SHOOL OF MEDICINE UNIVERSITY OF BELGRADE
PROGRAMME OF EXERCISES IN MEDICAL PHYSIOLOGY
III semester 2020 – 2021. academic year

Exercise I (3 hours) 12.-13.10.2020., dr Nikola Šutulović 10:00h

1. Introduction to educational plan and program and evaluation of knowledge in Medical physiology
2. Working protocol for the exercises in Medical physiology
3. Experiment as a method for scientific research in medicine (selection of animals, acute and chronic experiment)
4. Consideration for medical students using laboratory animals (UNESCO, 1978; WSPA, 2000; European convention of protection of the mammals).

SEMINAR: ***Biophysics in Medical Physiology - Osmosis. Osmotic pressure (total and effective osmotic pressure). Reflection coefficient. Surface tension*** **(*2 hours*).**

Exercise II (3 hours) 19.-20.10.2020., dr Rada Jeremić 13:00h

1. General principles and the ways of giving injections (practicing on a model)
2. *Usage of computers in virtual laboratory (interactive laboratory simulations)*
3. *Interactive presentation of preparation of the nervus ischiadicus of a frog (SimNerv)*

Exercise III (4 hours) 26-27.10.2020., dr Biljana Đurić 12:00h

1. Obtaining of blood samples for laboratory analysis from the finger tip
2. Maintaining of a cell volume:
   a) bearing of erythrocytes in iso-, hypo- i hypertonic solution
   b) exploring of the osmotic fragility of the red blood cells in the hypotonic solutions
   c) investigation of the importance of osmotic reflection coefficient
3. *Interactive presentation of homeostasis of the body water* (*A.D.A.M.*)
4. *Hydro-electrolitic balance: compartemnts, examples and calculations* (*Darrow-Yannet*)
5. *Interactive presentation of homeostasis of the body electrolytes* (*A.D.A.M.*)

SEMINAR 1: Body fluids and physiological solutions (types and application) (2 hours)

Exercise IV (4 hours) 02-03.11.2020., dr Rada Jeremić 12:00h

1. Introduction to recording and analysis of the membrane potentials
2. *Recording and analysis of an action potential (AP) of a single nerve fiber and determination of a threshold stimulus parameters (AP7)*
3. *Investigation of changes in the extracellular concentrations of Na^+, K^+ and Ca^+ on the resting membrane potential, action potential amplitude and excitability*
4. *Investigation of excitability of a single nerve fiber (voltage-duration curve)*
5. *Demonstration of the accommmodation of a nerve fiber applying threshold stimuli of slowly rising amplitudes*
6. *Investigation of the effects of temperature on the Nernst potential for certain ions*
7. *Recording and analysis of ion currents under condition of normal composition of the extracellular and intracellular fluid and at the temperature of 37°C*
8. *Recording and analysis of the origin of inward and outward currents using blockers of Na^+, K^+ and Ca^+ channels*

Exercise V (4 hours) 09-10.11.2020., dr Slavica Mutavdžin 12:00h

1. Anesthesia in experimental research
   a. Introduction to anesthesia in surgery (types and stages)
   b. Demonstration of anesthesia on the experimental animals (frog, mouse, rat)
   c. *Interactive session on types and application of different anesthetics in rat* (Rat Blood Pressure)
2. *Investigation of the nerve compound action potential properties (SimNerv)*
   d. *Recording and analysis of the compound action potential of the nervus ischiadicus of the frog*
   e. *Change the polarity sign of the voltage pulse. What effect on the action potential is noted?*
   f. *Demonstration that the cathode is an active electrode*
   g. *Demonstration of the induced polarization currents*
   h. *Determination of the minimal and maximal stimulus intensity (demonstration of the graded response)*
   i. *Demonstration of absolute and relative refractory periods and calculation of its duration*
   j. *Calculation of the nerve conduction velocity of the action potential*
   4. Interactive video presentation of central nervous system (A.D.A.M.)

SEMINAR 2: Excitation and contraction of skeletal and smooth musles (2 hours).

Exercise VI (4 hours) 16-17.11.2020., dr Nikola Šutulović 12:00h

1. General principles and practicing of obtaining blood samples by venipuncture and intravenous application of drugs (individual practicing on a model)
2. Separation of blood plasma and serum
3. Interactive presentation of skeletal muscles' physiology (*A.D.A.M.*)
4. Interactive presentation of preparation of nerve-muscle preparation of a frog (*m. gastrocnemius and n. ischiadicus*) (*SimMuscle*)
   a. *Recording of the single isotonic skeletal muscle twitch* (*myogram*)
   b. Determination of the intensity of the threshold and maximal stimulus and demonstration of the graded response
   c. Recording of summation of two muscle twitch
   d. *Recording of the sustained muscle contraction* (*tetanus*)
   e. Demonstration of the effect of loading on amplitude of a muscle contraction
   f. Demonstration of fatigue effects on myogram
   g. Recording of the single isometric contraction of skeletal muscle
   h. *Demonstration that amplitude of the muscle contraction is a function of the stimulus intensity (graded response)*

Exercise VII (3 hours) 23-24.11.2020. dr Dušan Todorović 12:00h

1. Analyse the sense of taste and smell
   a. a qualitative and quantitative analysis of smell
   b. a qualitative analysis of taste
   c. analyse interdependence between the sense of taste and smell
2. Recording of the single isometric contraction (*myogram*) (*PhysioEx 4.0*) *and analysis of the obtained myograms*
3. Recording of sustained muscle contraction and determination of the obtained developing force
4. Demonstration of a »treppe« phenomenon
5. *Demonstration of the effect of muscle length on muscle tension due to application of a constant intensity stimulus* (*maximal stimulus*) *and drawing a length-tension diagram*
6. Demonstration of the effect of stimulus intensity on muscle tension on the base of resting muscle length and construction of diagram
7. *Demonstration of the effect of loading on the velocity of the isotonic muscle contraction and construction of the diagrams under different muscle length*

