequisite: Stages of embryogenesis, primordial tissues, development of primordial tissues		

Objectives: This subject will allow the student to acquire, after recalling the embryonic development in batrachians, birds and mammals, the cellular and molecular mechanisms of the establishment of the various tissues during the stages of embryonic development

Content elements: The module is organized in 2 sessions of 1h30 each per week and one session of 3h00 each week. The classes are held in the lecture hall or in a large room with a video projector. The practical sessions are carried out in the laboratory equipped with a video projector, microscopes and other laboratory equipment (ovens, centrifuge, ELISA reader ....).

Contents:

1. Main developmental characteristics of some basic types
- 1.1. Development of Amphibians
- 1.2. Development of Birds
- 1.3. Development of Insects

2. Elements necessary for development
- 2.1. Vitellogenesis
- 2.2. Heterogeneity of the distribution of reserves
- 2.3. The different envelopes that protect the gamete

3. Fertilization
- 3.1. Modification of the structure of the egg after fertilization
- 3.2. Activation of the egg

4. Segmentation
- 4.1. Transformation of the egg into a multicellular structure
- 4.2. Molecules involved in segmentation
- 4.3. Cellular interactions and affinities
- 4.4. Regulation of segmentation

5. Gastrulation
- 5.1. Positioning of the three primordial tissues
- 5.2. Primary and secondary induction
- 5.3. Control of transcription by cytoplasmic factors
- 5.4. Molecules involved in cell migration
- 5.5. Morphogenetic movements

6. Neurulation: Establishment of the neural tube and autonomic ganglia

7. Organogenesis

8. Morphogenesis of embryonic appendages: Birds and Mammals

9. Genetic control of development
- 9.1. Expression of the developmental plan in Drosophila
- 9.2. Regulatory genes in vertebrate development

10. Placenta

11. Insect development

Key words/concepts: Descriptive embryology, amphibians, birds, insects, humans

Pedagogical recommendations: Consultation of books at the library level Consultation of documents, scientific articles and videos on fertilization, segmentation, neurulation and organogenesis	**Evaluation methods:** The student is evaluated by a continuous control (CC) grade which represents 40% of the total grade of the subject and a final exam grade which represents 60%. The continuous control (CC) during the PW sessions includes a note of the presence and the attendance, a note of the reports and a note of a final test of PW. **Evaluation criteria:** The evaluation is based on the knowledge of the cellular and molecular mechanisms of the establishment of the different tissues during the stages of embryonic development
References *(Books and handouts, websites, etc)* **1.** DUDEK R.W. (2002) Embryologie Eds Pradel.	

UEF 3.1.1(O/P) : Descriptive Biology	**Functional histology**
Semester: 5	

Global hourly volume of the subject in the unit Global hourly volume of personal work: **55h00** Global hourly volume of classroom work (courses/PW): **45h00**		
Course: **22h30**	DW: **0h00**	PW: **22h30**
Nature of PW : Manipulation, microscopic observation, drawing of histological sections		
Credits: 04		
Prerequisite: Animal biology, the different classes of animal tissues		
Objectives: This subject is devoted to the anatomical study of the different systems of the body and to the histological study of the tissues that constitute them.		
Content elements: The module is organized in one 1h30 lecture session per week and one 3h00 PW session every 15 days. The classes are held in the lecture hall or in a large room with a video projector. The practical work is carried out in the laboratory equipped with a video projector and microscopes and other laboratory equipment (microtomes, incubators).		
Contents: Histological study of the different structures of mammalian systems and apparatuses : **1. Structure and Histology of the digestive system** **2. Structure and Histology of the respiratory system** **3. Circulatory System** **4. Histology of blood vessels and lymphatic vessels** **5. Lymphatic system** **6. Urogenital system** **7. Endocrine system** **8. Musculoskeletal System** **9. Nervous system**		
Key words/concepts: Histology, tissues, organs, apparatus		
Pedagogical recommendations: Consultation of books in the library Consultation of histology websites	**Evaluation methods:** The student is evaluated by a continuous control (CC) grade which represents 40% of the total grade of the subject and a final exam grade which represents 60%. The continuous control (CC) during the PW sessions includes a note of the presence and the attendance, a note of the reports and a note of a final test of PW. **Evaluation criteria:** The evaluation is based on the knowledge of the anatomy of the different systems of the body and the histology of the tissues that constitute them	
References *(Books and handouts, websites, etc)* 1. Platzer W. (2001) –Atlas de poche d'anatomie. 3 tomes, Eds Flammarion 2. Wheater (2008) –Atlas d'histologie fonctionnelle de Wheater. Eds De Boeck université		

