

College of Medicine

Physiology Department

**PHRM 215**

**Course Description**

**Academic year 2024-2025(1446H)**

**1st Semester**

**Course Organizers**

|  |  |
| --- | --- |
| **Male side** | **Female side** |
| Dr. Salah Elmalik | Dr. Norah Algarzae |
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**Chairman of Physiology Department**

Prof. Abdelrahman Al-Howaikan

**Vice Chair of Physiology Department**

Dr.Manan Al Hakbani

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# Course identification & general information

|  |  |
| --- | --- |
| Institution | King Saud University (KSU) |
| College/Department | College of Medicine / Department of Physiology |
| Course title and code | PHL 215 “Physiology-I” |
| Credit hours | 3 hours |
| Credit distribution | Theory (3+0) |
| Program(s) in which the course is offered | Doctor of Pharmacy (Pharm. D.) |
| Name of course organizer | Dr. Salah Elmalik/Dr. Norah Algarzae |
| Level/year at which this course is offered | Level 5, 2nd year students (1st year at Pharmacy College) |
| Pre-requisites for this course (if any) | None |
| Location | Pharmacy College |
| Recommended textbooks | Berne & Levy Physiology, 8th edition, © Elsevier 2023.  Physiology, Linda Costanzo, 7th edition, © Elsevier 2021. |

# Course Description

This course is designed to provide pharmacy students with an understanding of the basic functions of human body systems, the physiological integration of the different systems, and the different regulatory mechanisms operating to maintain a constant internal environment “homeostasis”. Proper understanding of the physiological processes that govern bodily functions will provide students with the necessary background for proper understanding of the mechanism of action of drugs, their side effects and how body functions may be altered upon drug administration. Students will also be trained to think independently and will be encouraged to integrate their knowledge in a clinical setting. This course will specifically focus on the fundamentals of physiology including an introduction, cell physiology, nerve & muscle, blood, the autonomic nervous system, the respiratory system, the cardio vascular system. Upon completion of this introductory course, students will be able to take more advanced courses in physiology including Pharm 224.

## Form of course delivery

This course is delivered primarily in the form of formal lectures. Supplementary information is provided through audiovisual units that help illustrate various principles of normal human physiology. Students may be required to engage in activities in the form of presentations or completion of assignments, but this is subject to modification according to the course organizer and will be announced at the beginning of the course.

## Time & location

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Day** | **Time** | **Batch no.** | | **Location** | |
| **Male** | **Female** | **Male** | **Female** |
| Sunday | 9am-10am | 87461  89692 |  | **Lecture Theater 115** | **TBA\*** |
| Tuesday | 8am-10am |

\*TBA=to be announced

## Assessment and exams

* Student assessment will be in the form of written examination; continuous assessments (CATs), and the final exam are usually in the form of multiple-choice questions (MCQs).
* There are three exams in total; two CATs and one final exam. The date and mark distribution for each is shown in the table below.

**A table showing exam timing and mark distribution for the PHL-226 course**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name of exam** | **Week** | **Date** | **Marks** |
| 1st Continuous assessment (CAT-1) | 6 | **TBA\*** | 25 |
| 2nd Continuous assessment (CAT-2) | 11 | **TBA\*** | 25 |
| Student’s Activity – Physiology Video | **TBA\*** | **TBA\*** | 10 |
| Final exam | 16-19 | **TBA\*** | 40 |
| \* TBA= To be announced. We are waiting for confirmation from the Pharmacy College. | | Total marks | 100 |

## Grading

A minimum passing score of 60% of the total marks is required for passing the course.

Grading goes as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **Mark** | **Grade** | **Mark** | **Grade** |
| 95-100 | A+ | 75-79 | C+ |
| 90-94 | A | 70-74 | C |
| 85-89 | B+ | 65-69 | D+ |
| 80-84 | B | <60 | Fail |

## Exam policy

Exam format is objective and exam answer keys are graded with the use of a computer program. Exam questions will include material presented in lecture, assigned chapter readings from recommended/reference book, and any material distributed by the lecturer concerning their specific lecture.

Students are expected to ***TAKE ALL THREE EXAMS ON THE SCHEDULED DATES*** indicated above. No make-up exams will be given except in situations of pre-arranged excusable absence, significant illness, or grave family emergencies. ***In the event of an emergency, you must email the course organizer no later than 8:00 am on the day of the exam*** and give reason for absence and a phone number to contact you.

