

Physiology

(Course code: BMS0744)

I. Course Information

Course credit: 7

Class: 112, including 90 for lecture, 12 for discuss and 10 for self-study Open to: students from classes of clinic medicine, preventive healthcare, forensic science, traditional medicine, imaging medicine, oral medicine and related disciplines

Lectured by: Department of Physiology, School of Basic Medicine

II. Course Description

One of the most important fundamental courses of medicine, Physiology is the study of the intricate functional mechanisms of the human body. This course will provide scientific knowledge and methodology necessary for students to further study other courses of medicine, and enable them with critical thinking and problem solving skills in future work involving medicine, healthcare and laboratory test.

III. Requirements for instructors

1. Principles

The instructors should always combine knowledge education with ethic education. The course are expected to be taught in systematic, integral, scientific manners while reflecting the latest advances of physiology. Practicability should be kept as top priority by integrating theory with practice, and basic science with clinical application during the teaching process.

2. Teaching methods

The contents of the course should meet the requirement of medicine education, emphasizing on basic theories and knowledge of physiology and training of basic skills. The instructors should be aware of the importance to develop students' capabilities of scientific thinking and analyzing, scientific attitude and creativity.

The contents listed in this syllabus will primarily taught by the lecture in classroom, but some parts are designed for self-study, and some even will be learned in other courses.

3. Contents classification

All contents are divided into three types: Contents which should be known by students;

Contents which should be understood by students; Contents which should be mastered by students.

IV. Topic outline and schedule

Topic	Class *	Lab practice	Self-study
Chapter I Introduction	2		
Chapter II The cell and its function	16		
Chapter III Blood	4 for discussion		
Chapter IV Circulatory system	20		5
Chapter V Respiration	8		
Chapter VI Digestion and absorption	8		
Chapter VII Energy metabolism and temperature regulation	4		
Chapter VIII Urine formation and excretion	10		
Chapter IX Sense organs	4 for discussion		
Chapter X The function of nervous system	18		
Chapter XI Endocrine system	8		
Chapter XII Reproductive system			5
Total	102		10

***Unless specified, class refers to lecture.**

V. Textbook

Human physiology, Eric P. Widmaier, 11th.

VI. Assessment

Theory examination

Chapter I Introduction

I. Objective and requirements

To know the goal and scope of physiology

To know the research methods of physiology at different levels To master the concepts of internal environment and homeostasis

To master the regulation mechanisms of body function, especially feedback

II. Key points and sticky points

Key points : Concepts of internal environment and homeostasis

Sticky points : Mechanism of feedback (negative feedback, positive feedback and feed-forward)

III. Contents and important points

1. The goal and scope of physiology
2. The research methods of physiology
3. Internal environment and homeostasis, distribution of body fluid
4. Regulation of body function: nervous regulation, humoral regulation and autoregulation
5. Control systems of the body: non-automatic control system and automatic control system, feedback (negative feedback and positive feedback), feed-forward

IV. Core concepts

physiology ; internal environment ; homeostasis ; nervous regulation ; humoral regulation ; autoregulation ; hormone ; paracrine ; neurosecretion ; negative feedback ; positive feedback; feed-forward control

V. Reference

1. Textbook

Human physiology, Eric P. Widmaier, 11th.

Guyton AC, Hall JE. Textbook of Medical Physiology, 10th edition , Philadelphia, Saunders, 2000

2. Journal

Hall JE. The promise of translational physiology. Am. J. Physiol. Renal Physiol. 283 : F207-F208, 2002

3.Web

linkshttp://oc.hust.edu.cn/webshow/courseshow_kcjs?coursetype=1&CourseID=20140317092243246422

VI. Study questions

How the body maintain homeostasis? And the significance of homeostasis?

Chapter II The cell and its function

I. Objective and requirements

To know the function of cell

To master transmembrane signal transduction To master the transport cross cell membranes

To master the concepts of resting membrane potential and action potential and their generation mechanisms

To master the concepts of excitation and excitability

To master the relations between threshold, threshold potential and action potential

To master the mechanism and characteristic of conduction of excitation

To master the characteristic of transmission of excitation at the neuromuscular junction

To master the mechanism of the excitation-contraction coupling in skeletal muscle

II. Key points and sticky points

Key points : Characteristics of simple diffusion, channel mediated facilitated diffusion and carrier mediated diffusion, functions and importance of sodium-potassium pump, generation of resting potential and action potential, concepts of excitation and excitability, changes of excitability during action potential, difference between action potential and local response, mechanism and importance of local response, mechanisms of transmembrane signal transduction, mechanism of excitation transmission at the neuromuscular junction, mechanism of muscle contraction, factors affect muscle contraction

III. Contents and important points

Transport cross cell membrane, generation and conduction of excitation, transmission of excitation at the neuromuscular junction, mechanism of skeletal muscle contraction

IV. Core concepts

Simple diffusion, passive transport, permeability, facilitated diffusion, active transport, primary active transport, secondary active transport, exocytosis, endocytosis, resting membrane potential, action potential, depolarization, hyperpolarization, repolarization, threshold potential, threshold, electrotonic potential, local response, excitation-contraction coupling, preload, afterload, contractility, size principle, frequency summation, single twitch, tetanus contraction, incomplete tetanus contraction, complete tetanus contraction

V. Reference

1. Textbook

Human physiology, Eric P. Widmaier, 11th.