UEF 3.1.1(O/P) : Descriptive Biology — Comparative anatomy of vertebrates

<table>
<tr><td colspan="3">Semester: 5</td></tr>
<tr><td colspan="3">Global hourly volume of the subject in the unit
Global hourly volume of personal work: 82h30
Global hourly volume of classroom work (courses/PW): 67h30</td></tr>
<tr><td>Course: 22h30</td><td>DW: 0h00</td><td>PW: 45h00</td></tr>
<tr><td colspan="3">Nature of PW : Manipulation, microscopic observation, PowerPoint presentation</td></tr>
<tr><td colspan="3">Credits: 06</td></tr>
<tr><td colspan="3">Prerequisite: Animal biology,</td></tr>
<tr><td colspan="3">Objectives: This subject deals with the comparison of the anatomy of the different systems of vertebrates</td></tr>
<tr><td colspan="3">Content elements: The module is organized in a 1h30 lecture session and a 3h00 PW session each week. The lectures are given in the lecture hall or in a large room with a video projector. The practical work is carried out in the laboratory equipped with a video projector and photonic microscopes.</td></tr>
<tr><td colspan="3">Contents:
1. Anatomy of the digestive system
2. Anatomy of the respiratory system
3. Anatomy of the cardiovascular system
4. Urogenital system
5. Endocrine system
6. Anatomy of the nervous system
7. Sense organs</td></tr>
<tr><td colspan="3">Key words/concepts: Anatomy, organs, apparatus</td></tr>
<tr><td colspan="2">Pedagogical recommendations:

Consultation of books in the library
Consultation of histology and anatomy websites.</td><td>Evaluation methods:
The student is evaluated by a continuous control (CC) grade which represents 40% of the total grade of the subject and a final exam grade which represents 60%. The continuous control (CC) during the PW sessions includes a note of the presence and the attendance, a note of the reports and a note of a final test of PW.
Evaluation criteria:
The assessment is based on knowledge of the anatomy of the various vertebrate systems.</td></tr>
<tr><td colspan="3">References (Books and handouts, websites, etc)

1. Platzer W. (2001) –Atlas de poche d’anatomie. 3 tomes, Eds Flammarion
2. Wheater (2008) –Atlas d’histologie fonctionnelle de Wheater. Eds De Boeck université</td></tr>
</table>

UE methodology : UEM 3.1		**Physiology of reproduction**
Semester: 5		
Global hourly volume of the subject in the unit Global hourly volume of personal work: **65h00** Global hourly volume of classroom work (courses/PW): **60h00**		
Course: **22h30**	DW: **22h30**	PW: **15h00**
Nature of DW/PW : Manipulation, microscopic observation, PowerPoint presentation, exercises, oral presentations		
Credits: 05		
Prerequisite: Concepts of endocrine glands, regulation and biochemistry		
Objectives: To familiarize the student with the concepts of regulation of the reproductive function, male and female gametogenesis, endocrine aspects of testicular and ovarian functions, regulation by the hypothalamo-hypophyseal axis.		
Content elements: The module is organized in one lecture and one DW session of 1h30 each per week and one PW session of 3h00 each 21 days. The lectures are given in the lecture hall or in a large room with a video projector. The tutorials are given in small rooms. Practical work is carried out in the laboratory equipped with a video projector and photonic microscope.		
Contents: **1. Physiology of the Gonads** 1.1. Reminder on gametogenesis 1.2. Sex hormones (biochemistry, biosynthesis, physiological actions, mechanisms of action) 1.3. Neuroendocrine, endocrine, paracrine, autocrine, intracrine regulations 1.4. Endocrine aspects of puberty and fertility **2. Fertilization - Nidation** **3. Gestation and Physiology of the pregnant female** **4. Fetal physiology and endocrinology: genetic and endocrine bases of sexual differentiation** **5. Parturition** **6. Lactation** **7. Contraception** **8. Reproductive immuno-pharmacology** 8.1. Immunodeficiency 8.2. Immunopathology		
Key words/concepts: gametogenesis, fertilization, gestation, parturition, lactation.		

