Action potential

different tissues

**Laboratory exercise and seminar in medical physiology**

Student protocol

Student:

Teacher:

Date:

**Action potential (NMJ - neuromuscular junction)**

**1. Education program NMJ**

***Task A***

Determine the threshold intensity of the depolarizing current to evoke a typical physiological action potential at a stimulus duration of 1 ms.

**Threshold:**

***Task B***

At a stimulus amplitude of 17 nA, change its duration to 0.5 ms.

***How has AP changed?***

***Explain the observed phenomenon.***

***Task C***

Vary the concentration of K+ in the perfusate (3, 5 and 8 mM/L). Read the value of the resting membrane potential and determine the threshold intensity of the stimulus for eliciting an AP. Keep the stimulation time at 1 ms. Explain the relationship between extracellular potassium concentration and muscle fiber excitability.

**Complete the table.** Also write down the results of calculations from home preparation.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Extracellular concentration of K+ (mmol/l)** | **Equilibrium potential for K+, calculation from home preparation (mV)** | **Threshold stimulus intensity (nA)** | **RMP (mV)** | **Muscle fiber excitability (major and minor)** |
| 3 (hypokalemia) |  |  |  |  |
| 5 (normal ) |  |  |  | „normal“ |
| 8 (hyperkalemia) |  |  |  |  |

***Task D***

Don't forget to return the K+ concentration in the washing solution to normal after the previous experiment!!!

In the following experiments, use a stimulation stimulus with an intensity of 15 nA and a duration of 1 ms.

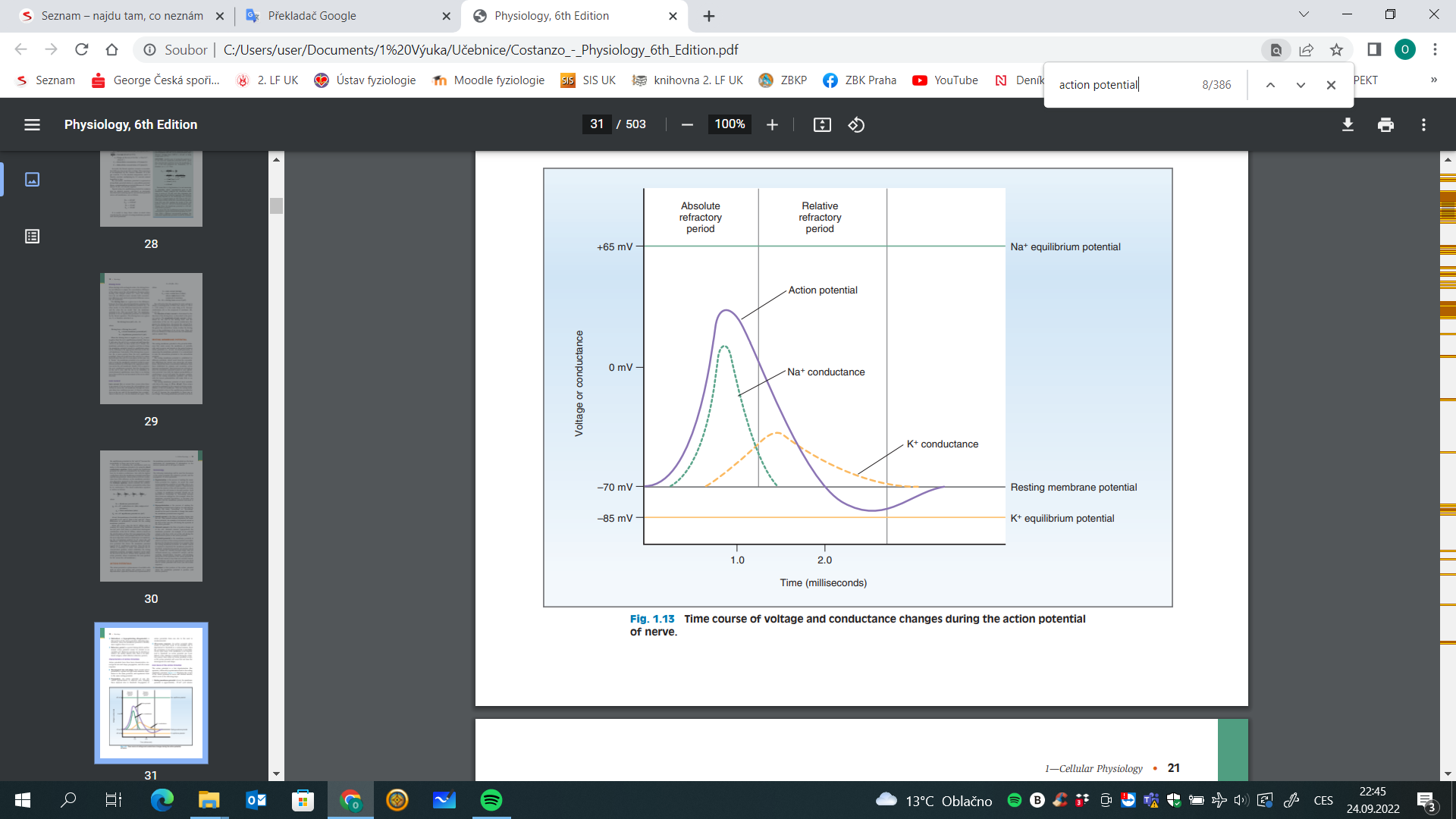
***Describe and explain the effect of tetrodotoxin (blocker of voltage-gated Na+ channels)*** at 1mM concentration. Explain its effect on the action potential.