Make-up exams will be allowed in situations of family tragedy, serious illness or other grave situations as determined by the course organizer. Eligibility for a make-up exam requires that a student submits one of the following documents depending on the reason for missing the exam:

1. A medical report from a university hospital is required in case of illness.
2. A death certificate is required in the unfortunate event of bereavement.
3. A police statement is required in the unfortunate event of being involved in a car accident.

All pre-arranged excusable absences need to be approved by the course organizer at least 1-2 weeks prior to the scheduled exam.

### Make-up exams

If the student supplied all required documents and the circumstance/reason for missing the exam was determined to be acceptable by the course organizer, a make-up exam will be scheduled in a time suitable for both student and organizer. Please note that ***MAKE-UP EXAMS ARE IN THE FORM OF SHORT NOTE QUESTIONS ONLY.***

In the unfortunate event of the student not supplying required documents for missing the exam or if reason was found to be non-excusable by the course organizer, a make-up exam may be denied, and the student will receive a zero for that exam.

### Retake exams

No retake exams are given to remediate an exam grade.

### Review of exam questions

Review of test questions for point alterations will be considered if the student contacts the course organizer **within two weeks** following result announcement of each exam. Exam questions will not be returned to the students however the exams with answer key will be available in the course organizer’s office for review on announced dates. Students ***MAY NOT*** take photos of exam questions or copy exam questions.

# Advice to students

This booklet contains the whole semester program including the integrated course schedule and lecture contents for the academic year 1446H (2024-2025). You are advised to keep this booklet always with you for reference.

Try to practice the following methodical approach:

1. Read the recommended textbook before coming to class.
2. Regularly attend all classes and regularly assess whether you are running along with the program or lagging.
3. If you face any difficulties during the course or if you have any questions, you can contact the course organizer or any member of the teaching staff to help resolve the issue and answer any queries.
4. ***DO NOT DEPEND SOLELY ON HANDOUTS FOR STUDY MATERIAL.***
5. In the event of the student being absent for more than 25% of total lecture attendance, he/she will ***NOT*** be allowed to enter the final term exam.

# General course outline

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Wk** | **Day & Date** | **Topic** | **Lecturer** | |
| 1 | Sunday  18-8-2024 | **Introduction-1** | Dr. Salah | Dr.Norah Algarzae |
| Tuesday  20-8-2024 | **Introduction-2** | Dr. Salah | Dr.Norah Algarzae |
| 2 | Sunday  25-8-2024 | **Nerve & Muscle-1** | Prof. M Al-Otaibi | Dr.Norah Algarzae |
| Tuesday  27-8-2024 | **Nerve & Muscle-2** | Prof. M Al-Otaibi | Dr.Norah Algarzae |
| 3 | Sunday  1-9-2024 | **Nerve & Muscle-3** | Prof. M Al-Otaibi | Dr.Norah Algarzae |
| Tuesday  3-9-2024 | **Nerve & Muscle-4** | Prof. M Al-Otaibi | Dr.Norah Algarzae |
| 4 | Sunday  8-9-2024 | **Blood-1** | Dr. Ahmed | Dr. Laila Aldoukhi |
| Tuesday  10-9-2024 | **Blood -2** | Dr. Ahmed | Dr. Laila Aldoukhi |
| 5 | Sunday  15-9-2024 | **Blood-3** | Dr. Ahmed | Dr. Laila Aldoukhi |
| Tuesday  17-9-2024 | **Autonomic Nervous System-1** | Dr. Khalid | Prof.Faten Zakaria |
| 6 | **TBA\*** | **1st Continuous Assessment Exam** | **Dr. Salah Elmalik** | **Dr.Norah Algarzae** |
| 7 | Sunday  29-9-2024 | **Autonomic Nervous System-2** | Dr. Khalid | Prof.Faten Zakaria |
| Tuesday  1-10-2024 | **Autonomic Nervous System-3** | Dr. Khalid | Prof.Faten Zakaria |
| 8 | Sunday  6-10-2024 | **Autonomic Nervous System-4** | Dr. Khalid | Prof.Faten Zakaria |
| Tuesday  8-10-2024 | **Autonomic Nervous System-revision** | Dr. Khalid | Prof.Faten Zakaria |
| 9 | Sunday  13-10-2024 | **Respiratory-1** | Prof. Abdulrhman | Dr.Felwah Al-Zaid |
| Tuesday  15-10-2024 | **Respiratory-2** | Prof. Abdulrhman | Dr.Felwah Al-Zaid |
| 10 | Sunday  20-10-2024 | **Respiratory-3** | Prof. Abdulrhman | Dr.Felwah Al-Zaid |
| Tuesday  22-10-2024 | **Respiratory-4** | Prof. Abdulrhman | Dr.Felwah Al-Zaid |
| 11 | **TBA\*** | **2nd Continuous Assessment Exam** | **Dr.Salah Elmalik** | **Dr.Norah Algarzae** |
| 12 | Sunday  3-11-2024 | **Cardio Vascular System-1** | Prof. Meo | Dr.Asma Alyahya |
| Tuesday  5-11-2024 | **Cardio Vascular System-2** | Prof. Meo | Dr.Asma Alyahya |
| **13** | **10-11-2024** | **First Midyear Vacation** | **Dr.Salah Elmalik** | **Dr.Norah Algarzae** |
| 14 | Sunday  17-11-2024 | **Cardio Vascular System-3** | Prof. Meo | Dr.Asma Alyahya |
| Tuesday  19-11-2024 | **Cardio Vascular System-4** | Prof. Meo | Dr.Asma Alyahya |
| **15** | Sunday  24-11-2024 | **Cardio Vascular System-5** | Prof. Meo | Dr.Asma Alyahya |
| Tuesday  26-11-2024 | **Cardio Vascular System-6** | Prof. Meo | Dr.Asma Alyahya |
| **16-19** | **TBA\*** | **Final Exams** | | |