Pedagogical recommendations: Consultation of books in the library	**Evaluation methods:** The student is evaluated by a continuous control (CC) grade which represents 40% of the total grade of the subject and a final exam grade which represents 60%. The continuous control (CC) during the practical sessions includes a grade of the attendance, a grade of the reports and a grade of the final test of the practical. The continuous control (CC) during the DW sessions includes a mark of attendance and attendance, and a mark of written questions and/or presentations. **Evaluation criteria:** Assessment is based on knowledge of the regulation of reproductive function, male and female gametogenesis, endocrine aspects of testicular and ovarian function and regulation by the hypothalamic-pituitary axis.

References *(Books and handouts, websites, etc)*

1. Johnson M.H., 2007, Essential reproduction / Martin H. Johnson. Ŕ Blackwell Publishing, 6th ed.
2. Thibaut C. Levasseur M.C., 2001, La reproduction chez les mammifères et l'homme. ed.Ellipse.
3. *Le Moigne A., Foucrierb J., 2009, Biologie du développement*, 7ème édition

UE methodology : UEM 3.1	**Structure and function of biological complexes**	
Semester: 5		
Global hourly volume of the subject in the unit Global hourly volume of personal work: **55h00** Global hourly volume of classroom work (courses/DW): **45h00**		
Course: **22h30**	DW: **22h30**	PW: **0h00**
Nature of DW: PowerPoint presentations, exercises, oral presentations		
Credits: 04		
Prerequisite: Knowledge in Cell Biology, Biochemistry, Animal Biology		
Objectives: To familiarize the student with the structure and function of complexes formed with proteins, lipids and carbohydrates in a first step. In a second step, the structure of hormones, extracellular matrix molecules and signaling molecules will be studied.		
Content elements: The module is organized in one course session and one DW session of 1h30 each per week. The courses are held in the lecture hall or in a large room with a video projector. The DW is realized in small rooms with a video projector.		

Contents:

1. Structure, biosynthesis and functions of complexes formed with proteins :
- 1.1. Glycoprotein
- 1.2. Lipoproteins
- 1.3. Phosphoproteins
- 1.4. Chromoproteins

2. Structure, biosynthesis and functions of complexes formed with lipids :
- 2.1. Phosphatides
- 2.2. Sphingolipids
- 2.3. Isoprenic lipids

3. Structure, biosynthesis and function of complexes formed with carbohydrates :
- 3.1. Glycans
- 3.2. Mucopolysaccharides

4. Structure, biosynthesis and functions of hormones :
- 4.1. Definition
- 4.2. Chemical structure
- 4.3. Biosynthesis and secretion
- 4.4. Circulation and degradation of hormones
- 4.5. Membrane receptors
- 4.6. Intracellular receptors

5. The extracellular matrix
- 5.1. The fundamental substance
- 5.2. Collagen, elastin and reticulin fibres

<table>
<tr><td colspan="2">Key words/concepts: proteins, lipids, carbohydrates, hormones, extracellular matrix</td></tr>
<tr><td>Pedagogical recommendations:

Consultation of books in the library</td><td>Evaluation methods:
The student is evaluated by a continuous control (CC) grade which represents 40% of the total grade of the subject and a final exam grade which represents 60%. The continuous control (CC) during the DW sessions includes a note of the presence and the attendance, and a note of the written questions and the presentations.
Evaluation criteria:
The assessment is based on knowledge of the structure and function of complexes formed with proteins, lipids and carbohydrates, hormones, extracellular matrix molecules and signaling molecules.</td></tr>
<tr><td colspan="2">References (Books and handouts, websites, etc)
1. Cau P., Seite P., 2002, Cours de biologie cellulaire. Edition Ellipses, 493p.
2. Callen J.C., 2005, Biologie cellulaire : des molécules aux organismes. Dunod, Paris</td></tr>
</table>

UE Discoveries : EDU 3.1		**Biostatistics**
Semester: 5		
Global hourly volume of the subject in the unit Global hourly volume of personal work: **5h00** Global hourly volume of classroom work (courses/DW): **45h00**		
Course: **22h30**	DW: **22h30**	PW: **0h00**
Nature of DW: exercises		
Credits: 02		
Prerequisite: Have knowledge of statistical tools		
Objectives: To be able to describe the main characteristics of a multivariate data matrix, to define relevant major groups, to analyze such matrices or data tables and to describe the relationships between these variables using linear and non-linear models (e.g. exponential, Beta, Gamma) adapted to the needs of geneticists, immunologists and biologists		
Content elements: The module is organized in one lecture and one DW session of 1h30 each per week. The lectures are given in the lecture hall or in a large room with a video projector. The tutorials are given in small rooms with a video projector.		
Contents: **1. Analysis of variances with two (or more) factors Crossed (interaction of the effects of the factors)** **2. Hierarchical (including the effects of one factor in the other)** **3. Correlation and linear regression.** **4. Non-linear regression (logistic, exponential, Monod, Beta, Gamma É models)** **5. Multivariate analysis (Principal component analysis).** **6. Hierarchical ascending classification**		
Key words/concepts: proteins, lipids, carbohydrates, hormones, extracellular matrix		