Exercise VIII (4 hours) 30.11-01.12.2020. dr Dušan Todorović 12:00h

1. Construction of an image of object in a complex optical system
2. Determination of the near and far point of vision and visual acuity testing
3. Demonstration of the blind spot – Mariotte's assey
4. Charting the visual field by perimetry and confrontation method
5. Testing of the color vision
6. Testing of binocular depth perception of objects
7. Examination of the conjugated eyeball movements
8. *Examination of the role of contrast in a visual image interpretation* (*background and illumination*)
9. *Demonstration of afterimages and optical illusions*
10. *Examination of visual attention* (*Brain Metric*)

SEMINAR 3: Physiology of pain (2 hours)

Exercise IX (4 hours) 07-08.12.2020. dr Biljana Đuric 12:00h

1. Examination of the ocular fundi with an ophthalmoscope
2. Testing of air and bone conduction of the sound
3. Somatic sensations testing: exteroceptive (sensation of touch and thermal sensation); proprioceptive (vibration, position sense and sense of movement – kinesthesia)
4. Cortical sensations testing (graphesthesia, stereognosis, barognosis)
5. *Multimedial presentation of the visual system physiology* (*Power Point*)
6. *Multimedial presentation of the auditory system physiology* (*Power Point*)
7. *Assessment of auditory threshold for the sounds of different frequencies* (*audiometry – Brain Metric*)

SEMINAR 4: **Neurophysiology of vision (2 hours)**

Exercise X (4 hours) 14-15.12.2020. dr Slavica Mutavdžin 12:00h

1. Performing of the clinically important reflexes: corneal and conjuctival reflexes; papillary light reflex; reflex of accommodation; cutaneous reflexes and stretch reflexes
2. Testing of muscle strength and muscle tone
3. Performing of tests for evaluation of the cerebellar motor functions
4. Examination of the functional specialization of the cerebral hemispheres: dominance for hand, leg and eye
5. *Performing of POSOV* ("*Programme for evaluation of the subjective sense of vertical position*") *for evaluation of the vestibular system function*
6. *Reaction time testing*
7. *Withdrawal reflex and coordinated frog response (Pro dissector frog)*

SEMINAR 5: Spinal cord reflexes (2 hours)

COLLOQUIUM I: 1. INTRODUCTION TO MEDICAL PHYSIOLOGY. HOMEOSTASIS AND CONTROL MECHANISMS; 2. TRANSPORTS THROUGH THE BIOLOGICAL MEMBRANES; 3. BODY FLUIDS; 4. PHYSIOLOGY OF EXCITABLE TISSUES; 5. MUSCLE PHYSIOLOGY; 6. GENERAL PRINCIPLES OF NEUROPHYSIOLOGY; 7. SENSORY PHYSIOLOGY; 8. SPECIAL SENSES PHYSIOLOGY (SPECIAL SENSORY SYSTEMS);

Exercise XI (4 hours) 21-22.12.2020. dr Nikola Šutulović 12:00h

1. Tests for evaluation of the vestibular system function: rotatory test; Romberg test; compass

walk test
2. Electroencephalography (EEG) – principles of recording and basic analysis,
3. Electromyoneurography (EMNG) – determination of nerve conduction velocity
4. *Analysis of a representative sample of normal EEG record*
5. *Testing of attention characteristics: range of attention, split* (*Trail-Making test*) *and nonsplit* (*Stroop test*) *attention*
6. *Testing of immediate and short-term memory*

SEMINAR 6: Control of posture and locomotion: brain stem (2 hours)

Exercise XII (4 hours) 28-31.12.2020. dr Nikola Topalović 12:00h

1. Palpation of heart apical impulse (ictus cordis)
2. Auscultation of heart sounds
3. Determination of heart rate and the rhythmicity of heartbeats
4. *Interactive presentation of rat's heart preparation* (*SimHeart*) *and apparatuses for recording by Langendorff Method*
5. *Recording and analysis of rat's heart muscle contractions*
6. *Demonstration and analysis of the effects of adrenaline, acetylcholine, and other substances on the heart rate and amplitude of the heart contraction*
3. *Interactive presentation of heart activity* (*A.D.A.M.*)
4. *Demonstration of Frank-Starling's law of the heart*

SEMINAR 7: Learning and memory (2 hours)

Exercise XIII (4 hours) 11-12.01.2021. dr Nikola Topalović 12:00 h

1. Observation of the function of a valves on isolated beef heart (Gad's experiment)
2. Recording and analysis of human electrocardiogram (EKG)
3. *Video presentation of EKG: assesment of basic ECG analysis*
6. *Interactive presentation of frog's heart function*: (*PhysioEx 4.0*)
   a. *recording of the baseline frog heart activity* (*mechanogram*)
   b. *induction and analysis of an extrasystole*
   c. *assesing the effect of temperature on the frog heart activity*
   d. *examining the effect of vagus nerve stimulation on the frog heart activity*

SEMINAR 8: EKG: recording and analysis (2 hours)

***makeup of the exercise will be arranged in timely manner**

Signitures, makeup of exercises and seminars