**Second (2nd) year of Pharmacy study**

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

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**Deuxième (2ème) année des études de Pharmacie**

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

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<th>UE (Unité d’enseignement)</th>
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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 \( \pi \)-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
  - \( \text{SE} \) in aromatic series
  - Benzene and aromatics hydrocarbons
  - The aromatic functional derivatives
    - The halogenated derivatives, \( \text{SNAr} \) and \( \text{EA} \)
    - The aromatic rings systems with electron-poor nuclei (nitrates ...)
    - The aromatic systems with electron-rich nuclei (phenols, aniline ...)
    - The polyfunctional aromatic systems
    - \( \text{SNAr} \) and \( \text{EA} \)

- Heterocyclic series
  - General characteristics of heterocyclic series
  - Pentagonal heterocyclic series (furan, thiophene, pyrrole, diazoles ...)
  - Hexagonal heterocyclic series (pyrans, pyridine, quinoline, acridine ...)

Tutorials

- Polyfunctional organic chemistry

* 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