Guyton AC, Hall JE. Textbook of Medical Physiology, 10th edition ,
Philadelphia, Saunders, 2000

《Textbook of Medical Physiology》 W.B. Saunders Company

《Neuroscience》 Sinauer Associates, Inc. Publishers

《Review of Medical Physiology》 Lange Medical Books/ McGraw-Hill

《Principles of Anatomy and Physiology》 John Wiley & Sons, INC

2. Journal

《Journal of Physiology》

《Review of Physiology》

《Journal of Neuroscience》

《Cell Research》

《Cell》

3. Web link

http://oc.hust.edu.cn/webshow/courseshow_kcjs?coursetype=1&CourseID=20140317092243246422

VI. Study questions

1. How is glucose transported across the plasma membrane in different parts of body?
2. What is the characteristic of carrier-mediated transport?
3. State the physiological significance of sodium pump.

4. State in detail the mechanisms of resting membrane potential and action potential generation.
5. Compare action potential with local response, state the differences or characteristics of two potentials).
6. Describe in detail the mechanism (process) by which excitation is transmitted across the neuromuscular junction.
7. State the factors that affect the contraction efficacy of skeletal muscle and how they work.
8. List different types of transmembrane signal transduction and provide an example for each type.
9. Taking the action of norepinephrine on cardiomyocytes as example, describe the process of the transmembrane signal transduction

Chapter III Blood

I. Objective and requirements

To know the function of blood

To know the regulation of hemopoiesis

To understand the composition, physical and chemical characteristics of blood

To understand blood type, especially ABO group and Rh factor

To understand red blood cells agglutination and principle of blood transfusion

To master physiological properties of red blood cells, white blood cells and platelets

To master the process and mechanism of hemostasis and blood coagulation

To master the functions of major anticoagulants

To master the function of fibrinolysis system

II. Key points and sticky points

Key points: physical and chemical characteristics of blood, physiological properties of red blood cells, properties of platelets, process and mechanism of hemostasis and blood coagulation, function of anticoagulant, events in lysis of blood clots

Sticky points: coagulation factors, coagulation pathways, anticoagulant

III. Contents and important points

Function of blood, composition of blood, physical and chemical characteristics of blood, blood osmotic pressure, formation and functions of crystal and colloid osmotic pressure, genesis of blood cells, regulation of hemopoiesis, process and mechanism of hemostasis and blood coagulation, coagulation pathways, anticoagulant, function of platelets in hemostasis

IV. Core concepts

Plasma, blood cells, plasma protein, erythrocytes, leukocytes, platelets, hematocrit, viscosity, crystal osmotic pressure, colloid osmotic pressure, isotonic solution, hemopoiesis, pliability of red blood cells, suspension stability, erythrocyte sedimentation rate (ESR), rouleaux formation, osmotic fragility, chemotaxis, hemostasis, blood coagulation, fibrinolysis, serum

V. Reference

1. Textbook

Human physiology, Eric P. Widmaier, 11th.

Guyton AC, Hall JE. Textbook of Medical Physiology, 10th edition, Philadelphia, Saunders, 2000

Bentler E, Lichtman M, Coller B, et al. Williams Hematology, 6th ed. New York, McGraw-Hill, 2001

Ganong WF. Review of Medical Physiology. 20th ed, New York, McGraw-Hill, 1999

Hoffman R, Benz EJ, Shattil SJ et al. Hematology: Basic Principles and Practice, 3rd ed. New York, Churchill Livingstone, 2000

Lee GR, Foerster J, Wintrobe's Clinical Hematology, 10th ed. Philadelphia, Williams and Wilkins, 1999

VI. Study questions

Describe the types of plasma proteins and their physiological functions.

Describe the formation and physiological importance of plasma osmotic pressure.

Describe the physiological properties of red blood cells.

Describe the differences between anemias caused by iron deficiency, lack of vitamin B12 or lack of folic acid.

Describe the function of platelets in hemostasis.

Describe the differences between intrinsic and extrinsic pathways.

Describe the components and function of anticoagulant system.

Describe the composition of fibrinolysis system and the process of fibrinolysis.

