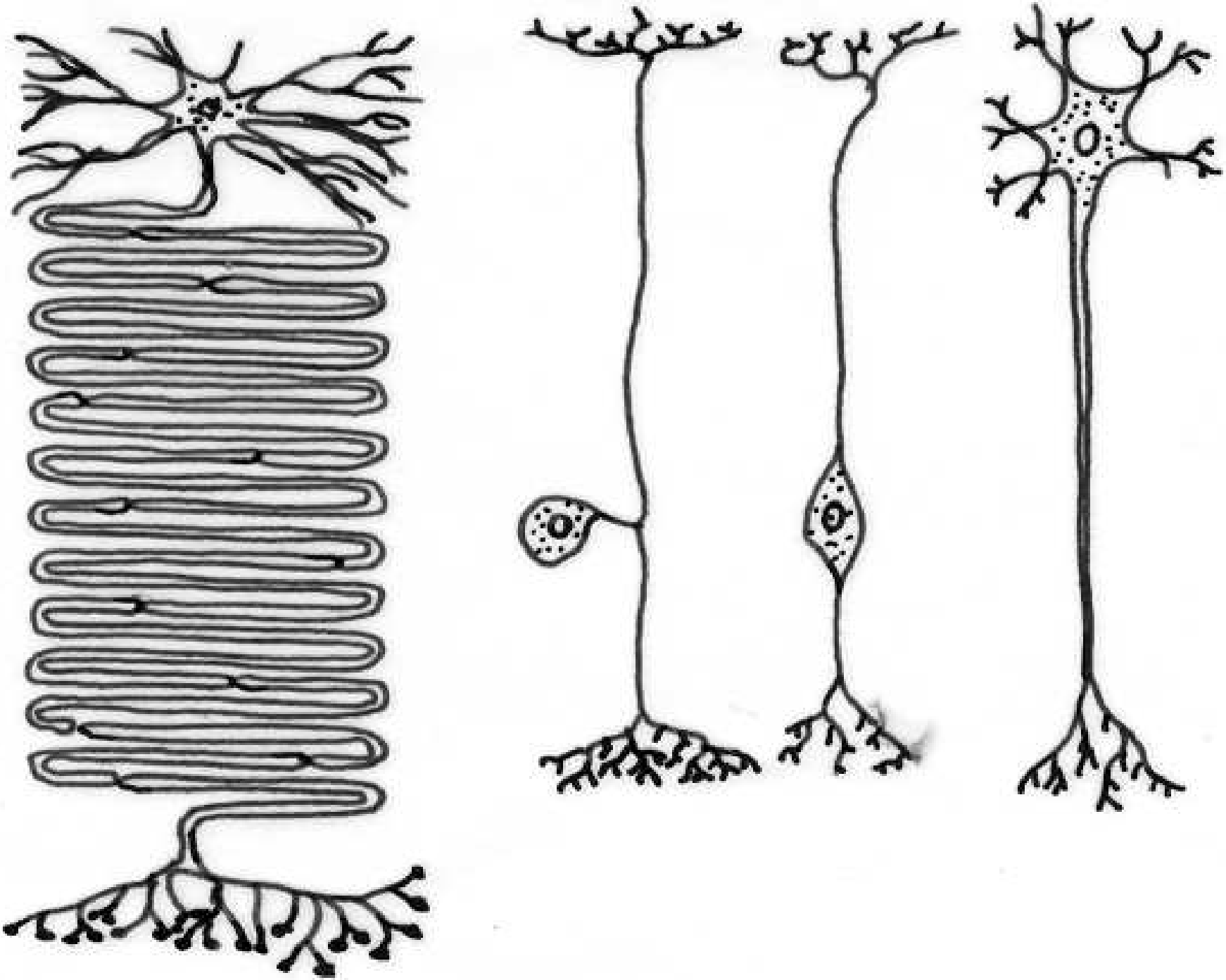
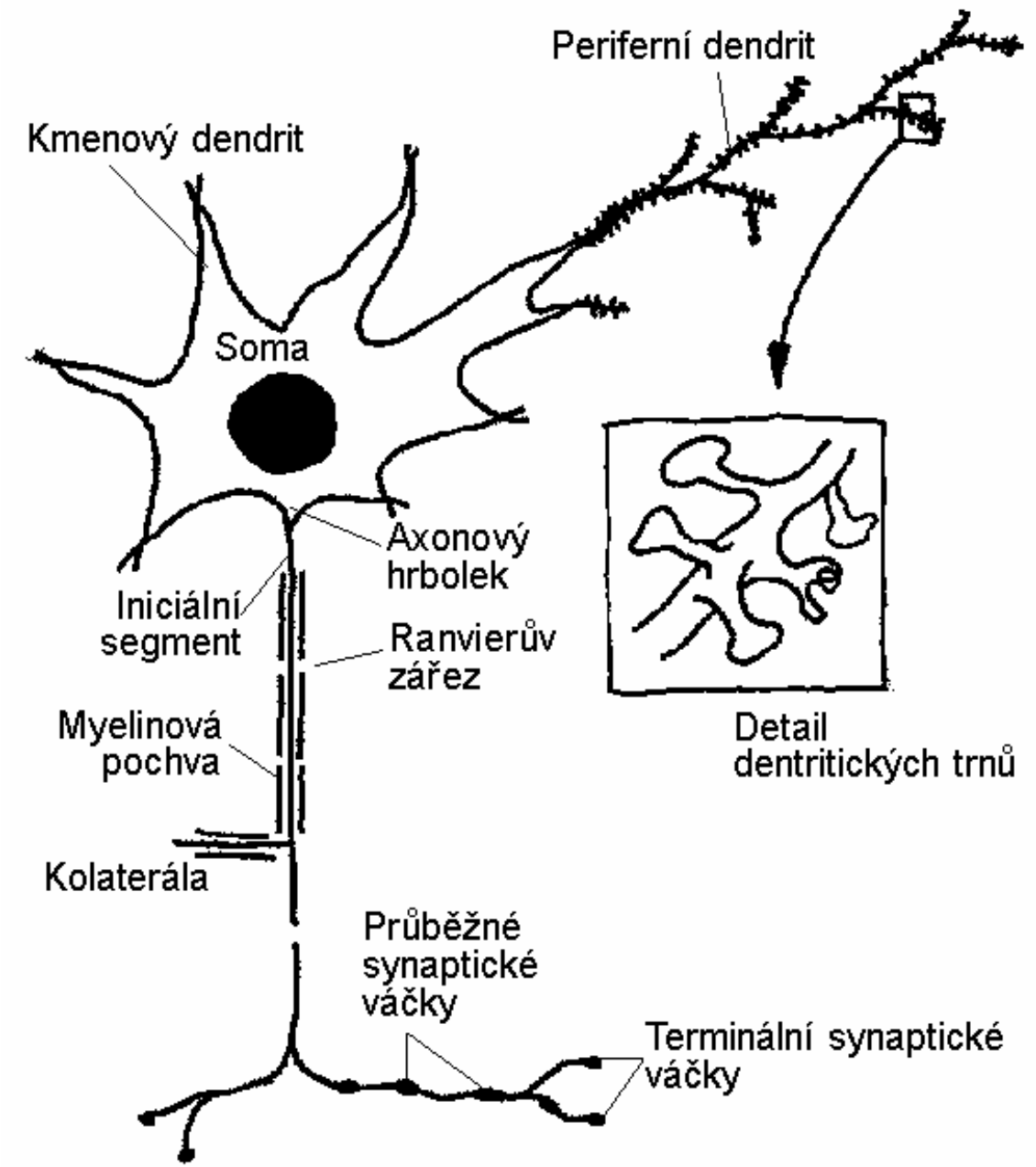
Obecná neurofyziologie