Pedagogical recommendations: Consultation of books in the library Doing series of exercises	**Evaluation methods:** The student is evaluated by a continuous control (CC) grade which represents 40% of the total grade of the subject and a final exam grade which represents 60%. The continuous control (CC) during the DW sessions includes a note of the presence and the attendance, and a note of written questions. **Evaluation criteria:** The evaluation is based on the knowledge of the main statistical tests used in the field of animal experimentation.

References *(Books and handouts, websites, etc)*

1. Bernard Legras et François Kohler. 2007- Eléments de statistique à l'usage des étudiants en médecine et en biologie : Cours et exercices corrigés. Edition Broché.
2. Mansour., Hermès 2007- Probabilités et statistiques pour les ingénieurs. Lavoisier 1ère edition
3. Michel Huguier et Antoine Flahault 2004- Biostatistiques au quotidien. Edition Broché.

Transversal UE : UET 3.1 — Scientific English

Semester: 5

Global hourly volume of the subject in the unit
Global hourly volume of personal work: **2h30**
Global hourly volume of classroom work (courses/DW): **22h30**

Course: **22h30**	DW: **0h00**	PW: **0h00**

Nature of DW: /

Credits: 01

Prerequisite: English Prerequisites (Spelling, Grammar and Conjugation.....)

Objectives: The objective of the English course is to achieve mastery of scientific English, required for bibliographic research

Content elements: The module is organized in one session of 1h30 per week. The classes are held in the lecture hall or in a large room with a video projector

Contents:

1. **The active and passive form**
2. **The simple past tense**
3. **Past tense with its different forms**
4. **Present tense with different forms**
5. **Translation of scientific text**
6. **Writing a scientific topic**
7. **Translation from oral to written**

Key words/concepts: Spelling, Grammar and Conjugation

Pedagogical recommendations:	**Evaluation methods:**
Accessing selected scientific journals Reading articles in English aloud	The student is evaluated by a final exam grade that represents 100%. **Evaluation criteria:** The evaluation is based on the mastery of scientific English.

References *(Books and handouts, websites, etc)*

1. BOSWORTH. 1998- Comprendre l'anglais scientifique et technique (C.A.S.T.). Edition EllIlpses Marketing.
2. BOSWORTH. 1994- . Ecrire l'anglais scientifique et technique (EAST). Edition Lavoisier

3rd year / "Animal Biology and Physiology" course

Semester 6

UEF 3.2.1 : General Physiology		Physiology of major functions
Semester: 6		
Global hourly volume of the subject in the unit Global hourly volume of personal work: **82h30** Global hourly volume of classroom work (courses/PW): **67h30**		
Course: **45h00**	DW: **0h00**	PW: **22h30**
Nature of PW : Manipulation, microscopic observation, PowerPoint presentation		
Credits: 06		
Prerequisite: Anatomy and Physiology of the different apparatus		
Objectives: This subject provides the essential notions in physiology of the major functions with particular study of the main circulatory, respiratory, digestive, motor and renal excretion systems.		

Content elements: The module is organized in 2 sessions of 1h30 each week and one session of practical work of 3h00 each 15 days. The lectures are given in the lecture hall or in a large room with a video projector. The practical work is carried out in the laboratory equipped with a video projector and photonic microscopes.

Contents:

1. Internal environment and blood
2. Physiology of the cardiovascular system
3. Physiology of the respiratory system
4. Physiology of the digestive system
5. Physiology of the urinary system

Practical work:

- Practical work on blood (blood count, blood smear, osmolarity study)
- Practical work on renal excretion
- Practical work on digestion (artificial digestion and action of enzymes)
- Practical work on respiration

Key words/concepts: blood, respiration, digestion, excretion

Pedagogical recommendations:	**Evaluation methods:**
Consultation of books in the library Consultation of histology, anatomy and physiology websites	The student is evaluated by a continuous control (CC) grade which represents 40% of the total grade of the subject and a final exam grade which represents 60%. The continuous control (CC) during the PW sessions includes a note of the presence and the attendance, a note of the reports and a note of a final test of PW. **Evaluation criteria:** The assessment is based on knowledge of the physiology of the major functions, particularly circulation, respiration, digestion and renal excretion.

