Second (2nd) year of Pharmacy study

First semester: from September to December
Exam period: December / early January

UE (Teaching unit)	ECTS
UE 1 BIODIVERSITY / BIO-EVOLUTION OF PLANT, FUNGAL, AND ANIMAL KINGDOMS	**5**
UE 2A NEUROPHYSIOLOGY	**5**
UE 3A BIOLOGICAL SCIENCES 1: Bacteriology/Virology	**5**
UE 3B BIOLOGICAL SCIENCES 1: Basic Immunology	**5**
UE 3B BIOLOGICAL SCIENCES 1: Hematology	**4**
UE 4 BIOLOGICAL SCIENCES 2: Biochemistry and enzymology	**5**
UE 4 BIOLOGICAL SCIENCES 2: Molecular Biology	**4**
UE 5 ANALYTICAL SCIENCES	**8**
UE 9A PATHWAYS TO ACTIVE DRUG SUBSTANCES: Organic Chemistry 1	**4**

Some UEs have very few face-to-face lessons and teachers will drop courses on the e-Campus pedagogical platform early in the year for students to do personal work. For example, for the EU5, 1 hour of lesson could be equivalent to 6h / 7h of lessons realized in the form of personal work.

Deuxième (2ème) année des études de Pharmacie

Premier semestre : de septembre à décembre
Période d'examens : décembre / début janvier

UE (Unité d'enseignement)	ECTS
UE 1 BIODIVERSITÉ / BIOÉVOLUTION DES RÈGNES VÉGÉTAL, FONGIQUE ET ANIMAL	**5**
UE 2A NEUROPHYSIOLOGIE	**5**
UE 3A SCIENCES BIOLOGIQUES 1 : Bactériologie/Virologie	**5**
UE 3B SCIENCES BIOLOGIQUES 1 : Immunologie fondamentale	**5**
UE 3B SCIENCES BIOLOGIQUES 1 : Hématologie	**4**
UE 4 SCIENCES BIOLOGIQUES 2 : Biochimie et enzymologie	**5**
UE 4 SCIENCES BIOLOGIQUES 2 : Biologie moléculaire	**4**
UE 5 SCIENCES ANALYTIQUES	**8**
UE 9A VOIES D'ACCÈS AUX SUBSTANCES ACTIVES MÉDICAMENTEUSES : Chimie organique 1	**4**

Certaines UE ne comportent que très peu d'heures de cours en présentiel et les enseignants déposeront des cours sur la plateforme pédagogique e-Campus en tout début d'année pour que les étudiants réalisent un travail personnel. Ainsi, par exemple, pour l'UE5, 1 h de cours pourra être équivalent à 6h/7h de cours réalisés sous la forme de travail personnel.

UE 1 Biodiversity / Bio-evolution of Plant, Fungal, and Animal Kingdoms

5 ECTS

Content

Module 1: Biodiversity and bio-evolution of Plant kingdom

Classes*

Plant cell
Morphological and anatomical description of the vegetative and reproductive systems
Plant development and transgenic plants
Major biogeochemical cycles (carbon cycle, nitrogen cycle)
Concept of species and systematic classification, evolutionary theories
Description of the plant families for food, cosmetic, and pharmaceutical use

Tutorials*

Bio-evolution of Plant kingdom, ecological, economic, and pharmaceutical importance of algae, mosses, ferns, conifers, and flowering plants
Illustrated organography of the plant unit and the reproductive system of flowering plants

Practical works*

Tissue organization of the stem and introduction to plant histology
Highlighting secondary tissues of some secretory tissues and specific anatomical structures in the stem
Illustrated organography of the plant unit and the reproductive system of flowering plants
Recognition of herbal drugs (observation, macroscopic identification, and recognition)

Module 2: Biodiversity and natural substances

Classes*

Why do living organisms produce natural substances?
The secondary metabolism from a chemical point of view, comparison with the large pathways of biochemistry
Major classes of natural substances
The major assumptions of prebiotic chemistry

* **Classes** (all students in amphitheater), **Tutorials** (small groups of students), **Practical works** (smaller groups of students in order to study in adapted practical rooms/laboratories).

Assessment

Final exam about classes and tutorials.
Continuous assessment for the practical works with report writings, oral presentations and/or lectures. Attendance to practical works needs to be approved.