Periferní dendrit
Kmenový dendrit
Soma
Axonový hrbolek
Iniciální segment
Ranvierův zářez
Myelinová pochva
Kolaterála
Průběžné synaptické váčky
Terminální synaptické váčky
Detail dentritických trnů

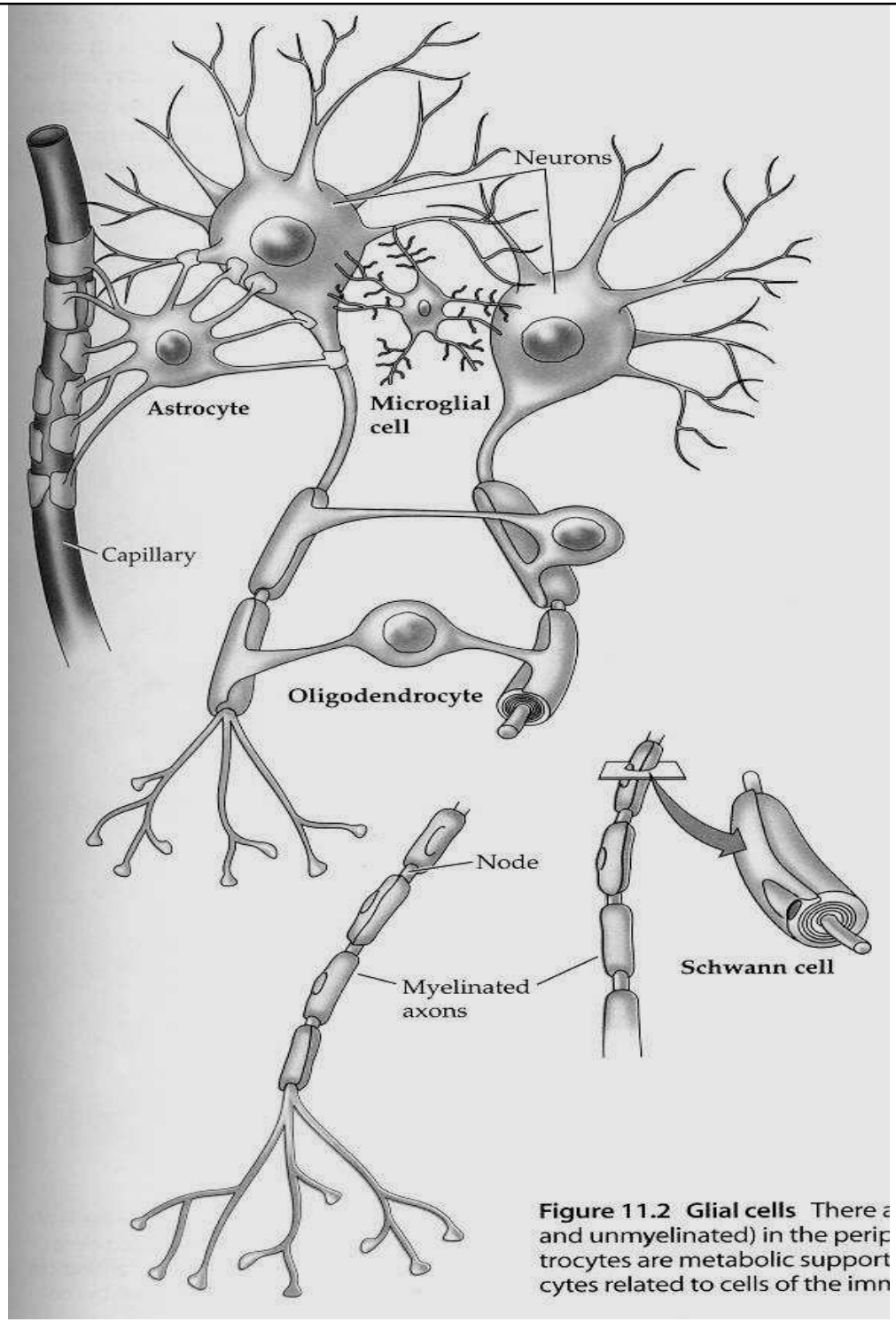