References *(Books and handouts, websites, etc)*

Hadj-Bekkouche F. et Khaldoun T. (2005) -Polycopié de TP de Physiologie. Eds. OPU
Lonchanpt P. (2007) –Bases de physiologie générale : grandes fonctions et régulations. Eds. Ellipses

UEF 3.2.1 : General Physiology		**Functional endocrinology**
Semester: 6		
Global hourly volume of the subject in the unit Global hourly volume of personal work: **82h30** Global hourly volume of classroom work (courses/PW): **67h30**		
Course: **45h00**	DW: **0h00**	PW: **22h30**
Nature of PW : Manipulation, microscopic observation, PowerPoint presentation		
Credits: 06		
Prerequisite: Concepts of endocrine glands, regulation and immunology		

Objectives: This component provides the basic concepts of general endocrinology, the study of the hypothalamus-pituitary complex and neuroendocrine transducers, the glandular and cellular endocrine systems of the body, and the concepts of immunoendocrinology.

Content elements: The module is organized in 2 sessions of 1h30 each week and one session of practical work of 3h00 each 15 days. The lectures are given in the lecture hall or in a large room with a video projector. The practical work is carried out in the laboratory equipped with a video projector and photonic microscopes.

Contents:

1. General information on the functioning of the endocrine system

1.1. Definitions and history
1.2. Intercellular communication
1.3. Coordination systems
1.4. Glandular activities
1.5. Endocrinological controls
1.6. Classification of hormones
1.7. Biosynthesis of hormones
1.8. Main intracellular transport pathways
1.9. Secretion of hormones
1.10. Transport of hormones
1.11. Metabolism of hormones
1.12. Receptors
1.13. Regulation of hormone production

2. The hypothalamic-pituitary complex

2.1. Introduction
2.2. The two hypothalamic neurosecretory systems
2.3. Neuroendocrine signals
2.4. The hypothalamic-neurohypophyseal system
2.5. The hypothalamic-adenohypophyseal system

3. The epiphysis

3.1. Localization
3.2. Structure
3.3. Roles
3.4. Melatonin (chemical structure and biosynthesis)
3.5. Other secretions

4. The main endocrine glands in vertebrates: For each gland the following points will be discussed.

4.1. Functional anatomy
4.2. Biosynthesis and hormonal secretion
4.3. Hormonal regulation
4.4. Presentation and physiological effects
4.5. Pathophysiology

5. Immuno-endocrinology

5.1. Elements of the immune response
5.2. Interrelations between the endocrine and immune systems

Practical work

1. Extraction, chromatography and elution of hormones
2. Adrenalectomy
3. Histo-physiology
4. Immunohormonemia
5. Castrations

Key words/concepts: gland, hormones, receptors, effectors, second messenger, pathologies

Pedagogical recommendations: Consultation of books in the library Consultation of websites on histology, anatomy of endocrine glands See videos on the different signaling pathways	**Evaluation methods:** The student is evaluated by a continuous control (CC) grade which represents 40% of the total grade of the subject and a final exam grade which represents 60%. The continuous control (CC) during the PW sessions includes a note of the presence and the attendance, a note of the reports and a note of a final test of PW. **Evaluation criteria:** Assessment is based on knowledge of endocrine gland physiology and pathophysiology.
References *(Books and handouts, websites, etc)* Aouichat S., Amirat Z. et Khammar F. -Polycope de TP d'endocrinologie. Eds. OPU	

UEF 3.2.1 : General Physiology		**Cellular and molecular physiology**
Semester: 6		
Global hourly volume of the subject in the unit Global hourly volume of personal work: **82h30** Global hourly volume of classroom work (courses/PW): **67h30**		
Course: **45h00**	DW: **0h00**	PW: **22h30**
Nature of PW : Manipulation, exercises, PowerPoint presentation		

Credits: 06

Prerequisite: Concepts of cell biology, biochemistry and molecular genetics (gene expression).

