Second (2nd) year of Pharmacy study

Second semester: from January to May
Exam period: May / June

UE (Teaching unit)	ECTS
UE 2B Physiology	**5**
UE 6 QUALITY AND HEALTH PRODUCTS	**4**
UE 9B PATHWAYS TO ACTIVE DRUG SUBSTANCES: Organic Chemistry 2	**4**
UE 9C PATHWAYS TO ACTIVE DRUG SUBSTANCES: Biotechnologies	**5**
UE 12 PHARMACOLOGICAL SCIENCES: Molecular Pharmacology	**5**
UE 12 PHARMACOLOGICAL SCIENCES: Pharmacokinetics	**5**
UE 13 Formulation, manufacturing, and biopharmaceutical aspects	**5**

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

Second semestre : de janvier à mai
Période d'examens : mai / juin

UE (Unité d'enseignement)	ECTS
UE 2B PHYSIOLOGIE	**5**
UE 6 QUALITÉ ET PRODUITS DE SANTÉ	**4**
UE 9B VOIES D'ACCÈS AUX SUBSTANCES ACTIVES MÉDICAMENTEUSES : Chimie organique 2	**4**
UE 9C VOIES D'ACCÈS AUX SUBSTANCES ACTIVES MÉDICAMENTEUSES : Biotechnologies	**5**
UE 12 SCIENCES PHARMACOLOGIQUES : Pharmacologie moléculaire	**5**
UE 12 SCIENCES PHARMACOLOGIQUES : Pharmacocinétique	**5**
UE 13 Formulation, fabrication et aspects biopharmaceutiques	**5**

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 2B Physiology

5 ECTS

Content

Classes*

- **Physiology of the urinary system**
  Anatomy of the kidney and urinary tract
  The functional unit of the kidneys
  Glomerular filtration
  Physiology of the renal tube
  Evaluation of the nephron functions
- **Physiology of the respiratory system**
  Anatomical description of the lungs
  The respiratory system
  Blood circulation in the lungs
  The ventilation
  Gas exchanges and transportation
  The regulation of the respiration
- **Physiology of the digestive system**
  Oral cavity
  The pharynx and esophagus
  The stomach
  The exocrine pancreas
  The liver and gall secretion
  The small intestine
  The large intestine
- **Physiology of the cardiovascular system**
  The heart and cardiac function: Anatomy of the heart
  Physiology of the heart pump
  The cardiac endocrine system
  Blood vessels and vascular function: Vascular network
  Hemodynamics

Practical works*

Physiology of the urinary system
Physiology of the respiratory system
Physiology of the digestive system
Hemodynamics

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

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 and Vladimir Veksler

UE 6 Quality and health products

4 ECTS

Content

Classes*

- **Product quality and quality control**
  Presentation of the European Pharmacopoeia
  Control of MP, PSO, and PF
- **Control and quality assurance and principles of good pharmaceutical practice**
  Process of production and distribution (BPF and BPD)
  Research process and development and need for a quality approach
- **Management of the quality**
  Principle of PDCA
- **Development of these concepts in various application fields**
  Dispensing of medications (AQ pharmacy, AQ hospital pharmacy)
  Biological and medical analyses

Tutorials*

Product quality and quality control
Control and quality assurance and principles of good pharmaceutical practice
Development of these concepts in various application fields

Practical works*

Product quality and quality control

* **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** downloaded from the DOKEOS pedagogical platform early in the year could be proposed.