Chapter IV Circulatory system

I. Objective and requirements

To know the vasoactive substances released from vascular endothelium

To know the chemoreceptor reflex and pulmonary artery reflexes of arterial blood pressure

To know the blood-cerebrospinal fluid barrier and blood-brain barrier

To understand mechanisms for heart sounds S1 and S2

To understand the composition and function of microcirculation

To understand the characteristic of coronary circulation and its regulation

To master the process and mechanism of heart pumping

To master the evaluation and regulation of cardiac pumping function

To master the transmembrane potential of cardiac working cells and autorhythmic cells and their ionic mechanisms

To master bioelectrical properties of cardiac myocytes (excitability, conductivity, autorhythmicity, contractility)

To master normal ECG and its physiological importance

To master the Formation of arterial blood pressure

To master central venous pressure and regulatory factors

To master the generation of interstitial fluid and related factors

To master the nervous regulation of cardiovascular activity

To master the humoral regulation of cardiovascular activity

II. Key points and sticky points

Key Points: Ionic mechanisms for action potential ventricular myocytes and sinus-atrial nodal cells, physiological properties of cardiac myocytes, periodic change in excitability after excitation, extrasystole, compensatory pause, mechanism for ventricular systole, regulation of cardiac output, mechanism for first and second heart sound, mechanisms for arterial blood pressure and affecting factors, mechanisms for interstitial fluid formation and affecting factors, central venous pressure and affecting factors, affecting factors of venous return to the heart, regulation and mechanism of

autonomic nerve onto heart and vessel, depressor reflex, humoral regulation of cardiovascular system (adrenaline, noradrenaline, vasopressin and renin-angiotensin-aldosterone system)

III. Contents and important points

Cardiac bioelectricity, physiological properties of cardiac myocytes and affecting factors, heart pump function, physiology of blood vessel, regulation of cardiovascular activity, circulation through special regions

IV. Core concepts

Excitability, autorhythmicity, conductivity, contractility, action potential duration, pacemaker current, extrasystole, compensatory pause, normal pacemaker, electrocardiogram, cardiac cycle, cardiac output, stroke volume, heart sound, arterial blood pressure, peripheral resistance, systolic pressure, diastolic pressure, pulse pressure, mean arterial pressure, mean circulatory filling pressure, microcirculation, effective filtration pressure, cardiovascular reflex, baroreceptors, brain ischemic response, adrenaline, noradrenaline, angiotensin II, rennin-angiotensin-aldosterone, vasopressin, antidiuretic hormone, atrial natriuretic peptide

V. Reference

1. Textbook

Human physiology, Eric P. Widmaier, 11th.

Guyton AC, Hall JE. Textbook of Medical Physiology, 10th edition, Philadelphia, Saunders, 2000

VI. Study questions

1. What is cardiac cycle? Describe the process of left ventricular pumping.
2. Describe autorhythmicity and its affecting factors.
3. Describe the mechanism for extrasystole and compensatory pause.
4. Describe the affecting factors of cardiac output.
5. Describe the affecting factors of arterial blood pressure.
6. Describe the affecting factors of venous return to the heart.
7. Define effective filtration pressure. Describe the affecting factors of interstitial fluid formation.

8. How is the arterial blood pressure maintained relatively stable?
9. How will the arterial blood pressure change after carotid artery is occluded on one side, and why?
10. How will the arterial blood pressure change after acute loss of total blood volume for 20%, and why?
11. How will the arterial blood pressure change after posture switch from squatting position to upright position, and why?

Chapter V Respiration

I. Objective and requirements

To know the basic process of respiration

To know the mechanisms for pulmonary ventilation

To know how respiration is regulated by central nervous system

To know the mechanisms for periodic respiration, the proprioceptive reflex of respiratory muscle, cough and sneeze reflexes

To be familiar with pulmonary volume and pulmonary capacity

To be familiar with pulmonary ventilation and alveolar ventilation volume

To be familiar with mechanisms for O₂ and CO₂ transportation in blood

To be familiar with oxygen dissociation curve

To be familiar with mechanisms for respiratory rhythm formation

To master the mechanisms for alveolar ventilation

To master the process of gas exchange in the lung and tissue

To master the affecting factors for pulmonary exchange

To master the regulation of respiratory by chemical factors

II. Key points

Key points :The mechanisms for alveolar ventilation, elastic resistance and airway resistance, pulmonary ventilation and alveolar ventilation volume, pulmonary exchange and influencing factors, respiratory center and its control of respiratory rhythm, pulmonary stretch reflex, chemoreceptor reflex