\*Liable for change, awaiting confirmation from Pharmacy College. TBA=To be announced.

# Contact details for faculty members involved in teaching the course

|  |  |  |
| --- | --- | --- |
| **Unit** | **Faculty member** | **Contact details** |
| Introduction and Cell Physiology | Dr. Salah Elmalik | salah.elmalik2@gmail.com |
| Dr.Norah Algarzae | nalgarzae@ksu.edu.sa |
| Nerve & Muscle | Prof. Mohamed Al-Otaibi | mfalotaibi@ksu.edu.sa |
| Dr.Norah Algarzae | nalgarzae@ksu.edu.sa |
| Blood | Dr. Ahmed Alsabih | aalsabih@ksu.edu.sa |
| Dr.Laila Aldokhi | lailadokhi@yahoo.com |
| Autonomic Nervous System | Dr. Khalid Alregaiey | kalregai@gmail.com |
| Prof. Faten Zakaria | faten@ksu.edu.sa |
| Respiratory System | Prof. Abdulrhman Alhowikan  Dr.Felwah Al-Zaid | ahowikan@ksu.edu.sa  falzaid@ksu.edu.sa |
| Cardio Vascular System | Prof. Sultan Meo  Dr.Asma Alyahya | smeo@ksu.edu.sa  drasmalyahya@hotmail.com |

# Course objectives

## General course objectives

This course is intended to help students:

* Build a comprehensive and balanced understanding of physiology from the cellular and molecular level to the level of the whole organism.
* Recognize the physiological mechanisms underlying the normal functioning of various human body systems from applied and practical viewpoints.
* Construct the basis of physiologic feedback mechanisms and regulation that govern the normal function of the various body systems highlighting the sequence of events taking place when these systems are damaged or become malfunctioning.
* Identify the major physiologic mechanisms underlying many of the commonly and widely used drugs in clinical medicine.

## Specific objectives for each section

### Introduction Lecture Objectives:

1. **Introduction:**
2. Appreciate the level of development of human being from cells to tissues to organs and organ systems and their co-relations to physiological functions.
3. Identify and describe the internal environment.
4. Identify and describe the homeostasis control by physiological processes.
5. **Cell membrane structure and transport across cell membrane:**
6. Describe the fluid mosaic model of membrane structure and function.
7. Define permeability and list factors influencing permeability.
8. Identify and describe carried-mediated transport processes: Primary active transport, secondary active transport, facilitated diffusion.
9. **Body fluids and Electrolytes:**
10. Identify and describe daily intake and output of water and maintenance of water balance.
11. List and describe of body fluid compartments as intra-cellular fluid (ICF) Extra-cellular fluid (ECF), interstitial fluid, trans-cellular fluid and total body water.
12. Describe the composition of each fluid compartment, in terms of volume and ions and represent them in graphic forms.
13. Physiology factor: age, sex, adipose tissue, etc. Pathological factors: Dehydration, fluid infusion.

