

Schémata a animace zpracovalo

Servisní středisko pro e-learning na MU

CZ.1.07/2.2.00/28.0041

Centrum interaktivních a multimediálních studijních opor pro inovaci výuky a efektivní učení

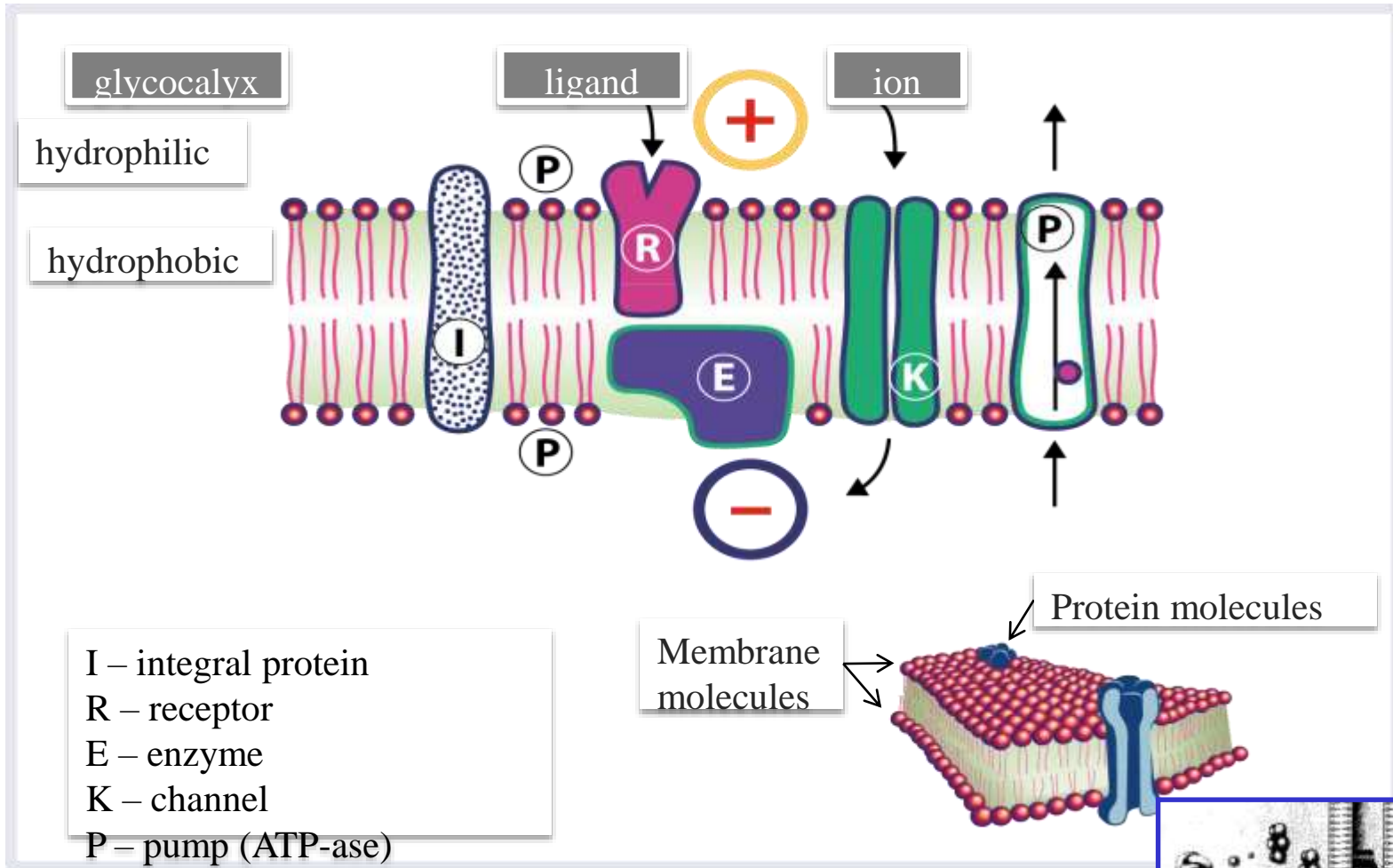


INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

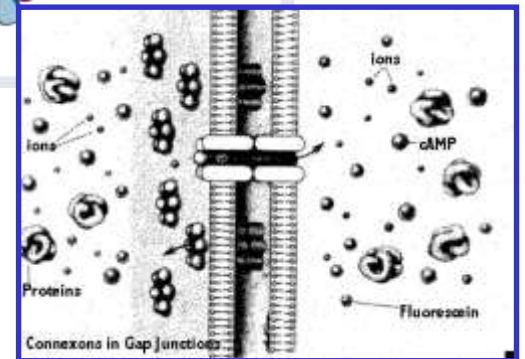