III. Contents and important points

Basic process of respiration, mechanisms for pulmonary ventilation, alveolar Pressure, intrapulmonary pressure and its changes during respiration, intrapleural pressure and its physiological significance, elastic resistance and airway resistance, surface tension and surfactant, compliance of lungs, airway resistance and its changes during respiration, total lung capacity, tidal volume, inspiratory capacity, functional residual capacity, vital capacity, alveolar ventilation, minute ventilation volume, maximum ventilation volume, residual volume, pulmonary exchange and the influencing factors, V/Q and its influence on pulmonary exchange, hemoglobin and O₂ and CO₂ transportation, oxygen capacity, oxygen content and oxygen saturation, O₂ dissociation curve and its affecting factors, CO₂ dissociation curve, the respiration center, medullary respiratory center, pontile respiratory center, the formation and maintenance of respiratory rhythm, pulmonary stretch reflex, chemoreceptor reflex, the respiratory regulation of CO₂, O₂ and H⁺ concentrations and their interaction

IV. Core concepts

Respiration, pulmonary ventilation, intrapulmonary pressure, artificial respiration; intrapleural pressure, compliance, specific compliance, airway resistance, pulmonary surfactant, tidal volume (TV), inspiratory volume (IRV), expiratory volume (ERV), residual volume (RV), inspiratory capacity (IC), functional residual capacity (FRC), vital capacity (VC), total lung capacity (TLC), forced vital capacity (FVC), forced expiratory volume (FEV), minute ventilation volume, alveolar ventilation, anatomical dead space, alveolar dead space, physiological dead space, ventilation / perfusion ratio (V/Q), oxygen capacity, oxygen content, oxygen saturation, oxygen dissociation curve, Bohr effect, respiratory center, pulmonary stretch reflex, Hering-Breuer reflex, pulmonary inflation reflex, chemoreceptor, central chemoreceptor, peripheral chemoreceptor

Chapter VI Digestion and Absorption

I. Objective and requirements

To be familiar with the process of mechanical digestion and chemical digestion;
To be familiar with the properties of digestive tract smooth muscle; gastrointestinal hormones,
To be familiar with gastrointestinal tract innervation

To be familiar with digestive juice secretion and release regulation; To be familiar with the components and functions of digestive juice;

To be familiar with the major types of gastric/ intestinal motility and their regulation;

To be familiar with defecation reflex;

To be familiar with the process of main nutriment absorption

To know digestion in large intestine;

To know digestion in mouth: mastication and deglutition

II. Key points

Key points : The properties, components and functions of gastric juice, gastric juice secretion regulation, the motion of stomach, gastric emptying and its regulation, the pancreatic juice secretion, components and functions of pancreatic juice, bile secretion and release: the components and functions of bile, regulation of bile secretion and release, the motion form of small intestine and its regulation

Electrophysiological properties of digestive tract smooth muscle, types and functions of gastrointestinal hormones, the mechanism of gastric juice secretion during digestion

III. Lecturing contents and important points

Definition of digestion and absorption, definition of mechanical digestion and chemical digestion; general and electrophysiological properties of digestive tract smooth muscle; secretion function of digestive glands; innervation of the stomach and intestine; hormonal regulation of stomach and intestine; gastrointestinal hormones; the names of main gastrointestinal hormones and the names and locations of their secretary cells, brain-gut peptide

Digestion in mouth: composition and function of saliva, regulation of saliva secretion, mastication and deglutition

Digestion in stomach: composition, function and nature of gastric juice, regulation of gastric juice secretion: endogenous substances that can stimulate/inhibit gastric juice secretion, gastric juice secretion regulation during digestion, inhibitory regulation of gastric juice secretion. Movement of stomach: the movement of proximal and distal stomach, receptive relaxation, peristalsis, gastric emptying and its influencing factors

Digestion in small intestine: pancreatic juice secretion, components and functions of pancreatic juice, secretion regulation of pancreatic juice during cephalic phase,

gastric phase, and intestinal phase, bile secretion and release: the components and functions of bile, the gallbladder's function in bile secretion and release, regulation of bile secretion and release, intestinal juice: the mechanism of intestinal juice secretion and regulation, the major types of intestinal motility and their regulation, the function of ileocecal valve

Digestion in large intestine: large intestine mucus secretion, the major types of large intestine motility and cation, feces discharge and defecation reflex, the function of bacteria in large intestine

IV. Definitions

Mechanical digestion; chemical digestion; absorption; brain-gut peptide; gastric juice; gastrin; pepsinogen; receptive relaxation; enterogastrone; pancreatic juice; trypsin; chymotrypsin; enterokinase; pancreatic amylase; pancreatic lipase; enterohepatic circulation of bile salt; micelles; chylomicron; segmentation contraction

V. Study questions

1. Please design an experiment to prove the gastric juice releasing during cephalic phase .
2. How to treat ulcer according to the knowledge you have learned in this chapter?