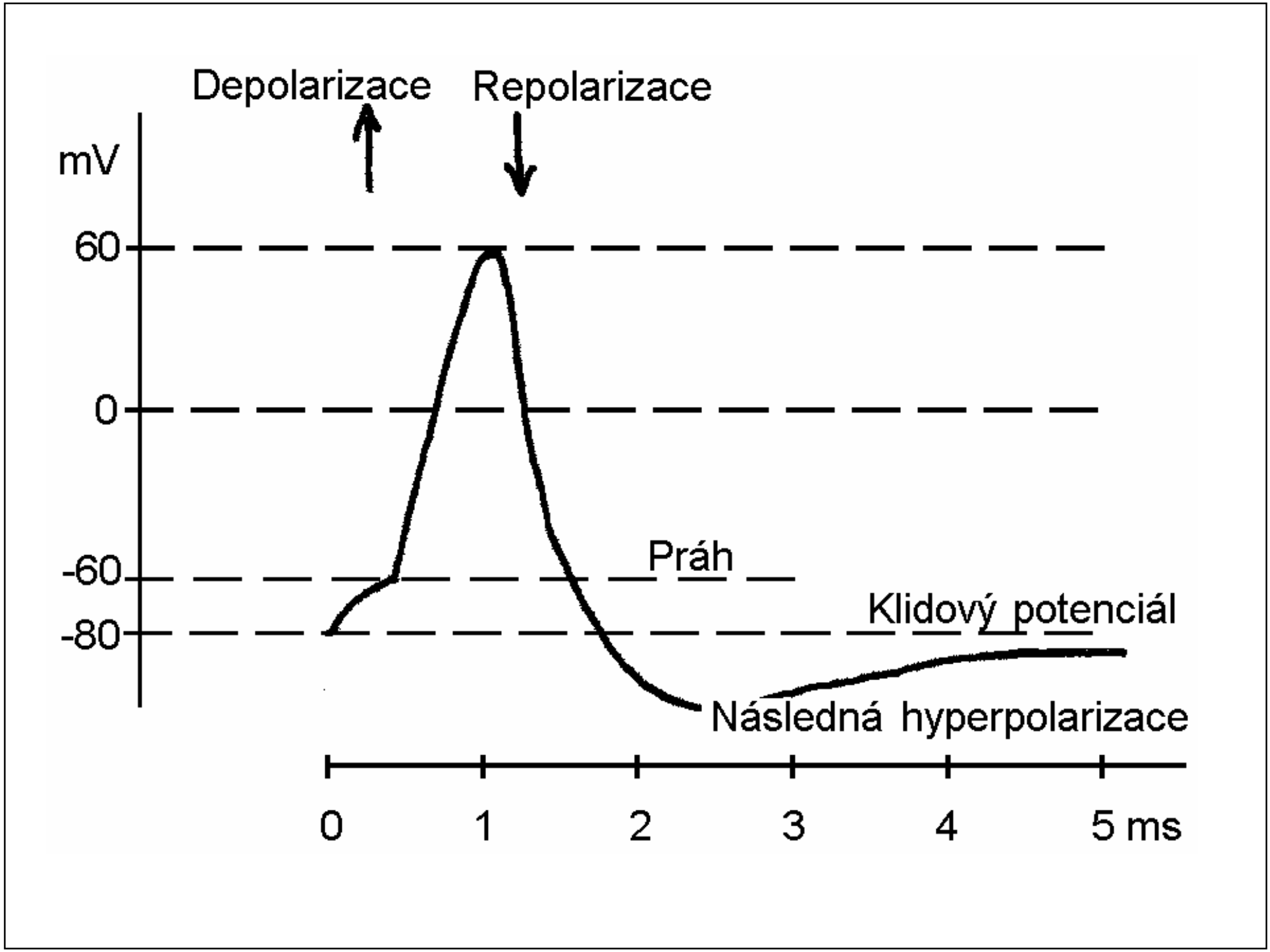
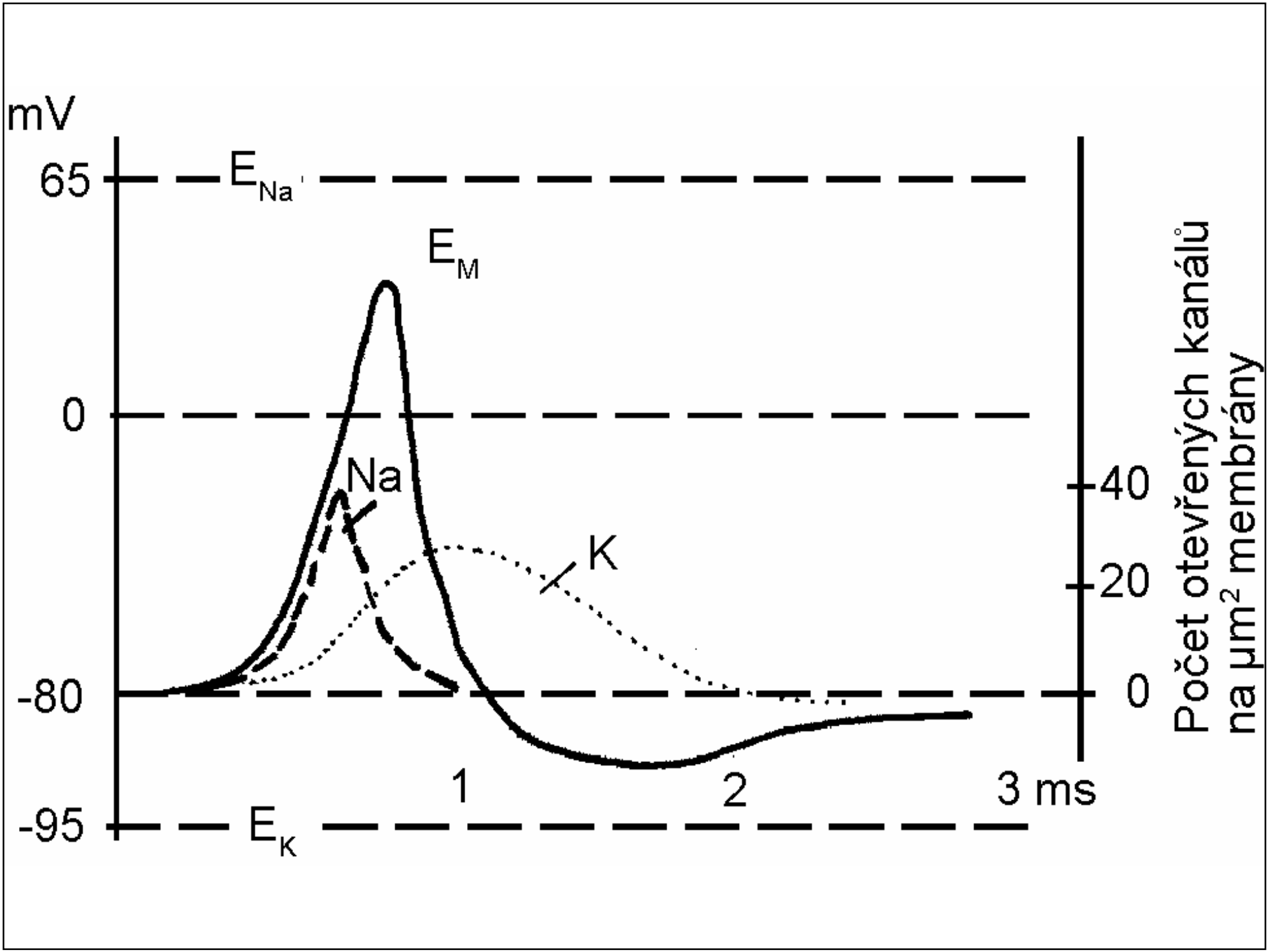
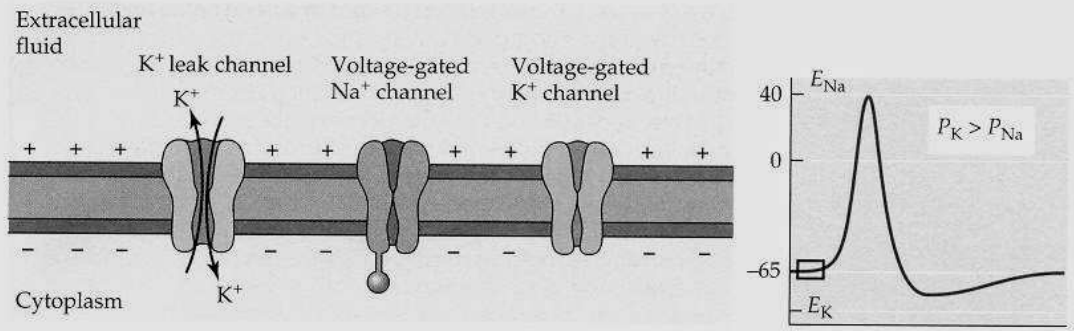