MEMBRANE OF EXCITABLE CELL

ELECTRICAL TRANSMISSION OF INFORMATION

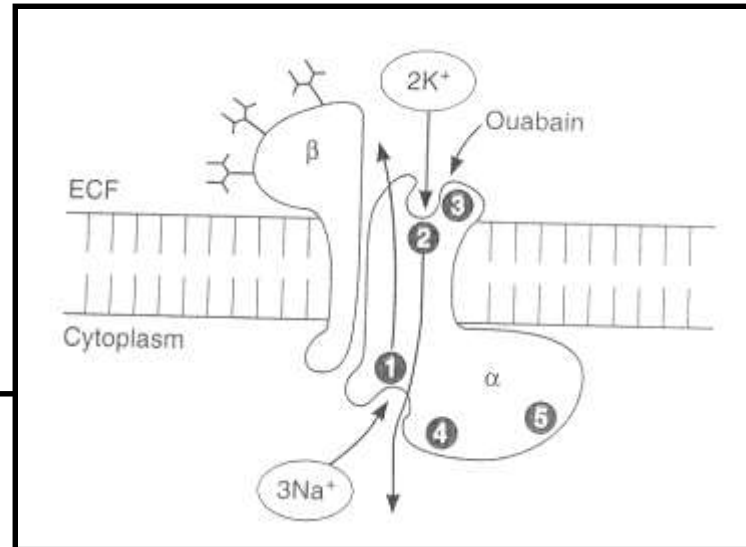
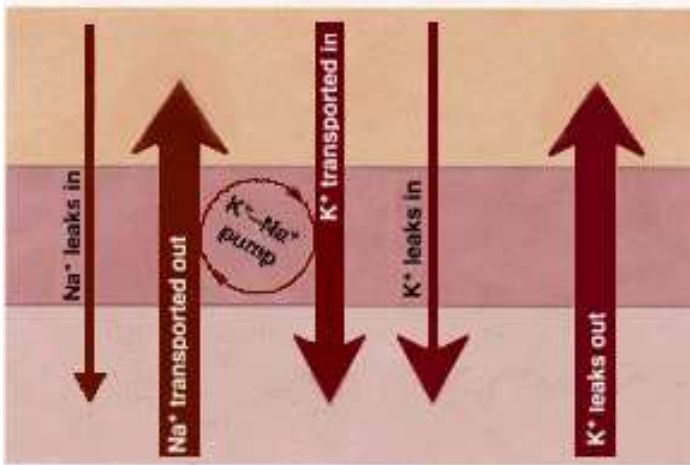
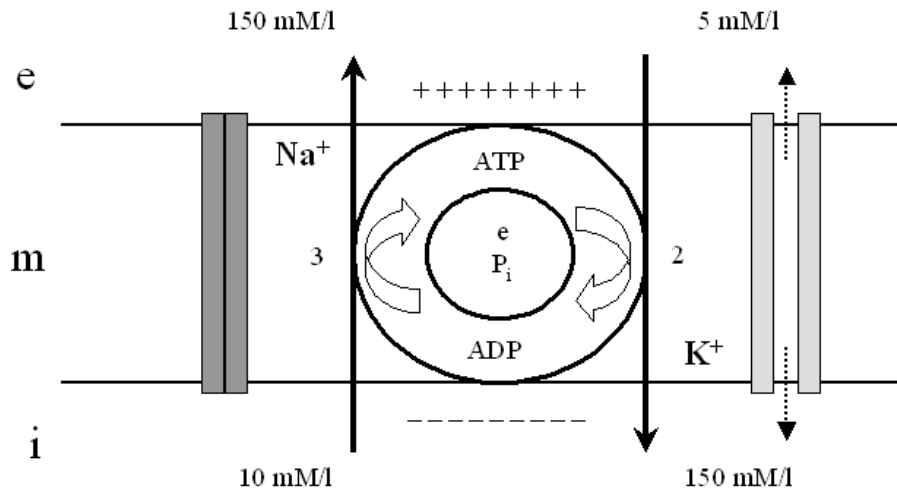
PLASMATIC MEMBRANE



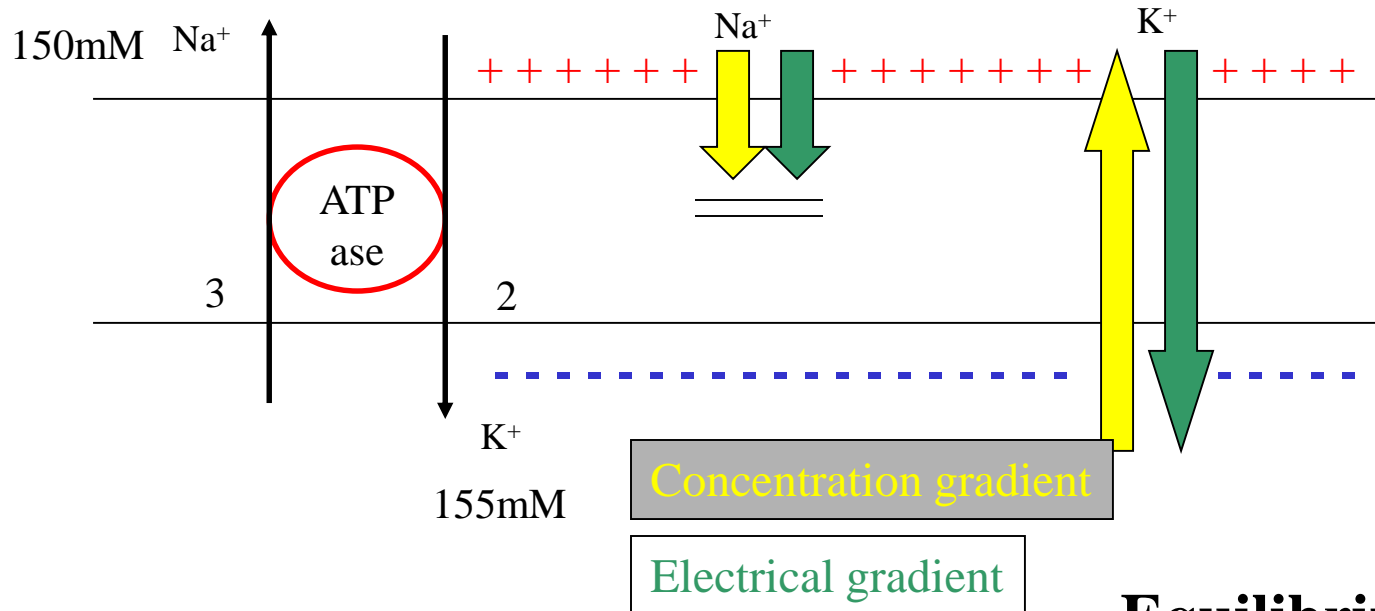
Nexus (gap junction) →



SODIUM-POTASSIUM PUMP



RESTING MEMBRANE VOLTAGE



Nernst equation:

$$E_x = \frac{R \cdot T}{F} \ln \frac{(C_{x_{out}})}{(C_{x_{in}})}$$

$$I_x = g_x \cdot (E - E_x)$$

Equilibrium potential

$$E_{Na} = +40 \text{ mV}$$

$$E_K = -90 \text{ mV}$$

$$E_{Cl} = -70 \text{ mV}$$

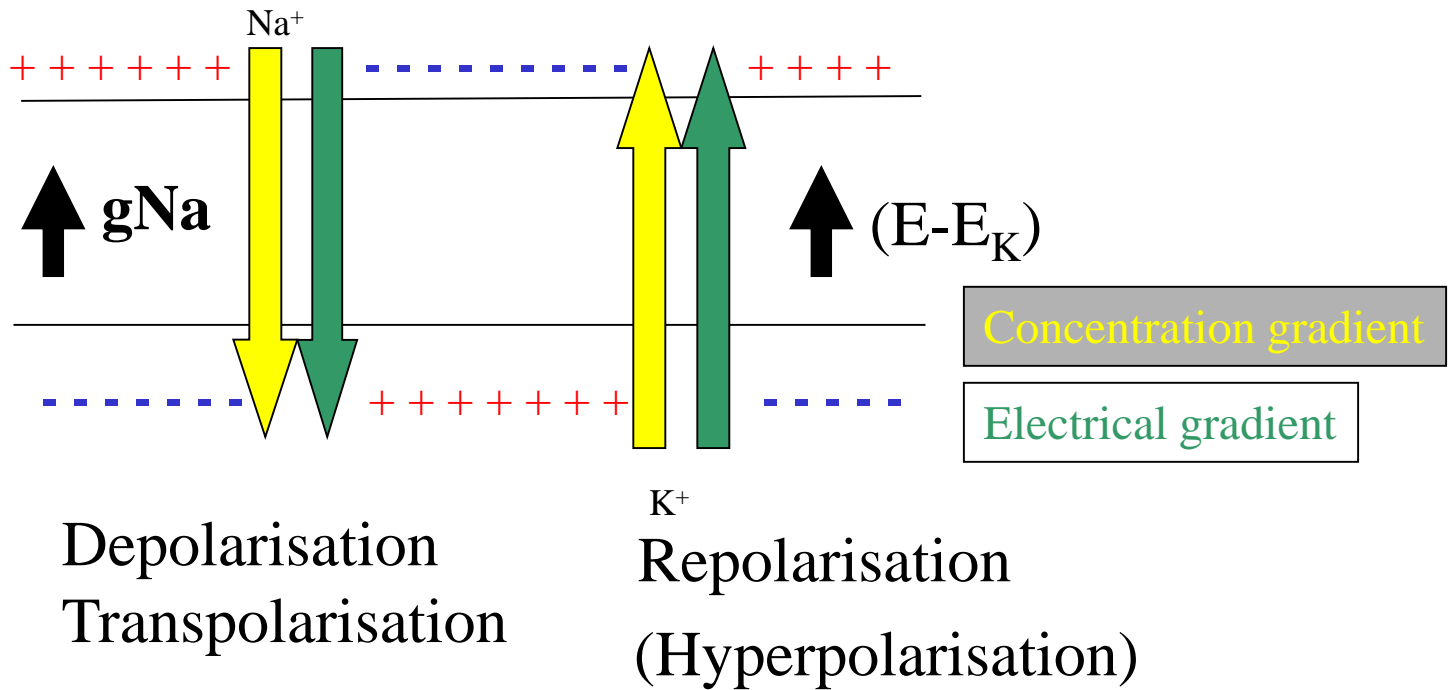
$$E_{Ca} = +60 \text{ mV}$$

$$E_r = -85 \text{ mV}$$

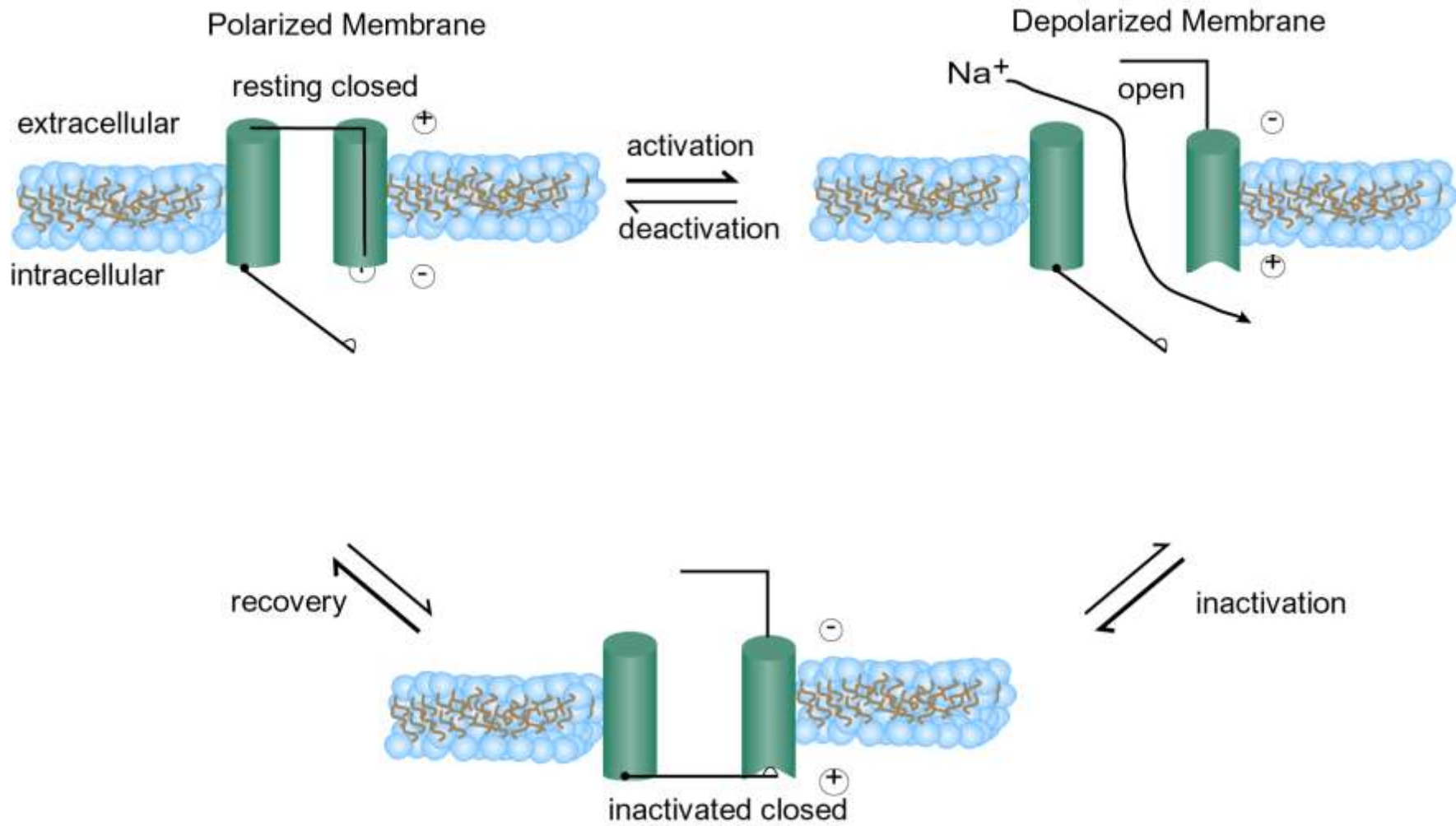
I – current, E – voltage, g – specific voltage and time-dependent conductance

- **RESTING MEMBRANE POTENTIAL IS A CONDITION OF EXCITABILITY**
- **IT DEPENDS ON HIGH RESTING MEMBRANE CONDUCTIVITY FOR POTASSIUM**