Chapter VII Energy Metabolism and Temperature Regulation

I. Objective and requirements

To be familiar with definition, measurement, influencing factors of energy metabolism;

To be familiar with definition, physiological fluctuation of body temperature, the mechanism to maintain the body temperature by heat production and loss; To be familiar with the method and position to measure body temperature; To be familiar with set point concept and set point theory

To know the source, transformation and utilization of energy

II. Key points

Several concepts of food energy index, the influencing factors of energy metabolism, principle and connotation of basal metabolism measurement, the measurement and fluctuation of body temperature, the mechanism to maintain the body temperature

Principle of indirect calorimetry, measuring method of basal metabolism, the source and fate of energy, the energy release, reservation, transformation, and utilization during metabolism, body temperature regulated by heat production and loss

III. Lecturing contents and important points

Energy metabolism: definition of energy metabolism, source of energy, food energy transformation, the principle and method for energy metabolism measurement, principle of direct and indirect calorimetry, caloric value and thermal equivalent of oxygen of food, respiratory quotient (RQ), the main influencing factors of energy metabolism, definition and measuring method of basal metabolism and basal metabolism rate, sedentary conditions, basal metabolism rate representing method and normal value

Body temperature and its regulation: the definition of body temperature and its physiological fluctuation, the normal value, position and method for measuring body temperature, heat production and heat loss, the organ, form, and regulation of heat production, the manner of heat loss, radiation, conduction, convection, evaporation; sweat gland and its regulation, the types of perspiration and its center, behavioral and autonomic thermoregulation, thermoreceptor, thermoregulation center, preoptic-anterior hypothalamus area (PO/AH) for thermoregulation integration, set point concept and set point theory

IV. Definitions

Energy metabolism; thermal equivalent of oxygen; respiratory quotient, RQ; non-protein respiratory quotient, NPRQ; basal metabolism rate, BMR; body temperature; set-point; warm-sensitive neuron; cold-sensitive neuron; thermoregulation

V. Study questions

1. How to maintain body temperature in a very cold environment?
2. What are the detailed procedures for measuring basal energy metabolism by indirect calorimetry?

Chapter VIII Urine formation and excretion

I. Objective and requirements

To be familiar with the process of urine formation and its influencing factors; To be familiar with the mechanism of urine concentration and dilution;

To be familiar with the regulation of renal function of urinary;
To be familiar with the function of kidney in maintaining the stability of internal environment;
To be familiar with the blood circulation in kidney, the plasma clearance rate; To be familiar with the process of micturition
To know the importance of kidney function in micturition

II. Key points

Key points :Formation of glomerular effective filtration pressure, the influencing factors of glomerular filtration function, autoregulation of kidney blood flow volume proximal tubule, ascending thick limb of Henle's loop, the reabsorption mechanism, the volume and the properties of distal tubule and collecting duct for Na^+ 、 Cl^- 、water and glucose. The concept and physiological significance osmotic diuresis and glomerulotubular balance

The generation, function, and secretion regulation of antidiuretic hormone, the regulation role of renin-angiotensin-aldosterone system in urine formation, renin release and its regulation

Concept of filtration equilibrium, the formation of medullary high osmotic pressure, the mechanism of urine concentration and dilution, the concept and application of clearance rate

III. Lecturing contents and important points

Physiological significance of urinary system, anatomical features of kidney, blood supply features and regulation of blood flow volume;

Glomerular filtration function:①glomerular filtration rate GFR and filtration fraction, filtration membrane and its permeability,②glomerular effective filtration pressure and the influencing factors of glomerular filtration

Reabsorption and secretion function of kidney tubule and collecting duct: ① reabsorption of Na^+ 、 Cl^- 、 HCO_3^- 、 K^+ 、water and glucose,②secretion and excretion function of kidney tubule and collecting duct: secretion of H^+ 、 NH_3 、 K^+ ; ③ influencing factors of kidney tubule and collecting duct function

The relationship between medullary osmotic pressure gradient and urine concentration and dilution, the role of vasa recta for maintain medullary high osmotic pressure

Regulation of kidney urinary function: ① solute concentration in tubular fluid;
② neural and humoral regulation: renal sympathetic nerve, antidiuretic hormone (ADH), renin-angiotensin-aldosterone system

The concept, the measuring method and the clinical significance of plasma clearance, innervation of bladder and urethra, the micturition reflex; the concept of urine volume, the composition and the physicochemical properties of urine, hypotonic or hypertonic urine

IV. Definitions

Glomerular filtration rate GFR, filtration fraction, glomerular effective filtration pressure, tubuloglomerular feedback, reabsorption, tubular secretion, renal glucose threshold, glomerulotubular balance, osmotic diuresis, water diuresis, renin-angiotensin-aldosterone system, aldosterone

V. Study questions

1. What are the influencing factors for glomerular filtration?
2. How the urine volume will be affected after drinking large amount of water? How to explain this effect?
3. How the urine volume will be affected after intravenous injection 5 ml 20% glucose solution into rabbit (2.5 kg)?
4. How the renin-angiotensin-aldosterone system will be affected by the arterial blood pressure decline? What is the physiological signification of this effect?
5. How the urine volume will be affected by massive blood loss? Why?