Contacts

Valérie Flesch
Anita Baillet
Erwan Poupon
Sandrine Cojean

UE 2A Neurophysiology

5 ECTS

Content

Classes*

- **Nervous tissue**
  Reminders about the essential components of the nervous tissue
  Neurophysiology
    The different membrane potentials of a neuron
    Synapse and synaptic transmission
- **Sensory physiology**
  Generalities about sensory messages
  Somatic sensitivity or somesthesia
    Tactile sensitivity
    Thermal and algetic sentivity
    Proprioception
  Sensory sensitivity
    Vision
    Hearing and balance
    Olfaction and gustation
- **Motor physiology**
  Striated skeletal muscles
  Anatomy and histology of skeletal muscle
    Muscle contraction
    Properties of skeletal muscles
  Motility
    Spinal reflexes
    Functioning of striated bodies
    The cerebellum
    The study of somatic motility
- **The vegetative or autonomous nervous system**
  Sensory components of the vegetative nervous system
  Sympathetic efferent division
  Parasympathetic efferent division
  The enteric nervous system
  Central control of vegetative functions
  Neurotransmission in the vegetative nervous system
  The effects of the vegetative nervous system on the different target organs and major functions
    On the eye
    On the gastrointestinal tract and accessory glands of the digestive tract
    On the cardiovascular functions
    On the lungs and bronchi
    On the bladder
    Other effects of the vegetative nervous system
- **Examples of complex brain functions**
    Sleep and wakefulness
    Memory

Practical works*

Nervous tissue
Somatic sensitivity or somesthesia
Motility
The effects of the vegetative nervous system on the different target organs and major functions

* **Classes** (all students in amphitheater), **Practical works** (smaller groups of students in order to study in adapted practical rooms/laboratories).

Assessment

Final exam about classes.
Continuous assessment for the practical works with report writings, oral presentations and/or lectures. Attendance to practical works needs to be approved.

Contact

Anne Garnier

UE 3A BIOLOGICAL SCIENCES 1 - Bacteriology/Virology

5 ECTS

Content

Module 1: Bacteriology

Classes* and on-line lessons**

Taxonomy, study methods, principle of identification and of study of antibiotic sensitivity
Bacteria structure
Nutrition, growth – minimal inhibitory concentration (MIC), minimal bacteriostatic concentration (MBC)
Bacteria genetics
Host-bacteria relationship, transmission ways

Module 2: Virology

Classes* and on-line lessons**

General characteristics of viruses, public health issues, methods for the identification and the determination of antiviral sensitivity
Virus structure and taxonomy
Viral cycle
Host-virus relationship, transmission ways, genetic variability of viruses

* **Classes** (all students in amphitheater). ****On line-lessons** will be downloaded from the DOKEOS pedagogical platform early in the year.

Assessment

Final exam about classes.

Contacts

Claire Janoir
Audrey Esclatine

UE 3B BIOLOGICAL SCIENCES 1 - Basic Immunology

5 ECTS

Content

Classes* and on-line lessons**

- Immunoglobulins
- Innate immunity and inflammation
- MHC and antigen presentation
- Organs, T, B, and NK cells, and receptors
- Effector mechanisms of specific immunity and regulation
- Cytokines

Tutorials*

- Innate immunity and inflammation
- Effector mechanisms of specific immunity and regulation

Practical works*

- Analytical methods using antigen/antibody reaction

* **Classes** (all students in amphitheater), **Tutorials** (small groups of students), **Practical works** (smaller groups of students in order to study in adapted practical rooms/laboratories). ****On line-lessons** will be downloaded from the DOKEOS pedagogical platform early in the year.

Assessment

Final exam about classes and tutorials.
Continuous assessment for the practical works with report writings, oral presentations and/or lectures. Attendance to practical works needs to be approved.

Contact

Sylvie Chollet-Martin

UE 3B BIOLOGICAL SCIENCES 1 - Hematology

4 ECTS

Content

Classes* and on-line lessons**

- Blood
- Bone marrow
- Lymphocyte lineage
- Granulocyte lineage
- Monocytes / macrophages
- Physiology of erythropoiesis
- Red blood cells
- Blood groups
- Megakaryocyte lineage
- Primary hemostasis
- Coagulation
- Fibrinolysis

Tutorials*

- Red blood cells
  - Erythrocyte values
  - Blood groups

Practical works*

- Analysis of virtual slides
  - Study of blood cells
  - Study of marrow cells

* **Classes** (all students in amphitheater), **Tutorials** (small groups of students), **Practical works** (smaller groups of students in order to study in adapted practical rooms/laboratories). ****On line-lessons** will be downloaded from the DOKEOS pedagogical platform early in the year.

Assessment

Final exam about classes and tutorials.
Continuous assessment for the practical works with report writings, oral presentations and/or lectures. Attendance to practical works needs to be approved.