Objectives: This component provides the fundamental concepts of cell biology and the molecular mechanisms involved in cell physiology

Content elements: The module is organized in 2 sessions of 1h30 each per week and one session of practical work of 3h00 each 15 days. The lectures are given in the lecture hall or in a large room with a video projector. The practical work is carried out in the laboratory equipped with a video projector and photonic microscopes.

Contents:

1. Functional compartmentalization of the cell
2. Biomembranes
3. Cell sorting
4. Membrane transport
5. Receptors and signaling pathways
6. Bioenergetics
7. Cellular principles of immune defense.
8. Cellular growth and differentiation

Practical work:

- Methods of studying the cell
- Physico-chemical properties of proteins
- Cellular fractionation
- Bioengineering
- Membrane receptors

Key words/concepts: Cell, cell traffic, signaling, proliferation and differentiation

Pedagogical recommendations:	**Evaluation methods:**
Consultation of books in the library Consultation of websites on cellular and molecular physiology	The student is evaluated by a continuous control (CC) grade which represents 40% of the total grade of the subject and a final exam grade which represents 60%. The continuous control (CC) during the PW sessions includes a note of the presence and the attendance, a note of the reports and a note of a final test of PW. **Evaluation criteria:** The evaluation is based on the knowledge of cell biology and the molecular mechanisms involved in cell physiology

References *(Books and handouts, websites, etc)*

Alberts B. et coll. (2004) - Biologie moléculaire de la cellule. Eds. Flammarion

UE methodology : UEM 3.2.1 — Nerve Physiology

Semester: 6

Global hourly volume of the subject in the unit
Global hourly volume of personal work: **65h00**
Global hourly volume of classroom work (courses/PW): **60h00**

Course: **22h30**	DW: **22h30**	PW: **15h00**

Nature of DW/PW: Manipulation, microscopic observation, PowerPoint presentation, lectures.

Credits: 05

Prerequisite: Cellular Biology, Physiology of Organisms, Organization of the Nervous System

Objectives: Familiarize the student with the notions of anatomy and physiology of the nervous system, cellular and molecular aspects of neurophysiology, biochemistry and modes of transmission of the nervous signal, pharmacological approaches

Content elements: The module is organized in one session of course and one session of DW of 1h30 each per week and one session of PW of 3h00 every 21 days. The courses are held in the lecture hall or in a large room with a video projector. The DW are realized in small rooms. Practical work is carried out in the laboratory equipped with a video projector and photonic microscopes.

Contents:

1. General concepts of the nervous system
- 1.1. Cytology of the neuron and associated cellular elements
- 1.2. Embryology and development
- 1.3. In-vitro culture of neurons and associated cells

2. Chemistry of the nervous system
- 2.1. Chemical constituents of the nervous system
- 2.2. Chemical transmitters
  - 2.2.1. The cholinergic system and the catechol-indolamine system
  - 2.2.2. Other neurotransmission systems

3. Molecular and cellular pharmacology of neurotransmitters
- 3.1. Electrophysiology of the nervous system
- 3.2. Electrophysiology of the neuron

Practical work: microscopic observation of histological sections of the brain, cerebellum and spinal cord

Key words/concepts: neuron, nervous system, neurotransmitter

Pedagogical recommendations:	**Evaluation methods:**
Consultation of books in the library Consultation of the websites of the nervous physiology	The student is evaluated by a continuous control (CC) grade which represents 40% of the total grade of the subject and a final exam grade which represents 60%. The continuous control (CC) during the PW sessions includes a note of the presence and the attendance, a note of the reports and a note of a final test of practical. The continuous control (CC) during the DW sessions includes a note of the presence and the attendance, and a note of written interrogations and/or presentations. **Evaluation criteria:** The evaluation is based on the knowledge of physiology of the nervous system

References *(Books and handouts, websites, etc)*

Foreword by A. Claudio Cuello , 2002, Cellular and Molecular Methods in Neuroscience Research. Springer-Verlag New York, Inc.

UE methodology : UEM 3.2.2 — Molecular Biology

Semester: 6

Global hourly volume of the subject in the unit
Global hourly volume of personal work: **55h00**
Global hourly volume of classroom work (courses/PW): **45h00**

Course: **22h30**	DW: **22h30**	PW: **0h00**

Nature of DW : exercises, PowerPoint presentations

Credits: 04

Prerequisite: Knowledge in Cell Biology, Biochemistry and Genetics.