Chapter IX sense organs

I. Objective and Requirements

To understand the functions of various kinds of sense organs.

To know the physiological properties of sense organs.

To master the mechanisms of visual sense and auditory sense.

II. Key points

Important points: Myopic accommodation, two kinds of retinal photo sensory transducing systems: rod and cone system. The mechanism of rod cells' photo sensory transducing. Traveling wave theory of vibration of basilar membrane.

Key points: Bioelectric phenomenon of cochlea. The mechanism of rod cells' photo sensory transducing. Photochemical reactions of rhodopsin. The structure of rod cells' outer segment and its photoelectric conversion.

III. Lecturing contents and important points

Classification of receptors. The properties of receptors: suitable stimulation, transducing, coding adaptation.

Visual organ: 1, The dioptric imaging function of eye, Myopic accommodation, the definitions of pupillary light reflex and near reflex of the pupil. The formation and correction of myopia, hyperopia and astigmatism. 2, The photo sensory transducing of eye: Two kinds of retinal photo sensory transducing systems and its functions, the constitution of photopigment. 3, the definitions of vision, scotoma, visual field, light adaptation and dark adaptation.

Auditory organ: 1, the definitions of hearing threshold and hearing span, the function of external ear 2, The constitution of middle ear, the function of eardrum, ossicular chain and auditory tube, the air conduction and bone conduction of sound waves. 3, the structure of cochlea, the bioelectric phenomenon of cochlea.

Vestibular organ: 1, the constitution and function of vestibular organ. 2, the suitable stimulation and receiving setting of vestibular organ. 3, the definition of nystagmus.

IV. Definitions

Receptor; receptor potential; coding; adaptation; reduced eye; visual acuity; visual accommodation; near point of vision; dark adaptation; light adaptation; visual field; hearing threshold; air conduction; bone conduction

V. Textbook

1. Zhu Danian. Physiology. 8th edition. Beijing: People's Medical Publishing House. 2013
2. Guan Xinmin. Medical Neurobiology. 1th edition. Beijing: People's Medical Publishing House. 2002
3. Shou Tiande. Neurobiology. 1th edition. Beijing: Higher Education Press. 2001

4. Yao Tai, Luo Ziqiang. Physiology. Beijing: People's Medical Publishing House. 2001
5. Zeng Zhaolin. Special sensory physiology. Jian Yaotai Hominal Physiology. Beijing: People's Medical Publishing House. 2000
6. Ben Xianglixian, Guang zhongli. Standard physiology. Tokyo: Medical College. 1998
7. Xing Meng, Lin Xiusheng. Bibliographic Information. Tokyo Maru Corporation 1998

V. Study questions

1. What are the physiological properties of receptors?
2. What are the features of receptor potential? What are other potentials that share the same properties, please name them.
3. How are human eyes capable of seeing things within 6 meters?
4. What are the abnormalities of myopia, hyperopia, astigmatism and presbyopic? How to correct them?
5. What are the differences and similarities between rod and cone systems?
6. How is the sound conveyed to the inner ear?

Chapter X Functions of the nervous system

I. Objective and requirements

To be familiar with functions of the neurons and glial cells, to master the general rules of reflex and the role of the nervous system in regulating the function of the body (such as senses, muscular movement, visceral activity, etc.), to understand and master the basic concepts of this chapter, then truly understand the role of the nervous system in maintaining a steady state and regulating the functional balance between various organs of the organism.

II. Key points

The difficult point: presynaptic inhibition

The key points: principles of chemical synaptic transmission, excitatory postsynaptic potential, inhibitory postsynaptic potential. Stretch reflex: tendon reflex and muscle tonus. Facilitatory region and inhibitory region of reticular formation, decerebrate

rigidity

III. Lecturing contents and important points

1. The general rules of neuronal activity

(1) To master the concept and structure of neurons
(2) To master the concept of (un)myelinated nerve fibers and the function of nerve fibers

(3) To master the way of interaction between neurons

(4) To master the concept and anatomy of synapses

(5) To master the characteristics of central excitation

(6) To master the concept, significance and mechanism of excitatory postsynaptic potential and inhibitory postsynaptic potential

(7) Neurotransmitter

① To master the concept of neurotransmitters

② To master the types of peripheral neurotransmitters

③ To master the definition and distribution of cholinergic nerve fibers and adrenergic nerve fibers