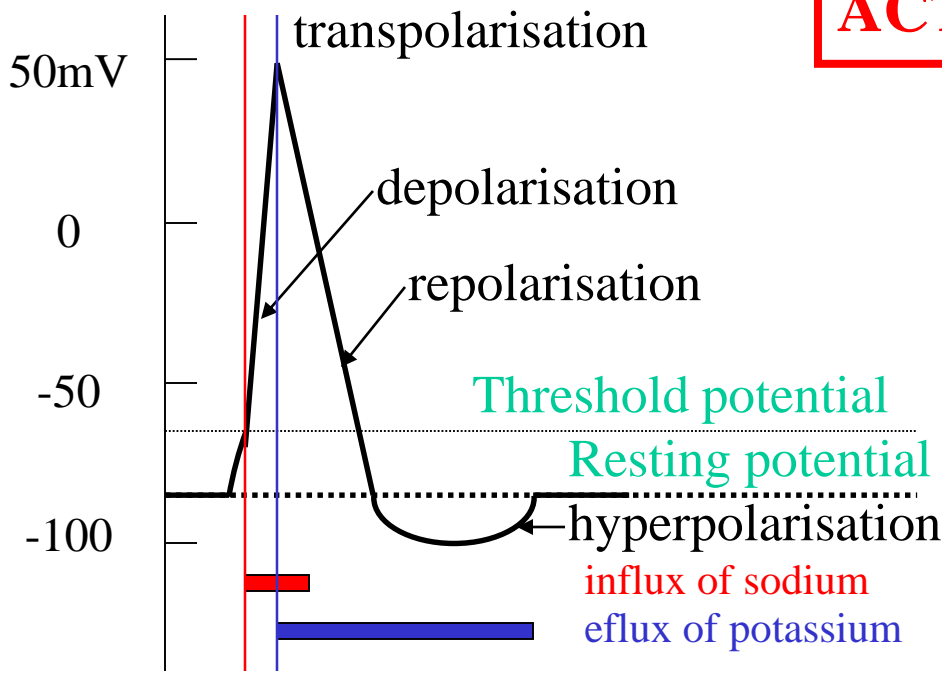
ACTION POTENTIAL



**ACTION POTENTIAL IS A PROPAGATED
ELECTRICAL SIGNAL GENERATED BY FAST
SODIUM CURRENT INTO THE CELL**

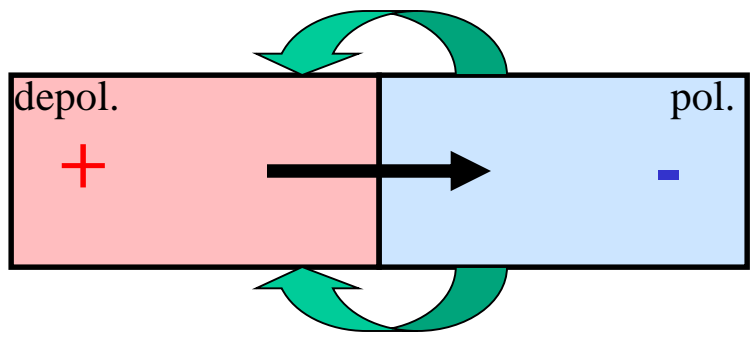


ACTION POTENTIAL

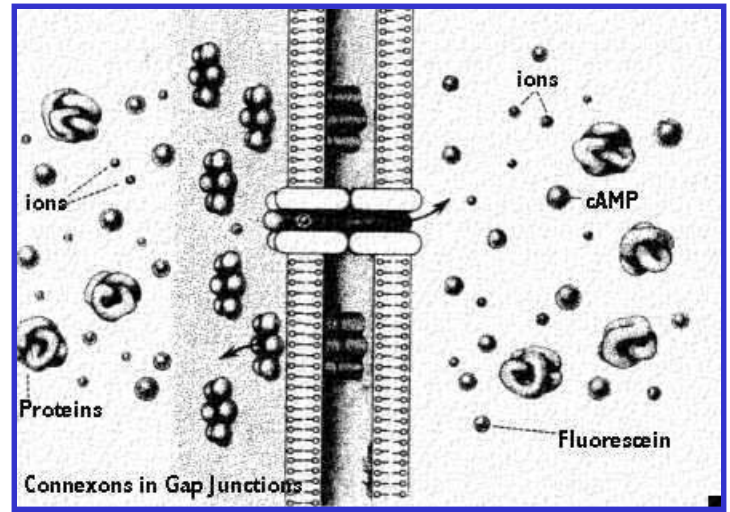


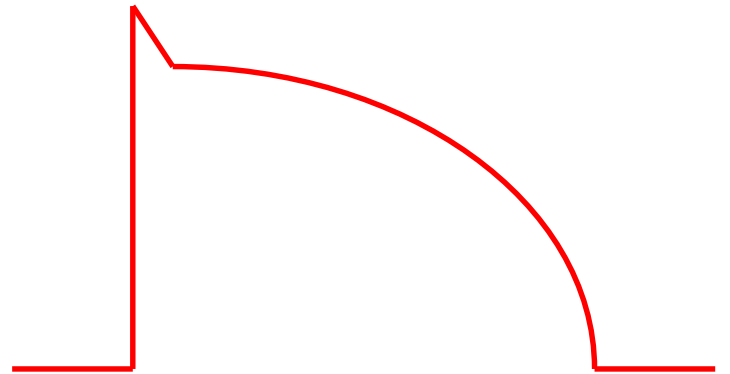
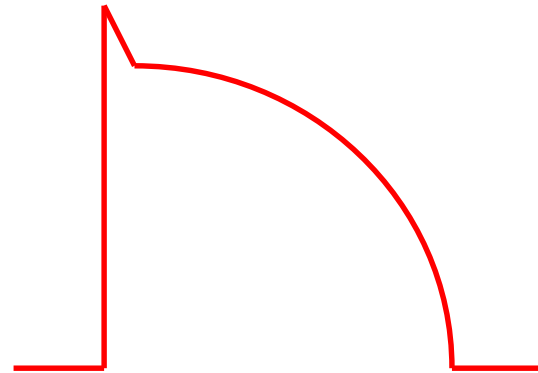
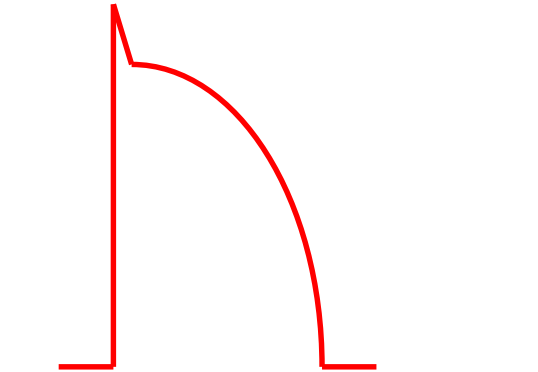
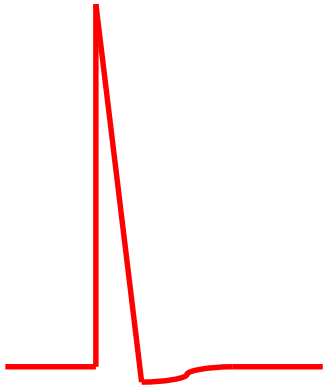
- Unit of excitation activity
- „All or nothing“ response
- Propagation without decrement („domino effect“)
- **Refractery**