Figure 11.2 Glial cells There a
and unmyelinated) in the perip
trocytes are metabolic support
cytes related to cells of the imn

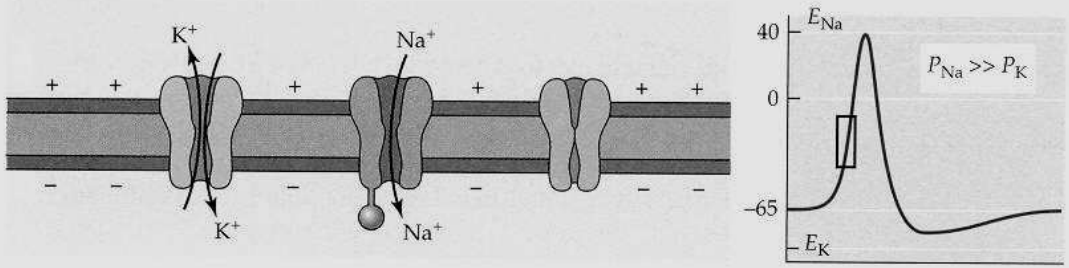

Depolarizace
Repolarizace
mV
60
0
-60
-80
Práh
Klidový potenciál
Následná hyperpolarizace
0
1
2
3
4
5 ms


mV
65
E_{Na}
E_M
0
Na
K
-80
-95
E_K
1
2
3 ms
40
20
0
Počet otevřených kanálů
na μm² membrány

