# Second (2nd) year of Pharmacy study

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

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<th>UE (Teaching unit)</th>
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Some UEs have very few face-to-face lessons and teachers will drop courses on the DOKEOS 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.

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# Deuxième (2ème) année des études de Pharmacie

**Premier semestre :** de septembre à décembre  
**Période d’examen:** décembre / début janvier

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<th>UE (Unité d’enseignement)</th>
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<td>UE 5 SCIENCES ANALYTIQUES</td>
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<td>UE 9A VOIES D’ACCÈS AUX SUBSTANCES ACTIVES MÉDICAMENTEUSES : Chimie organique 1</td>
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</table>

Certaines UE ne comportent que très peu d'heures de cours en présentiel et les enseignants déposeront des cours sur la plateforme pédagogique DOKEOS 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 sensitivity
    - 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
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-lessions will be downloaded from the DOKEOS pedagogical platform early in the year.

Assessment

Final exam about classes.

Contacts

Claire Janoir
Audrey Esclatine
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 Billiaud
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
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