④ To master the types of central neurotransmitters

⑤ To understand the concept of neurotransmitter and neuromodulator

⑥ To master the concept and classification of cholinergic and adrenergic receptors

(8) The general rules of reflexes

① Reflex and reflex arc

② To understand the central nervous system connection

③ Conditioned reflex and unconditioned reflex

The reflex feedback system: negative feedback and positive feedback

2. The sensory function of the central nervous system

(1) Sensory function of the thalamus

To understand the classification of thalamic nuclei

To master the concept of specific and nonspecific projection systems and the differences in structure and function between the two systems

To understand the concept of ascending reticular activating system

(2) Sensory function of cerebral cortex

(3) The sense of pain

To understand the concept of sense of pain

To understand the concept of skin pain

To master visceral pain and its characteristics

3. Regulation of somatic movement by the central nervous system

(1) To master the concept of motor neurons and motor units of the spinal cord

(2) To understand the concept of spinal shock, the main phenotype and cause

(3) To understand the concept of flexor and crossed extensor reflex

(4) Stretch reflex

① To master the concept of stretch reflex

② To understand the reflex arc

③ To master the types of stretch reflex and their physiological significance

(5) Regulation of movement by the brain stem

(6) Cerebellar regulation of somatic movement

① To understand the structure of the cerebellum

② To master the main functions of the cerebellum

(7) Regulation of movement by the basal ganglia

① To understand the anatomy of basal ganglia

② To master the functions of basal ganglia

③ To understand the clinical manifestations of basal ganglia injury

(8) Regulation of somatic movement by the cerebral cortex

① motor areas of the cerebral cortex

② To master the positioning and dominating features of major motor areas in the cerebral cortex

③ To master the concept and functions of the pyramidal system and the extrapyramidal system

4. Regulation of visceral activities by the nervous system

(1) To understand the structural characteristics of autonomic nervous system

(2) To master the main functions and characteristics of sympathetic and parasympathetic nervous system

(3) To be familiar with the regulation of visceral activities by the spinal cord and brain stem

(4) To master the main functions of the hypothalamus

5. Advanced brain functions and electroencephalogram

(1) To master the concept of conditioned and unconditioned reflex

(2) To understand the formation regression, generalization and differentiation of

conditioned reflex

- (3) To understand the formation mechanism and significance of conditioned reflex
- (4) To understand the concept of the first and second signal systems
- (5) To understand the concept of learning and memory
- (6) To be familiar with the language center of the cerebral cortex and the dominant hemisphere
- (7) To be familiar with the concept of EEG and the common EEG waveform and significance
- (8) To understand the general concept of sleep and wakefulness

IV. Definitions

Adequate stimulus; afferent collateral inhibition (or reciprocal inhibition); agonist; antagonist; ascending reticular activating system; autonomic nervous system; axon; axonal transport; Babinski sign; central inhibition; central nervous system (CNS); chemical synapse; synaptic cleft; conditioned stimulus; crossed extensor reflex; decerebrate rigidity; electroencephalogram (EEG); evoked cortical potential; excitatory postsynaptic potential (EPSP); fast pain; fast wave sleep (FWS); first signal system; flexor reflex; inhibition of synapse; inhibitory postsynaptic potential (IPSP); integrating information; local neuronal circuit ; muscle tonus ; nerve fiber ; neuromodulator; neurotransmitter; nonspecific projection system; parasympathetic nerve; Parkinson's disease; postsynaptic membrane; postsynaptic potential; recurrent inhibition; referred pain; second signal system; sense of pain; slow pain; slow wave sleep (SWS); specific projection system; spinal shock; stretch reflex; sympathetic nerve; Golgi tendon organ; tendon reflex; unconditioned stimulus; visceral pain; α rigidity; γ rigidity

V. Textbooks

Human physiology, Eric P. Widmaier, 11th.

Guyton AC, Hall JE. Textbook of Medical Physiology, 10th edition , Philadelphia, Saunders, 2000

VI. Study questions

1. What is stretch reflex? What are the major types of stretch reflexes? What are the underlying mechanisms?

2. What are the forms of central inhibition? What are the mechanisms? What is the physiological significance?
3. What is decerebrate rigidity? Please explain its mechanism.
4. What is γ rigidity ? What is α rigidity? How can you distinguish these two kinds of rigidity by experiment?
5. What is presynaptic inhibition? What is postsynaptic inhibition? How about the mechanism? What are the differences between them?
6. What are presynaptic and postsynaptic inhibition? Please describe their physiological mechanisms, and compare their differences.
7. What are excitatory postsynaptic potential and inhibitory postsynaptic potential? Please explain their mechanisms.
8. What are the characteristics of the central excitation?
9. What are thalamic specific and non-specific projection system? Please explain their projection characteristics and corresponding physiological functions, respectively.
10. Please describe the pathogenesis and curative principles of Parkinson's and Huntington's diseases.
11. What are conditioned reflex and unconditioned reflex? Please describe their characteristics and corresponding functions, respectively.