Local current



Propagation with decrement





Velocity of excitation propagation (depolarisation front) is a function of:

- Intensity of local currents
- Resistance outside the conductor (myelin)
- Resistance of the conductor (indirect relationship)

Nodes of Ranvier, saltatory conduction

Neuron

input section
(coding of inf.)

transmission section
(transmission of inf.)

output section
(decoding of inf.)



SYNAPSES

- excitatory
- inhibitory

Action potential
Calcium ions

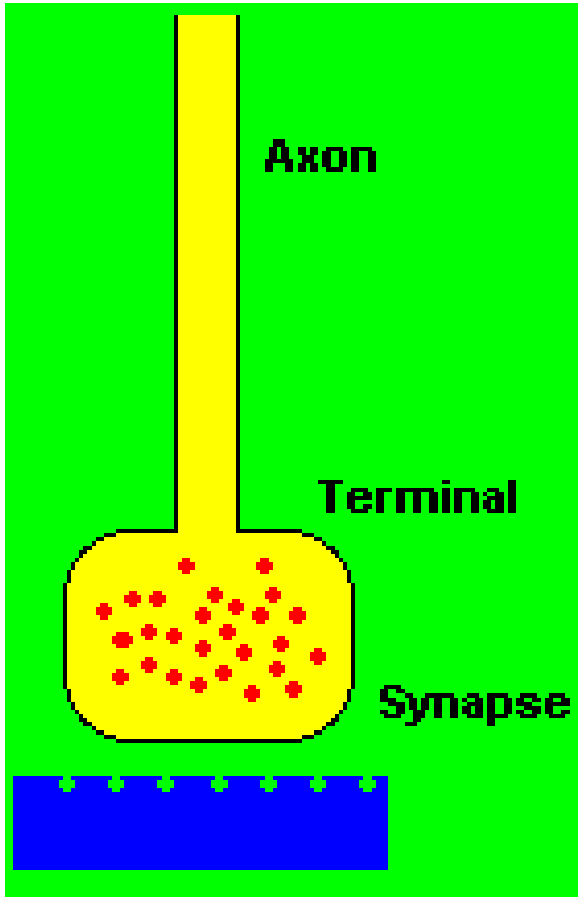
Synaptic vesicles (exocytose)