***Describe the effect of 3,4-diaminopyridine (voltage-dependent K+ channel blocker)***, which you apply at a dose of 1 mM. Explain its effect on the action potential.

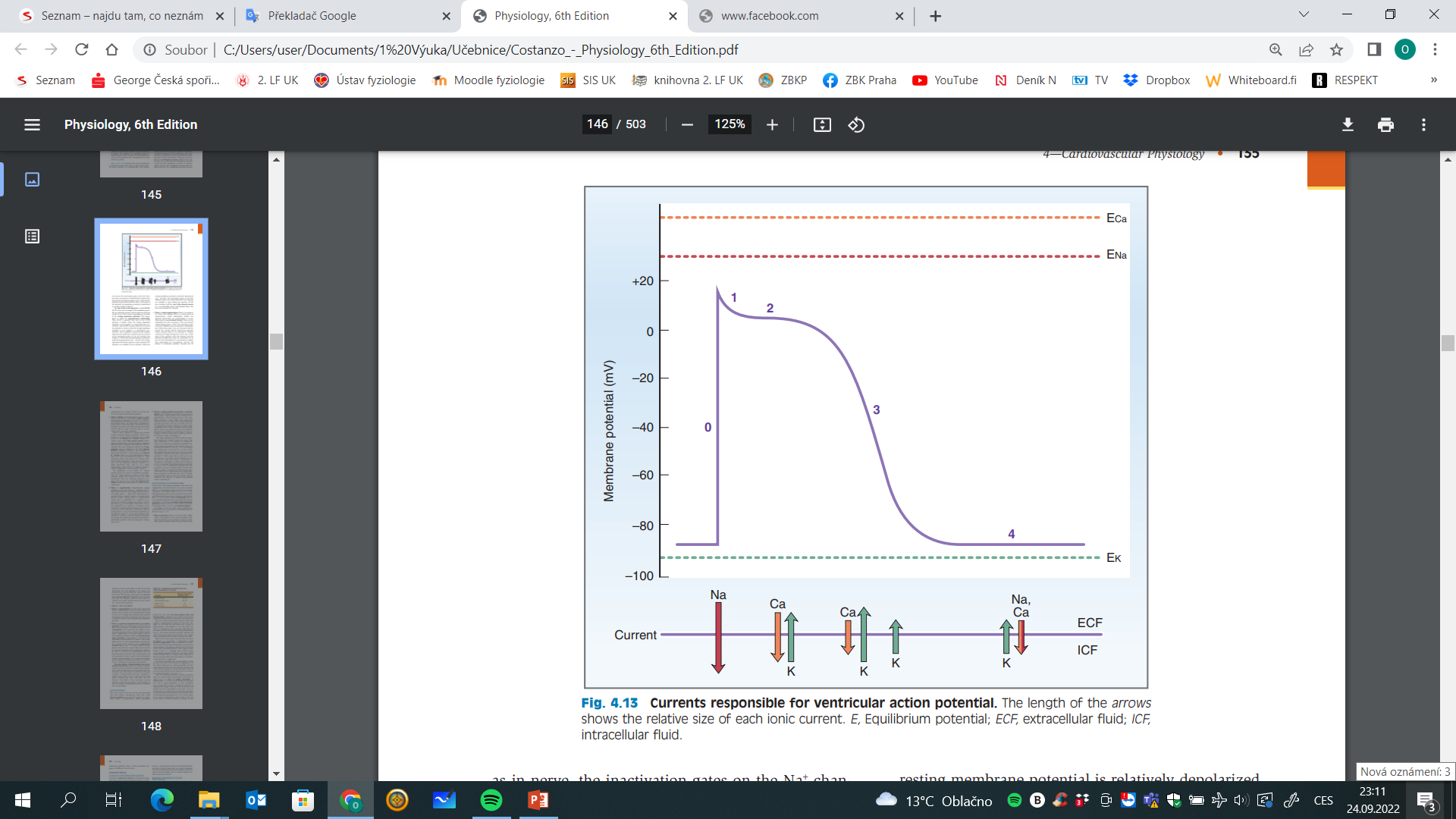
|  |  |
| --- | --- |
| **AP sketch under the influence of**  **3,4 diaminopyridine and TTX:** | **Explanation:** |

**2. Absolute and relative refractory period (ARP, RRP)**

***Mark ARP, RRP in both graphs.***



AP axon of a nerve cell



AP cardiomyocyte Images taken from Constanzo: Physiology.