Objectives: This subject is devoted to the study of nucleic acids, giving concepts on the mechanisms of replication and expression of genomes, transcription and post transcriptional modification

Content elements: The module is organized in one course session and one DW session of 1h30 each per week. The courses are held in the lecture hall or in a large room with a video projector. The DW are given in small rooms with a video projector.

Contents:

1. Structure of nucleic acids
- 1.1. Simple molecules of nucleic acids
- 1.2. The links in the nucleotides and the nomenclature of the nucleotide units
- 1.3. The links connecting the nucleotides
- 1.4. Adenine-Thymine and Guanine-Cytosine hybridization

2. The desoxyribonucleic acid (DNA)
- 2.1. Primary, secondary and tertiary structure,
- 2.2. Physicochemical properties of DNA,
- 2.3. The different forms of DNA (A, B and Z forms)
- 2.4. Chromosomes: structure, organization, karyotype, chromosomal and genomic mutations.
- 2.5. Molecular mechanism of replication in eukaryotes and prokaryotes and mechanism of DNA **repair**

3. RNA (ribonucleic acid)
- 3.1. Primary and secondary structure
- 3.2. The different types of RNA: mRNA, tRNA, rRNA, snRNA and scRNA

4. The transcription of genetic information
- 4.1. Molecular mechanism of transcription in prokaryotes
- 4.2. Molecular mechanism of transcription in eukaryotes and pre-messenger maturation

5. Regulation of transcription
- 5.1. Regulation of transcription in prokaryotes: Inducible system (the lactose operon) and repressible systems (the tryptophan operon)
- 5.2. Regulation of transcription in eukaryotes: concept of cis- and trans-regulatory factors

6. Translation, the genetic code and gene mutations

7. Gene organization in eukaryotes and prokaryotes

8. Post-transcriptional controls

9. Viral nucleic acids
- 9.1. Structural particularity
- 9.2. Gene expression of RNA and DNA viruses

Directed Work:
- DW 1: Structure of nucleic acids,

- DW 2 : Structure and physicochemical properties of DNA
- DW 3: Chromosomal and genomic mutations
- DW 4: DNA replication
- DW 5: Regulation of transcription
- DW 6: Translation, the genetic code and gene mutations
- DW 7: Post-transcriptional controls

Key words/concepts: DNA, RNA, genes, genome, transcription, translation

Pedagogical recommendations:	**Evaluation methods:**
Consultation of books in the library Consultation of molecular biology websites Doing a series of exercises	The student is evaluated by a continuous control (CC) note which represents 40% of the total note of the matter and a final examination note which represents 60%. The continuous control (CC) during the DW sessions includes a note of the presence and the assiduity, and a note of written interrogations. **Evaluation criteria:** The evaluation is based on the knowledge of nucleic acids and the mechanisms of replication and expression of genomes, transcription and post transcriptional modification.

References *(Books and handouts, websites, etc)*

1. ALBERTS, JOHNSON, LEWIS, RAFF, ROBERTS, WALTER (2004). Biologie moléculaire de la cellule. Edition FLAMMARION. 1500p.
2. B. Alberts, D. Bray, K. Hopkin, A. Johnson, J. Lewis, M. Raff, K. Roberts, P. Walter (2005). L'essentiel de la biologie cellulaire. *Flammarion* 2ème édition
3. LODISH, BERK, MATSUDAIRA, KAISER, KREIGER, SCOTT, ZIPURSKY, DARNELL (2005). Biologie moléculaire de la cellule. Edition DE BOECK. Edition ELSEVIER. 853p.
4. Stephen R. BOLSOVER, Jeremy S. HYAMS, Elisabeth A. SHEPHARD, Hugh A. WHITE, Claudia G. WIEDEMANN (2006). Biologie cellulaire et moléculaire. Edition DUNOD. 583p.