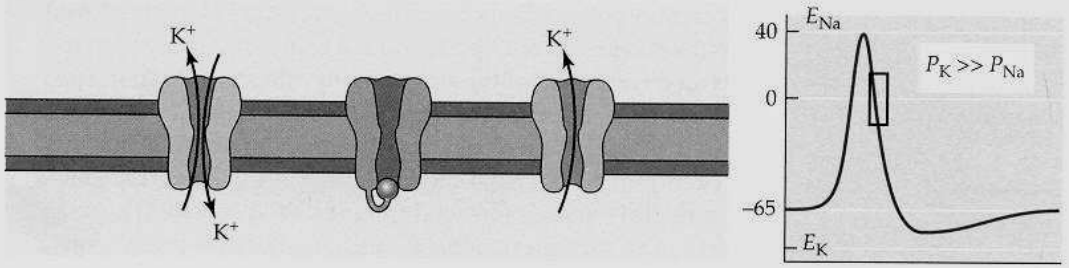
(a) Resting membrane potential



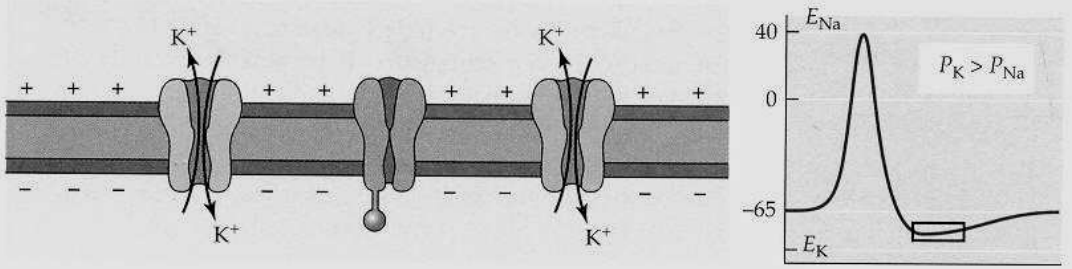
(b) Rising phase

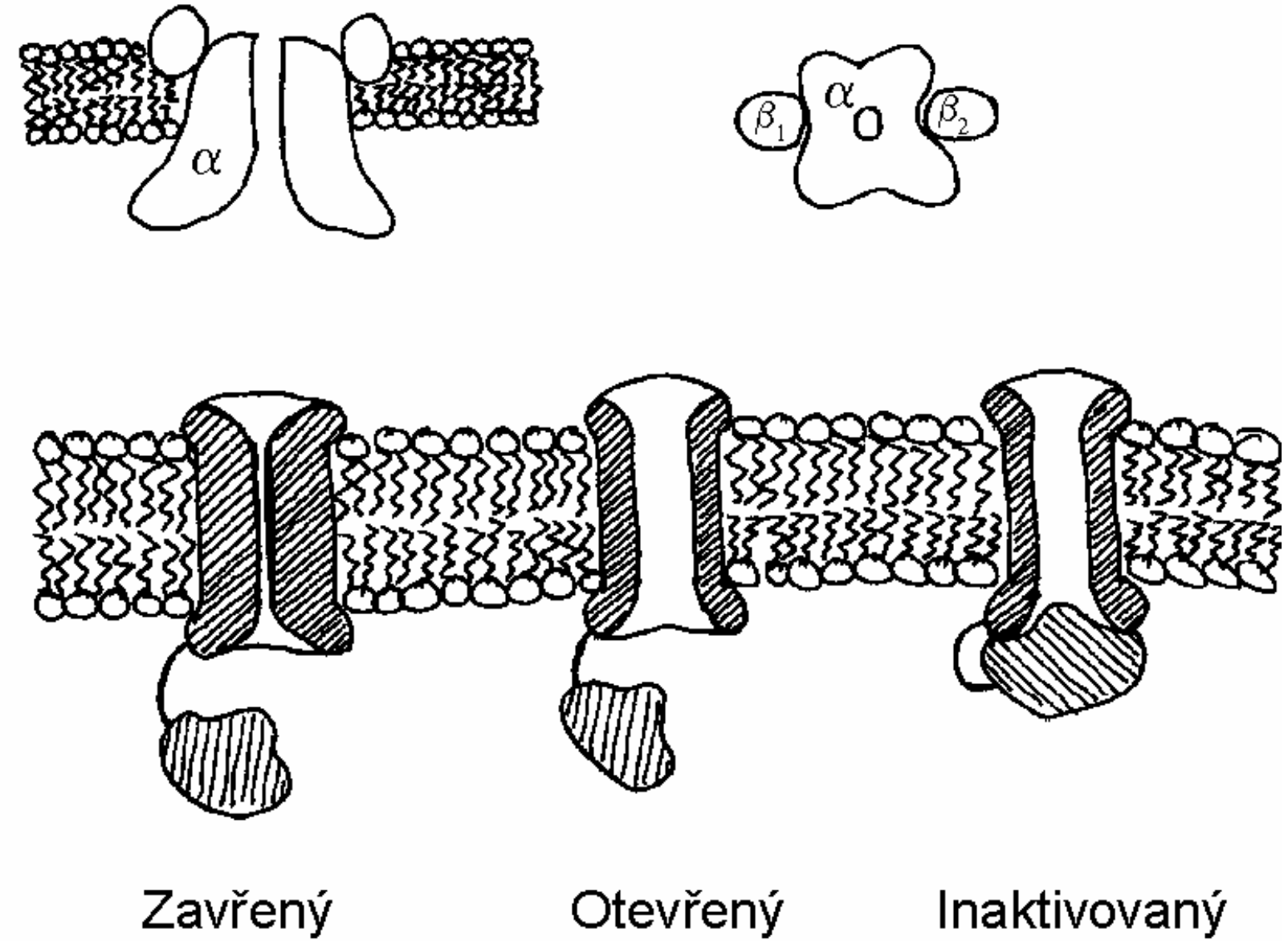


(c) Falling phase