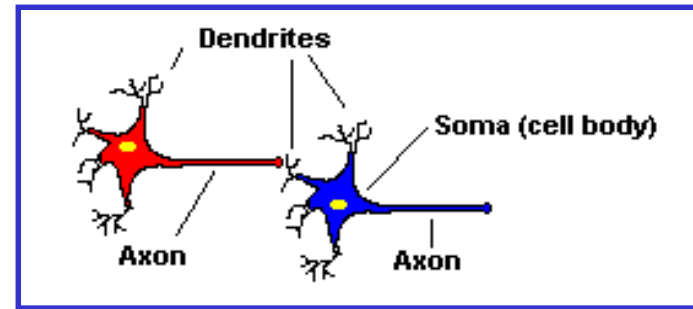
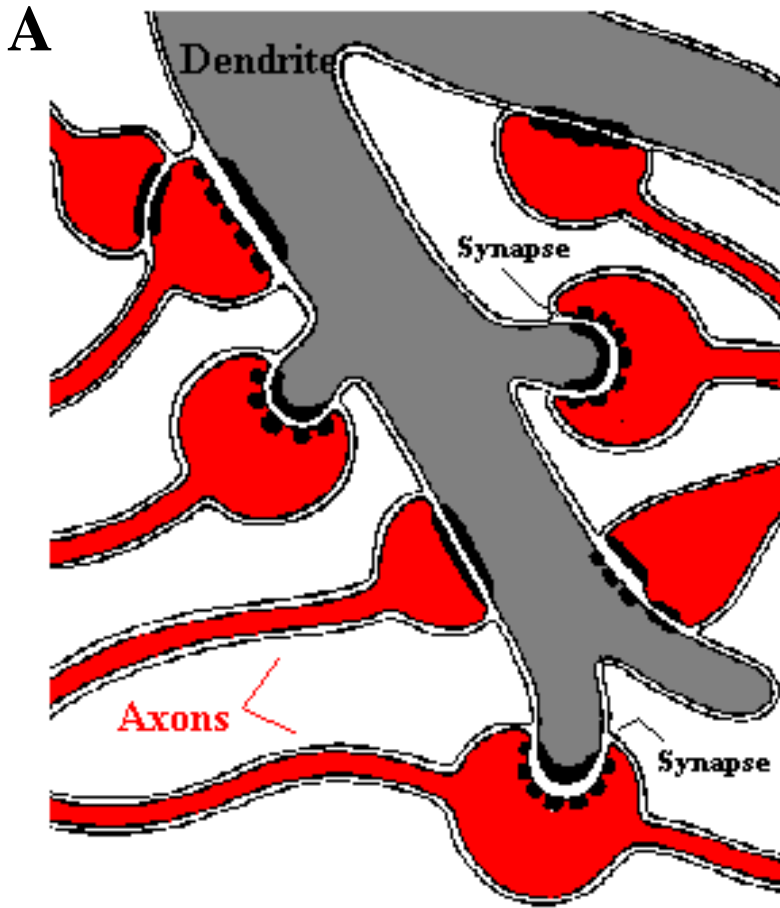
Neurotransmitter (mediator)

Presynaptic membrane

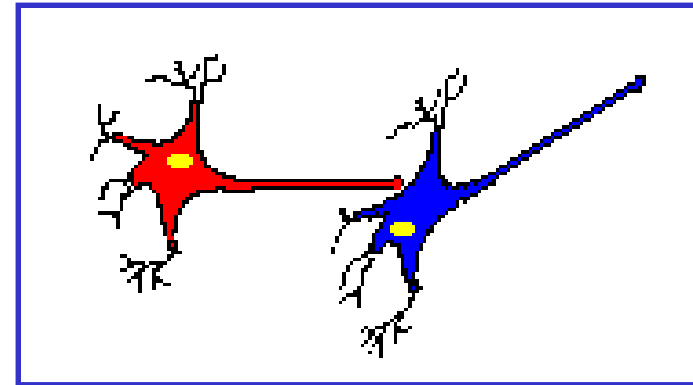
Synaptic cleft

Postsynaptic membrane
(local change of voltage)