### Nerve & Muscle Lecture Objectives:

1. **Neuron, RMP, and AP:** 
   1. Identify describe genesis of resting membrane potential (RMP) and the roles of ions channels, Na+ - K+ pump.
   2. Appreciate the effect of changes in ionic composition and/or permeability on resting membrane potential.
   3. Define and draw action potential giving membrane potential in mV and time course in msec and label all components such as latency, threshold (firing level), spike overshoot, after depolarization and after hyperpolarization.
   4. Account the above changes in excitability in terms of conductance changes of Na+ and K+.
   5. Correlate the conductance changes with opening (activation) or closing (inactivation) of relevant gates.
   6. Distinguish between a local potential and an action potential.
2. **Properties of Nerve Fibers:** 
   1. Describe the highest excitability of nerve cell compared to all other excitable cells in terms of rapid change over of selected ions across the membrane.
   2. Define absolute and relative refractory period and give their ionic basis.
   3. Describe differences in the propagation of action potential in myelinated and unmyelinated nerve fibers.
   4. Appreciate effects of local anesthetic, cooling, hypoxia, acidosis and alkalosis on nerve conduction.
   5. Describe the pre-junction and post-junction event in sequence in the neuromuscular transmission and appreciate special roles of transmitter, receptor, esterase and calcium.
   6. List neuromuscular blocking agents and state site and action.
   7. Identify the pathogenesis of myasthenia gravis and appreciate the rationality.
3. **Muscle & Basis of muscle contraction:** 
   1. Classify muscles on histological and functional basis.
   2. Describe microscopic and ultramicroscopic structures.
   3. Describe isometric and isotonic contraction.
   4. Response to exercise and oxygen debt and muscle fatigue.
   5. Define motor unit
   6. Describe steps in sequence in excitation–contraction coupling
   7. Describes sliding filaments theory of muscle contraction.
   8. Describe molecular structures of muscle proteins and their arrangements at resting phase, contraction and relaxation phase.
   9. Make a comparison of the properties of skeletal, cardiac and smooth muscles.
4. **Blood Lecture Objectives:**
5. **Composition and function of blood**
   1. Functions of blood
   2. Composition of blood
   3. Plasma, it’s content and function
6. **RBC, Anemia, White Blood Cells & Immunity:**
7. RBC (Erythrocytes)
8. RBC formation (Erythropoiesis)
9. Control of Erythropoiesis, iron metabolism
10. Hemoglobin
11. ANAEMIA
12. Classification of WHITE BLOOD CELLS and their counts
13. Formation of leucocytes
14. Abnormal counts: leucopenia, Leucocytosis, leukaemia
15. Functions of leucocytes
16. Immunity
    * Basis of immunity: Immune system and Immunocompetent cells
    * Types of immunity: Innate immunity, Acquired immunity
    * Immune response (primary and secondary)
    * Humoral immunity and Cellular immunity
    * Clinical application of immunity e.g. AIDS
17. **Platelets &Haemostasis, Blood groups and blood transfusion:** 
    1. Platelets: their count, physiology and function
    2. Definition of Haemostasis
    3. Mechanisms which prevents bleeding from cut wound

* Vasoconstriction, Platelets Plug, Blood Clot formation (Intrinsic Pathway & Extrinsic pathway)
  1. Fibrinolysis system
  2. Anticoagulants
  3. Bleeding and thrombotic disorders
  4. ABO blood group system
     1. RBC Aglutinogens, Plasma agglutinins, Inheritance of blood groups
     2. Rh blood groups and its application in Hemolytic disease of the newborn
     3. Blood transfusion

### ANS Lecture Objectives:

1. **Lecture 1** 
   1. Understand the main differences between the somatic and autonomic nervous system.
   2. Describe organization of Autonomic Nervous System
2. **Lecture 2**
3. Somatic and Autonomic Reflexes
4. Contrast the sympathetic and parasympathetic branches of the autonomic nervous system, based on
   1. Spinal cord division of origin, length of pre-ganglionic and post-ganglionic neurons, neurotransmitters and receptors at the ganglionic and target organ synapses.
5. **Lecture 3**
6. List the sensory input of the ANS, and the responses of different organs in the body to sympathetic and parasympathetic stimulation
7. List the major central nervous system control centers of the ANS
8. **Lecture 4**
9. Describe the functional effects of normal and abnormal ANS activity or lack of activity.
10. Define theeffects of various drugs on ANS activity.