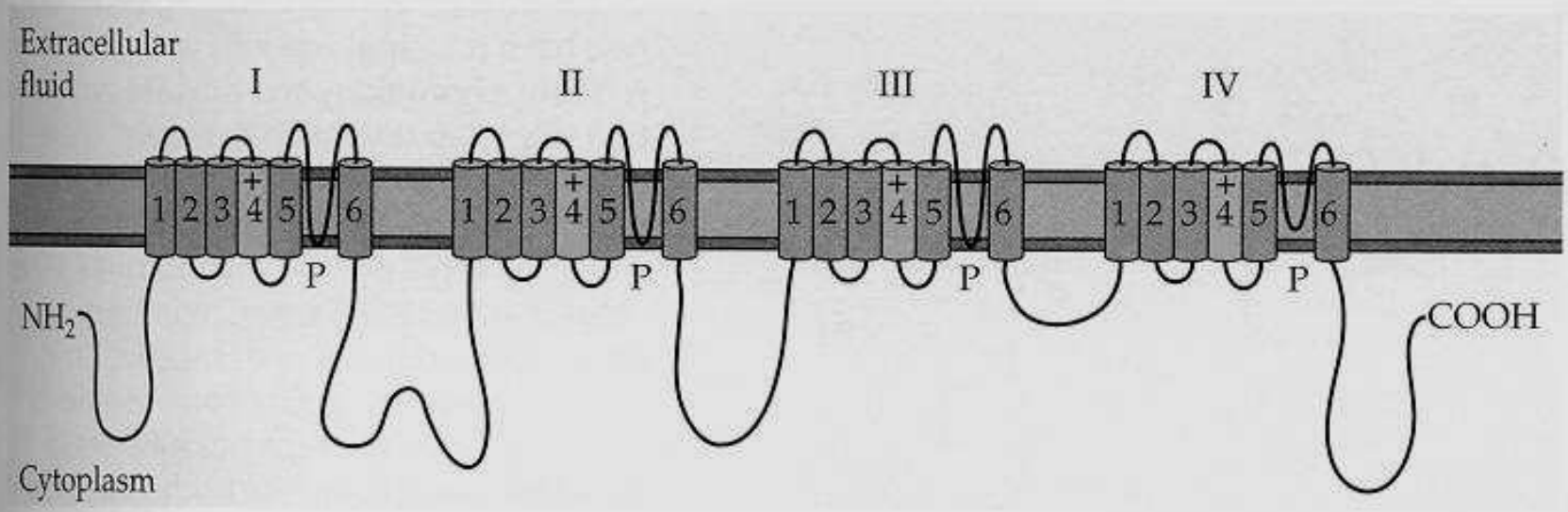


(d) Recovery

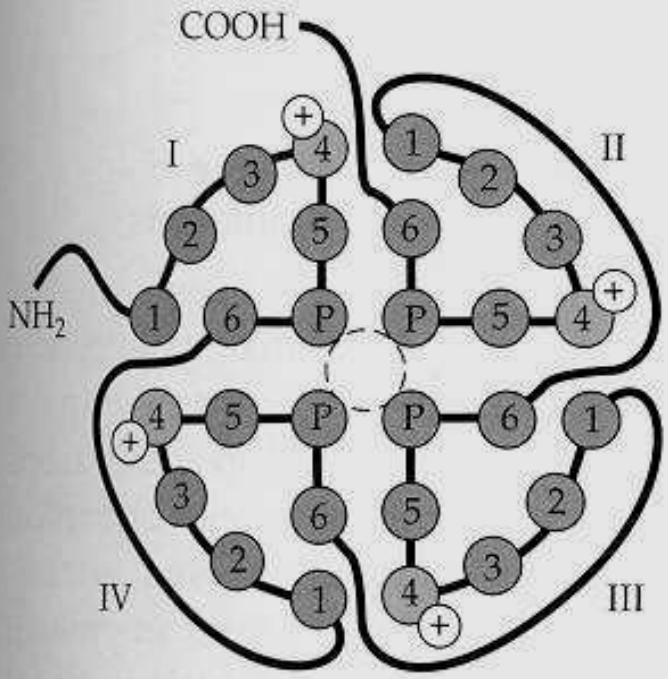



α
α
β1
β2
Zavřený
Otevřený
Inaktivovaný

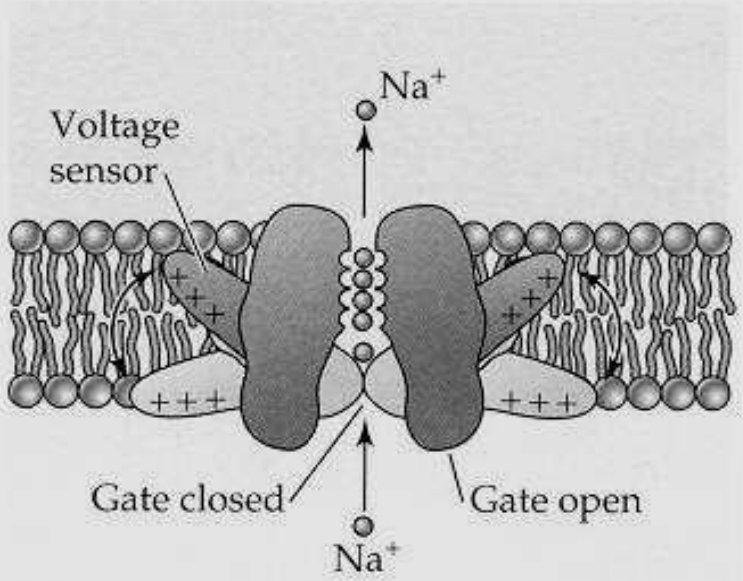
(a) Topology of voltage-gated Na^+ channels