UE Discoveries : UED 3.2.1		**Bioinformatics**
Semester: 6		
Global hourly volume of the subject in the unit Global hourly volume of personal work: **5h00** Global hourly volume of classroom work (courses/PW): **45h00**		
Course: **22h30**	DW: **0h00**	PW: **22h30**
Nature of PW : exercises, software manipulation		
Credits: 02		
Prerequisite: Molecular biology, biostatistics, informatics		
Objectives: This matter allows the treatment of experimental results and management of data bank in biology		
Content elements: The module is organized in one session of course of 1h30 per week and one session of TP of 3h00 per 15 days. The courses are held in the lecture hall or in a large room with a video projector. The practical sessions are held in small web rooms with computers connected to the Internet.		
Contents: **Chapter I: Sequencing libraries.** **1. Historical background.** **2. General libraries.** 2.1. Data quality. **3. Specialized banks.** 3.1. The pattern bases. 3.1.1. Nucleic pattern bases. 3.1.2. Protein motif bases. **4. Dissemination and use of databases** 4.1. Dissemination. 4.2. Integration. 4.2.1. Dedicated systems. 4.2.2. Database management systems. **Chapter II: The search for similarity between biological sequences.** **1. Score systems.** 1.1. The principle and determination of a score. 1.2. Nuclear matrices. 1.3. Protein matrices. 1.3.1. Protein matrices linked to evolution. 1.3.2. Protein matrices related to physico-chemical characteristics. 1.3.3. The choice of a matrix. **2. Algorithms and programs for sequence comparison.** 2.1. The basic principles. 2.1.1. Identity, similarity and alignment 2.1.2. The search for similar segments 2.1.3. The search for optimal alignment. 2.1.4. The search for identical segments.		

2.2. Evaluation of results.
2.2.1. Practical and empirical methods.
2.2.2. Monte-Carlo analysis methods.
2.3. Comparison programs with sequence banks.
2.3.1. The FASTA program.
2.3.2. The BLAST program
2.3.3. The availability of programs through computer networks
2.4. The pattern search program.
2.4.1. The different types of patterns.
2.4.2. The pattern definition.
2.4.3. Pattern search algorithms.

Practical work

1. Bioinformatics resource centers
2. Introduction to biological databases
3. Molecular biology tools ('lab bioinfo') Comparison of 2 sequences
4. Searching databases by sequence similarity
5. Multiple sequence alignments
6. Search for conserved domains
7. Structure II and protein folding motifs
8. Structure III of proteins
9. In silico' analysis of an unknown sequence

Key words/concepts: sequencing, databanks, programs

Pedagogical recommendations:	**Evaluation methods:**
Consultation of books in the library Doing series of exercises	The student is evaluated by a continuous control (CC) note which represents 40% of the total note of the matter and a final examination note which represents 60%. The continuous control (CC) during the PW sessions includes a note of the presence and the assiduity, and a note of written interrogations and reports. **Evaluation criteria:** The evaluation is based on the knowledge of the methods of treatment of the experimental results and management of data bank in biology.

References *(Books and handouts, websites, etc)*

1. REECE Richard J.R. 2004- Analysis of genes & genomes. Edition Lavoisier.
2. Frédéric Dardel, François Képès, 2002- Bioinformatique Génomique et post-génomique. Edition Elsevier.
3. Pevzner Pavel A. 2000- Bio-informatique moléculaire. 2000, Edition Springer Paris

UE transversal : UET 3.2.1		**Article analysis**
Semester: 6		
Global hourly volume of the subject in the unit Global hourly volume of personal work: **2h30** Global hourly volume of classroom work (courses/PW): **22h30**		
Course: **22h30**	DW: **0h00**	PW: **0h00**
Nature of DW/PW : -		
Credits: 01		
Prerequisite: Knowledge of Biology and English		
Objectives: To become familiar with analyzing a scientific article; to have the ability to synthesize the essence of a work and to become familiar with research at the international level, both written and oral, in order to provide a sufficient basis for students to progress independently		
Content elements: The module is organized in one session of course of 1h30 per week. The classes are held in the lecture hall or in a large room with a video projector.		
Contents: **1. Identification of the different parts of a scientific article:** journal, volume, year, issue, page numbers, title, authors and their affiliations, abstract, material and methods, results and discussion, bibliographic references..... **2. The bibliographic search** **3. Analysis sessions and reading of selected articles.** **4. Presentation session of selected articles.** **5. Writing of abstracts.** **6. Seminars followed by discussions with the speaker.**		
Key words/concepts: article, bibliography, references, writing		
Pedagogical recommendations: Accessing selected scientific journals Reading articles in English aloud	**Evaluation methods:** The student is evaluated by a final exam note that represents 100%. **Evaluation criteria:** The evaluation is based on the mastery of the analysis of a scientific article	
References *(Books and handouts, websites, etc)* 1. BOSWORTH. 1998. Comprendre l'anglais scientifique et technique (C.A.S.T.). Edition Ellilpses Marketing. 2. BOSWORTH. 1994. Ecrire l'anglais scientifique et technique (EAST). Edition Lavoisier		