PRACTICAL EXAM TOPICS

Practices to perform:

1. Red blood cell counting

2. White blood cell counting

3. Leukocyte differential count on peripheral blood smear

4. Measurement of transport rate on red blood cells

5. Determination of AB0 blood types by “one-sided” test and Rh (D) blood type

6. Determination of AB0 blood types by “two-sided” test

7. Evaluation of acid-base parameters with the Siggaard-Andersen nomogram (The student evaluates 3 tasks picked by the examiner from the Practice book)

8. Recording and analyzing the human ECG

9. Determination of blood pressure by using the auscultatory method

10. Human pulmonary function tests (Spirometry)

11. Respiratory physiology calculations (The student evaluates 3 tasks picked by the examiner from the Practice book)

12. *Computer simulation: Function and pharmacology of the neuromuscular junction (NMJ)

The effect of altered stimulating parameters; effects of tubocurarine, Na^+ channel blocker, K^+ channel inhibitor, and altered extracellular $[K^+]$ on membrane potential changes.

13. *Computer simulation: Studies on circulatory reactions of a virtual rat (RAT).

Investigation of nerve stimulation; effect of norepinephrine and acetylcholine.

Practices to explain:

14. Characterization of smooth muscle activity of isolated small intestine

15. Examination of the isolated fish heart preparation: effect of altered temperature and extrasystole, Stannius ligatures

* The concentrations or the concentration ranges will be given. (The student evaluates up to 2 tasks picked by the examiner from the list below)

12. Function and pharmacology of the neuromuscular junction (NMJ)

The student evaluates up to 2 tasks picked by the examiner.

A. The effect of altered stimulating parameters.

1.) Make a schematic drawing about the simulated experimental setup.

2.) Stimulate the muscle for 1 ms with a 1 nA current then increase the current stepwise (1 nA steps) until you reach the threshold! Continue increasing the current by 5 more steps!

3.) Stimulate the muscle for 3 ms, increasing stepwise the current intensity (by 1 nA)!

Construct a graph by drawing the amplitude of the electrotonic membrane potential as a function of current intensity with 1 ms and 3 ms duration on a millimeter paper!

Explain the graphs, and the differences upon using different stimulation parameters.

B. Effect of different drugs

Stimulating parameters (10 nA, 2 ms)

1.) Apply tubocurarine in the range of 10^{-7} M and 10^{-6} M changing the concentration in small steps! Notice and compare the shape change of the electrical response during direct (muscle) and indirect (nerve) stimulation!

2.) Add 3,4-aminopiridine (K^+ channel inhibitor) and change its concentration in the 10^{-7} M and 10^{-4} M range in 6-8 steps! In the first series apply direct, then indirect electrical stimulation!

3.) Add tetrodotoxin in the range of 10^{-8} M and 10^{-6} M! Notice and compare the shape change of the electrical response during direct (muscle) and indirect (nerve) stimulation!

Explain the results. Why are the results different when using either direct or indirect stimulation?

4.) Reduce the extracellular [K^+] stepwise to 2 mM then increase it from 5 mM to 9 mM in 1 mM steps! Note the reversal potential of the ion in each case (the value appears in the ions window)! In the first series apply indirect stimulation, then direct stimulation!

Notice the shape change of the electrical response! In the case of direct stimulation measure and construct a graph about the time necessary for the recovery of the membrane potential from the top of the AP (to the resting potential)!

13. Studies on circulatory reactions of a virtual rat (RAT)

The student evaluates up to 2 tasks picked by the examiner.

A. Investigation of nerve stimulation:

Choose the pithed rat and start the recording! After one perpendicular division (in the program 400 sec.) stimulate a.) the sympathetic nerve (except adrenals), b.) after 3 divisions stimulate the cardiac plexus, c.) after another 3 divisions stimulate the sympathetic fibers innervating the adrenal medulla!

Which intervention resulted in the highest and the lowest increase of the arterial blood pressure, respectively? Please explain why.

Which effect passed off the most slowly? Why?

What is the explanation of changes in the central venous pressure?

B. Effect of norepinephrine:

1.) Start the recording in pithed animal! Give 10 μg/kg norepinephrine at the end of the first division! After 2 divisions give 100 μg/kg norepinephrine! After another two divisions give 10 mg/kg prazosin and then again after 2 divisions 50 mg/kg propranolol!

How is the effect dependent on the dose of norepinephrine?

Which parameter(s) decreased following prazosin administration? Why?

Which parameter(s) changed when the animal got propranolol, as well? Why?

2.) Repeat the study on normal (intact cardiovascular regulation) animal!
Compare the results to those got in pithed animal! Explain the differences!

C. Effect of acetylcholine:

Start the recording on pithed animal! Following the first division give 10 μg/kg acetylcholine and after the next division add 100 μg/kg acetylcholine. After two further divisions add 0.2 mg/kg atropine! Following another division repeat the administration of the two acetylcholine doses!

Explain the drop in the arterial and the increase in central venous pressure detected following
acetylcholine administration!

How and why did the administration of atropine change the arterial blood pressure?

Which observation proves that atropine is a competitive antagonist of the acetylcholine receptors?