Chapter XI Endocrine system

I. Objective and requirements

To understand the role and the mechanism of the endocrine system in regulating the main physiological processes.

To master the physiological role of several major hormones and its secretion regulation.

II. Key points

Important points: The concept of hormone. The general characteristics of hormonal effects. The principle of hormonal action: Principle of nitrogen - containing hormones, principle of steroid hormones. The biological effects of growth hormone. Biological function and secretion regulation of thyroid hormone. The biological effects of glucocorticoids.

Difficult points: The functional contact of hypothalamus and adenohypophysis (pituitary portal system), hypothalamic regulatory peptide. The mechanism of action of auxin. The biological effects of glucocorticoids.

III. Content and key point of learning

The classification of hormone, mechanism of its action and cell signaling transmembrane transduction.

Endocrine function of hypothalamic: The functional contact of hypothalamus and adenohypophysis, hypothalamic regulatory peptide. Pituitary: the physiological role of pituitary hormones, the biological role of growth hormone and its secretion regulation. Neurohypophysis: the source physiological and secretory regulation of vasopressin and oxytocin.

Thyroid: Biosynthesis, storage, release, transport and metabolism of thyroid hormone. Types and physiological effects of thyroid hormones. Secretion regulation of thyroid hormone.

Parathyroid hormone, vitamin D and calcitonin. The biological role and secretion regulation of parathyroid hormone, the biological role and secretion regulation of vitamin D₃, calcitonin.

Adrenal cortex: corticosteroid species, physiological effects and the action mechanism of adrenal cortical hormone, the secretion regulation of corticosteroid.

Adrenal medulla: The species and role of medulla (adrenaline, norepinephrine, adrenomedullin).

Islet: The biological effects and secretion regulation of insulin and glucagon.

The endocrine function and hormones in other organs: the endocrine function of pineal and thymus.

The role of prostaglandin.

IV. Definition

Hormone ; telecrine ; paracrine ; autocrine ; permissive action;
hypothalamo-adenohypophysis system; hypothalamo-neurohypophysis system;
hypothalamic regulatory peptides, HRP; growth hormone; prolactin; melanophore stimulating hormone; oxytocin; thyroid hormone; myxedema; cretinism; gigantism; acromegaly; parathyroid hormone; calcitonin; glucocorticoids; insulin; glucagon

V. Textbooks

Human physiology, Eric P. Widmaier, 11th.

Guyton AC, Hall JE. Textbook of Medical Physiology, 10th edition , Philadelphia, Saunders, 2000

VI. Questions

1. What is the hormone? What are the main ways and what are the general characteristics of hormonal delivery information?
2. Briefly introduce the hormone cell membrane receptor - mediated signal transduction pathway.
3. Briefly introduce the cell transduction mechanism mediated by hormone intracellular receptor.
4. Try to describe the role, relationship and regulation of growth hormone and somatomedin.
5. Try to describe the physiological role of thyroid hormones.
6. Try to describe the physiological role of What is the stress response? What are the hormones involved in the body's stress response?
7. What hormones regulate the body's metabolism of calcium and phosphorus? How they maintain the balance of calcium and phosphorus in the body?

Chapter XII Reproduction

I. Objective and requirements

To master the formation mechanism of the menstrual cycle. To know the function of male and female gonad

II. Key points

Key points : The endocrine function of ovary

III. Lecturing contents and important points

Male reproduction: 1. The spermatogenesis effect of the testis; 2. The endocrine function of testis: the physiological effects and the secretion regulation of testosterone

Female reproduction: 1. The role of ovary in oogenesis : 2 The physiological function of the estrogen and the progestin;3. Hormonal control of the periodical changes of the ovary and the uterine endometrium.; 4. The pregnancy process.

IV. Definitions

Erection, testis, corpus luteum, capacitation of spermatozoa, ovarian cycle, pregnancy

V. References

1. Physiology. the eighth edition. Da nian zhu. Beijing. People's Medical Publishing House . 2013
2. Germ Cell Apoptosis and Regulation in Testis.caixia guo. Progress in physiological sciences. 31:299~304,2000
3. Human Reproductive Biology. Xiao lin shi Beijing. Science Press. 2002
4. Berne RM, Levy MN. Physiology ,4th edition, St. Louis,Mosby ,1998
http://oc.hust.edu.cn/webshow/courseshow_kcjs?coursetype=1&CourseID=20140317092243246422

VI. Study questions

What is the relationship between menstrual cycle and endocrine?