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

Najet Yagoubi
Sylvie Bouttier
Cécile Laugel

UE 9B PATHWAYS TO ACTIVE DRUG SUBSTANCES: Organic Chemistry 2 (polyfunctional organic chemistry)

4 ECTS

Content

Classes*

- **Derivatives π-conjugated**
  Definition
  Nomenclature
  Structure
  Physicochemical properties
  Reactivity: conjugate addition, Diels-Alder
- **Alicyclic series**
  Cyclanes and derivatives
    Definition
    Nomenclature
    Structure and Reactivity
    Physicochemical properties
  Notions on steroids
    Definition and Structure
    Nomenclature
    Stereochemistry and reactivity
    Steroid of biological and therapeutic interest
- **Aromatic series**
  Aromatic character
  S_E in aromatic series
  Benzene and aromatics hydrocarbons
  The aromatic functional derivatives
    The halogenated derivatives, S_NAr and E_A
    The aromatic rings systems with electron-poor nuclei (nitrates ...)
    The aromatic systems with electron-rich nuclei (phenols, aniline ...)
    The polyfunctional aromatic systems
    S_NAr and E_A
- **Heterocyclic series**
  General characteristics of heterocyclic series
  Pentagonal heterocyclic series (furan, thiophene, pyrrole, diazoles ...)
  Hexagonal heterocyclic series (pyrans, pyridine, quinoline, acridine ...)

Tutorials*

Polyfunctional organic chemestry

* **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

Christian Cavé

UE 9C PATHWAYS TO ACTIVE DRUG SUBSTANCES: Biotechnologies

4 ECTS

Content

Classes*

- Molecular biotechnology
- Cell, animal, and plant transgenesis
- Production of therapeutic monoclonal antibodies
- Medicinal products derived from blood and labile blood products
- Methods to obtain recombinant proteins
  - Products derived from fractionating versus recombinant products
  - Production system
  - Host cells and organisms: advantages and disadvantages, selection criteria
  - Cultures, bioreactors, fermenters on an industrial scale
  - Purification
  - Formulation of biotechnology products
  - Quality Control

Tutorials*

Molecular biotechnology, transgenesis, therapeutic monoclonal antibodies, medicinal products derived from blood and labile blood products, and recombinant proteins.

* **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

Christophe Fourneau
Jean-Michel Bidart
Myriam Taverna

UE 12 PHARMACOLOGICAL SCIENCES: Molecular Pharmacology

5 ECTS

Content

Classes*

- **Pharmacometrics and molecular and cellular pharmacology**
  Definitions
  Drugs with non specific action
  Drugs with specific action
  The molecular targets of drugs

Tutorials*

Pharmacometrics and molecular and cellular pharmacology

* **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

Alain Gardier
Véronique Leblais

UE 12 PHARMACOLOGICAL SCIENCES: Pharmacokinetics

5 ECTS

Content

Classes*

- Pharmacokinetics
  - Definitions
  - Mathematical principles of pharmacokinetic analysis
  - Pharmacokinetic profiles
- Study of the oral pathway, definitions
  - Physiology, absorption mechanisms, influencing factors, first passage effect, enterohepatic cycle, bioavailability, bioequivalence
- Distribution
  - Fixation to plasma and tissue proteins
  - Apparent volumes of distribution
- Xenobiotic metabolism
- Definition of the drug metabolism
  - Phase 1 enzymes
  - Genetic polymorphism associated with metabolism
- Routes of drug elimination
- Data processing in pharmacokinetics / modeling
- Pharmacokinetics and administration rules
- Applications from the pharmacokinetics to the clinical
  - Nonlinear pharmacokinetics

Tutorials*

- Pharmacokinetics

* **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

Alain Gardier

UE 13 Formulation, manufacturing, and biopharmaceutical aspects

5 ECTS

Content

Classes*

- **Preformulation: definition, fundamentals**
- **Biopharmaceutical stage (release, dissolution, absorption)**
- **Liquid and semi-solid forms**
  Properties of solutions
  Filtration procedure
  Formulation of dispersions
  Application example: parenteral route (specificities, sterilization procedure, case studies)
- **Solid forms**
  Properties of powders
  The granulation process
  The compression process
  The coating process
  The drying process
  Oral route

Tutorials*

Application example: parenteral route (specificities, sterilization procedure, case studies)
Solid forms

Practical works*

Solid forms

* **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** downloaded from the DOKEOS pedagogical platform early in the year could be proposed.

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

Elias Fatal
Amélie Bochot