### Respiratory System Objectives:

**Lecture 1: Functions and Organization of the Respiratory System**

* 1. Understand the difference between internal and external respiration.
  2. Describe the structures and functions of the conductive and respiratory zones.
  3. Understand functions of the respiratory system, including non- respiratory functions, like clearance mechanism by mucus and cilia, production of surfactant and converting enzyme.

**Lecture 2: Mechanics of breathing**

* 1. List the muscles of respiration and describe their roles during inspiration and expiration.
  2. Understand the importance of the following pressures in respiration: Atmospheric, alveolar, intrapleural, and transpulmonary
  3. Describe the pressure and volume relationships in a single respiratory cycle.
  4. Define lung compliance and list the determinants of compliance.
  5. Describe the physiological significance of surfactant and provide an example of abnormal lung function due to a deficiency of surfactant.
  6. Define the various Lung Volumes and capacities and provide typical values for each.

**Lecture 3: Gas Transfer**

* 1. Define partial pressure of a gas.
  2. Describe the components of the alveolar-capillary membrane (i.e., what does a molecule of gas pass through).
  3. Know the various factors determining gas transfer: -Surface area, thickness, partial pressure difference, and diffusion coefficient of gas

* 1. State the partial pressures of oxygen and Carbon dioxide in the atmosphere, alveolar gas, at the end of the pulmonary capillary, in systemic capillaries, and at the beginning of a pulmonary capillary.

**Lecture 4: Oxygen & Carbon dioxide Transport**

* 1. Understand the forms of oxygen transport in the blood, the importance of each form.
  2. Describe: the relationship between PO2 and % saturation of hemoglobin with oxygen, and the significance of the shape of this relationship
  3. Describe the three forms of Carbon dioxide that are transported in the blood, and the chloride shift.
  4. Regulatory centers of respiration: Mechanism of regulation

### Cardiovascular Lecture Objectives:

1. **Lecture 1: Heart Introduction & Properties of the cardiac muscle:**
2. Functional anatomy of the heart
3. Functions of different components of the vascular system
4. Pulmonary and systemic circulation
5. Excitability and the electrical properties of the heart
6. Definition/ mechanism and factors affecting excitability
7. Conductivity
8. Rhythmicity:
9. Starling's law
10. **Lecture 2:  Cardiac Cycle I&II**
11. Definition and different phases of the cardiac cycle
12. Pressure changes during the cycle (atrial, ventricular, aortic and pulmonary)
13. Volume changes during the cycle
14. Heart sounds and murmur
15. **Lecture 3:  Electrocardiogram (ECG)**
16. Genesis and understanding of the normal ECG pattern
17. Interpretation and information derived from normal ECG
18. Peripheral resistance (diameters of arterioles and blood viscosity) and elasticity of aorta and large blood vessels
19. **Lecture 4: Blood Vessels Circulation**
20. Physiological variations affecting blood pressure e.g. age, sex, emotion, race, respiratory movements, exercise, gravity, posture and sleep
21. Factors that determine the normal B.P. e.g. heart rate, stroke Volume, blood volume
22. **Lecture 5:  Cardiac Output & Venous Return**
23. Cardiac output:
24. Definitiona
25. Factors controlling cardiac output: extrinsic control (nervous and chemical)
26. Preload, afterload and contractility: intrinsic control (hetero- and homometric mech)
27. Cardiac function and systemic function curves and their importance
28. Venous circulation and factors affecting venous return
29. Venous return curves: Jugular venous pulse (causes and clinical importance).
30. **Lecture 6:  Regulation of Blood Pressure I &II**
31. Nervous regulation of the cardiovascular system
32. Short term regulation of arterial pressure  by baroreceptors and chemoreceptors
33. Intermediate regulatory mechanisms of arterial Pressure
34. Long term regulatory mechanism
35. Coronary Circulation
36. Hypertension
37. Circulatory Shock

**-Good luck-**