Contact

Delphine Borgel

UE 4 BIOLOGICAL SCIENCES 2 – Biochemistry and enzymology

5 ECTS

Content

Classes*

- **Enzymology**
  - Determination of enzyme activity
  - Enzymatic assay of substrate
- **General biochemistry**
  - Energy metabolism, strategy, respiratory chain
  - Major mechanisms of metabolism regulation
  - Carbohydrate metabolism and specific control sites
  - Lipid metabolism and specific control sites
  - Protein metabolism and specific control sites
  - Biosynthesis of membrane lipids and steroids, cholesterol metabolism and control sites
  - Interconnection of the metabolic pathways
  - Reactive oxygen species

Tutorials*

- Enzymology
- General biochemistry

* **Classes** (all students in amphitheater), **Tutorials** (small groups of students). **On line-lessons** downloaded from the DOKEOS pedagogical platform early in the year could be proposed.

Assessment

Final exam about classes and tutorials.

Contacts

Philippe Billiald
Dominique Porquet
Bruno Baudin

UE 4 BIOLOGICAL SCIENCES 2 - Molecular Biology

4 ECTS

Content

Classes*

Reminder on DNA - Structure and physicochemical properties
DNA biosynthesis - Replication
RNA biosynthesis - Transcription
Regulation of gene expression - Genome organization
Protein biosynthesis - Translation

Tutorials*

DNA biosynthesis - Replication
Protein biosynthesis - Translation

* **Classes** (all students in amphitheater), **Tutorials** (small groups of students). **On line-lessons** downloaded from the DOKEOS pedagogical platform early in the year could be proposed.

Assessment

Final exam about classes and tutorials.

Contacts

Philippe Billiald
Franck Gesbert

UE 5 Analytical Sciences

8 ECTS

Content

Classes* and on-line lessons**

- **Chemistry of solutions**
  General introduction to the chemistry of solutions and analysis: solutions, concentration and quantity, major volumetric assays, the measurement of the equivalence point
  Acid-base titration
    In aqueous medium
    In non-aqueous medium
  Titration by ligand exchange
  Titration by sparingly soluble compound
  Redox titration
  Non-aqueous media, phase transfer
- **Separation methods**
  Aims of the analysis (identification, profiling, limit test, assay) - Selection of separation methods depending on the structure of the compounds to identify
  Fundamental values in separation methods
  Principle of different modes of separation methods
  Instrumentation and applications in pharmaceutical analysis
- **Spectral methods**
  Principle, instrumentation and application domain of electronic and vibrational spectrometries
  Principle and fields of application of mass spectrometry and spectrometry by nuclear magnetic resonance

Tutorials*

Chemistry of solutions
Separation methods
Spectral methods

Practical works*

Chemistry of solutions
Separation methods
Spectral methods

* **Classes** (all students in amphitheater), **Tutorials** (small groups of students), **Practical works** (smaller groups of students in order to study in adapted practical rooms/laboratories). ****On line-lessons** will be downloaded from the DOKEOS pedagogical platform early in the year.

Assessment

Final exam about classes and tutorials.
Continuous assessment for the practical works with report writings, oral presentations and/or lectures. Attendance to practical works needs to be approved.

Contact

Pierre Chaminade

UE 9A PATHWAYS TO ACTIVE DRUG SUBSTANCES: Organic Chemistry 1

4 ECTS

Content

Classes*

- **Introduction**
  Organic chemistry and the living
  Organic chemistry and medicine
  functional groups, systematic nomenclature
  Classification of organic compounds
  Polarization connections and consequences (inductive effects; mesomerism; reactivity)
- **Reaction mechanisms, kinetics and reaction intermediates**
  Kinetic and thermodynamic aspects
  Reactive species of acid and base concepts (electrophilic / nucleophilic); radicals,
  The radical reactions
    additions
    substitutions
  The ionic reactions
    The electrophilic and nucleophilic additions
    The eliminations
    The nucleophilic substitutions
- **Monofunctionally Organic Chemistry: Structure and Reactivity**
  Alkanes and cycloalkanes
  Halogenoalkanes
  Alcohols
  Amines
  Alkenes and Alkynes
  Carbonyls
  Carboxylic acids and derivatives
  (For these compounds: definition and nomenclature, physico-chemical structure and properties, reactivity)

Tutorials*

Monofunctionally Organic Chemistry: Structure and Reactivity

* **Classes** (all students in amphitheater), **Tutorials** (small groups of students). **On line-lessons** downloaded from the DOKEOS pedagogical platform early in the year could be proposed.

Assessment

Final exam about classes and tutorials.

Contacts

Delphine Joseph