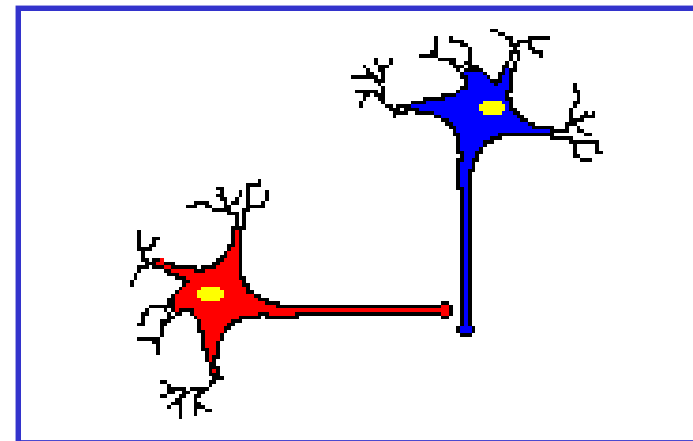




A



B



C

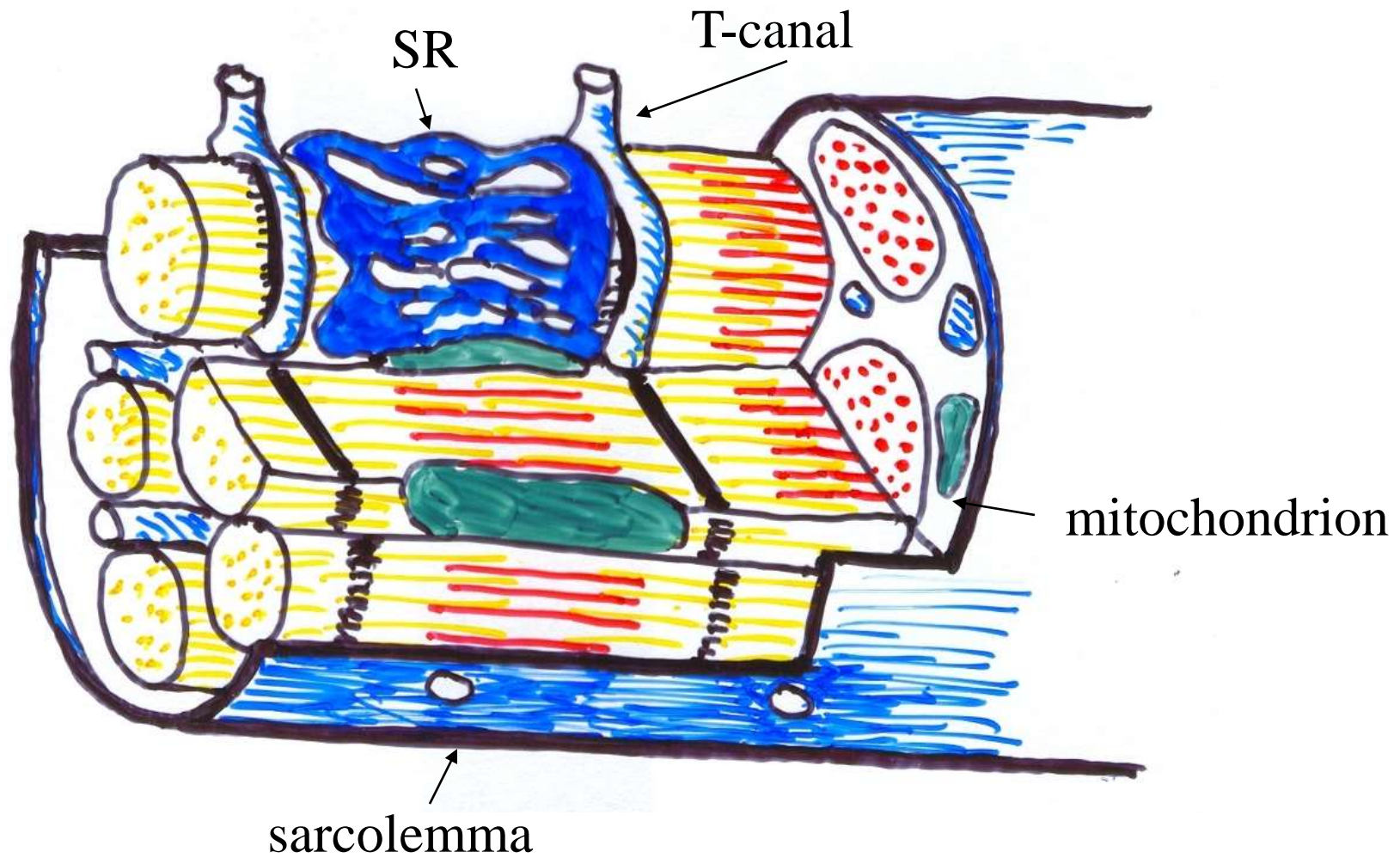
SYNAPSIS:

A – axodendritic

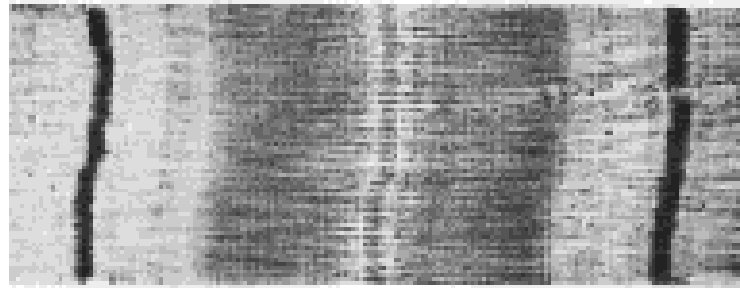
B – axosomatic

C - axoaxonal

MUSCLE: striated, heart, smooth
MYOFIBRILE



Sarcomere



Z line

Z line

Thin filaments

actin

Thick filaments

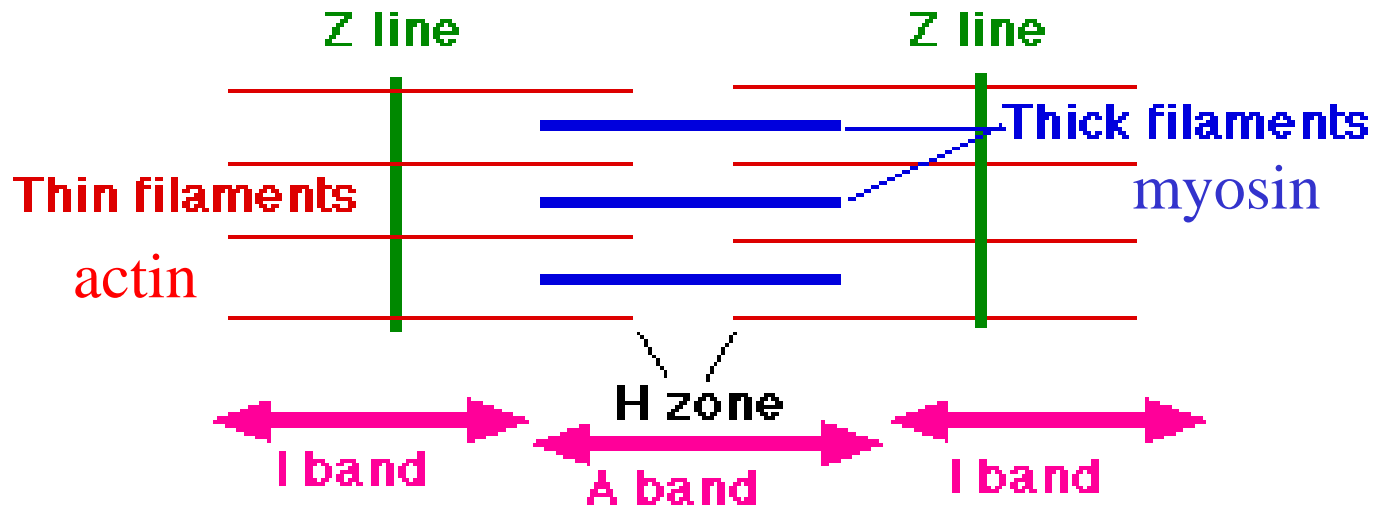
myosin

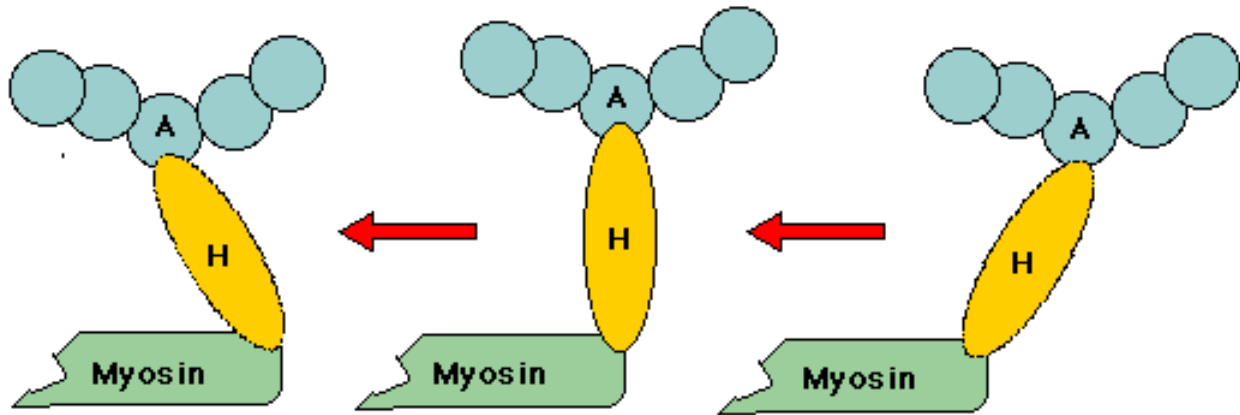
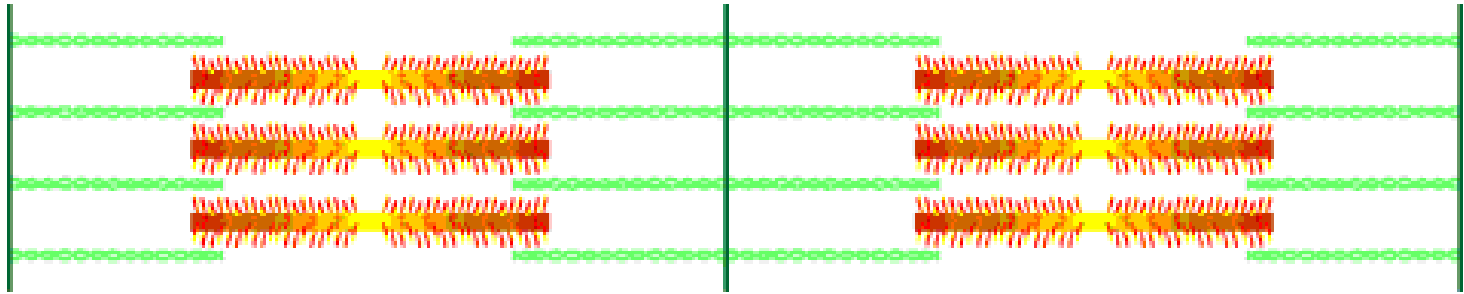
H zone

I band

A band

I band





Stavba a funkce

	hladký sval	srdeční sval (příčně pruhovaný)	kosterní sval (příčně pruhovaný)
motorická ploténka	žádná	žádná	ano
vlákna	fuziformní, krátká (max. 0,2 mm)	větvená	cyklindrická, dlouhá (max. 15 cm)
mitochondrie	nečetné	četné	nečetné (v závislosti na typu svalu)
buněčné jádro/vláknko	1	1	četná
sarkomera	žádná	ano, délka max. 2,6 μm	ano, délka max. 3,65 μm
elektrické spřažení	částečně (jednotkový typ)	ano (funkční syncytium)	ne
sarkoplazmatické retikulum	málo vyvinuté	přiměřeně vyvinuté	silně vyvinuté
Ca ²⁺ -„spínač“	kalmodulin/kaldesmon	troponin	troponin
pacemaker	zčásti spontánně rytmicky činný (1 s ⁻¹ –1h ⁻¹)	ano (sinoatriální uzel asi 1 s ⁻¹)	ne (nutný nervový podnět)
odpověď na podnět	změna tonu nebo frekvence rytmu	„vše nebo nic“	odstupňovaná
tetanizovatelný	ano	ne	ano
pracovní rozsah	křivka délka/síla je proměnlivá	na vzestupu křivky síla/délka (viz tab. 2.15 E)	v maximu křivky síla/délka (viz tab. 2.15 E)

odpověď na podnět

potenciál —
napětí svalu —