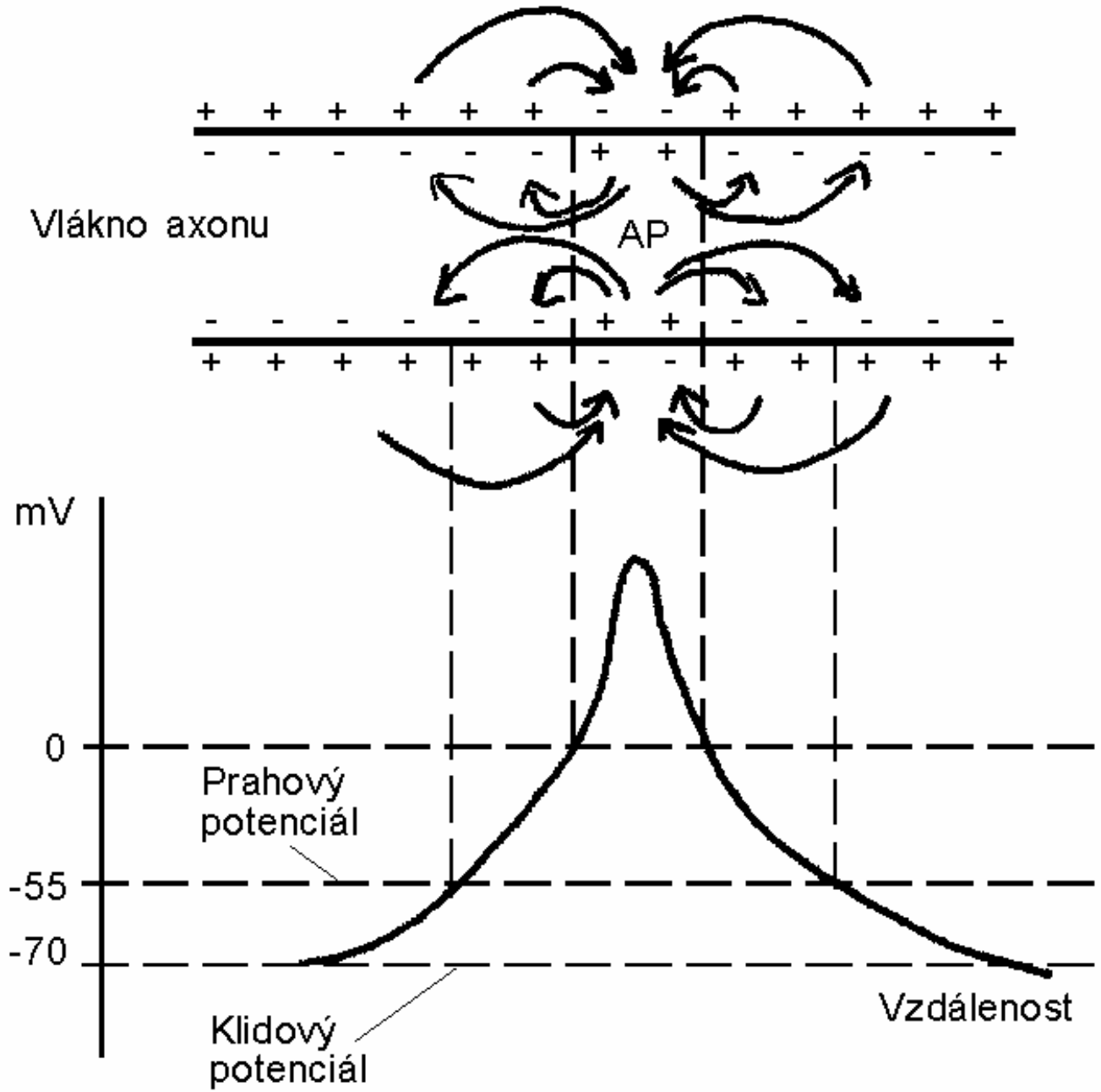


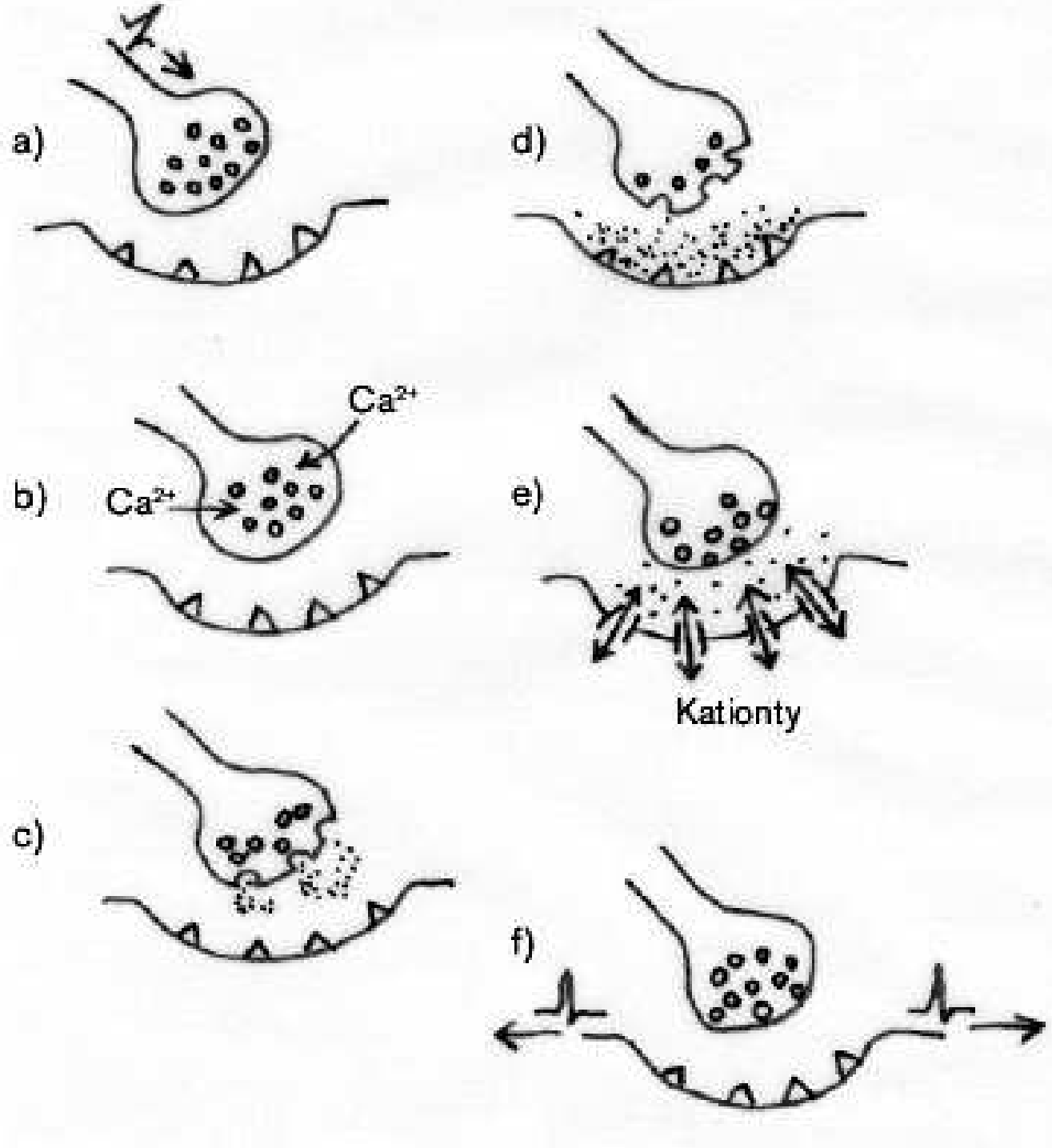
(b) Surface view of a Na^+ channel



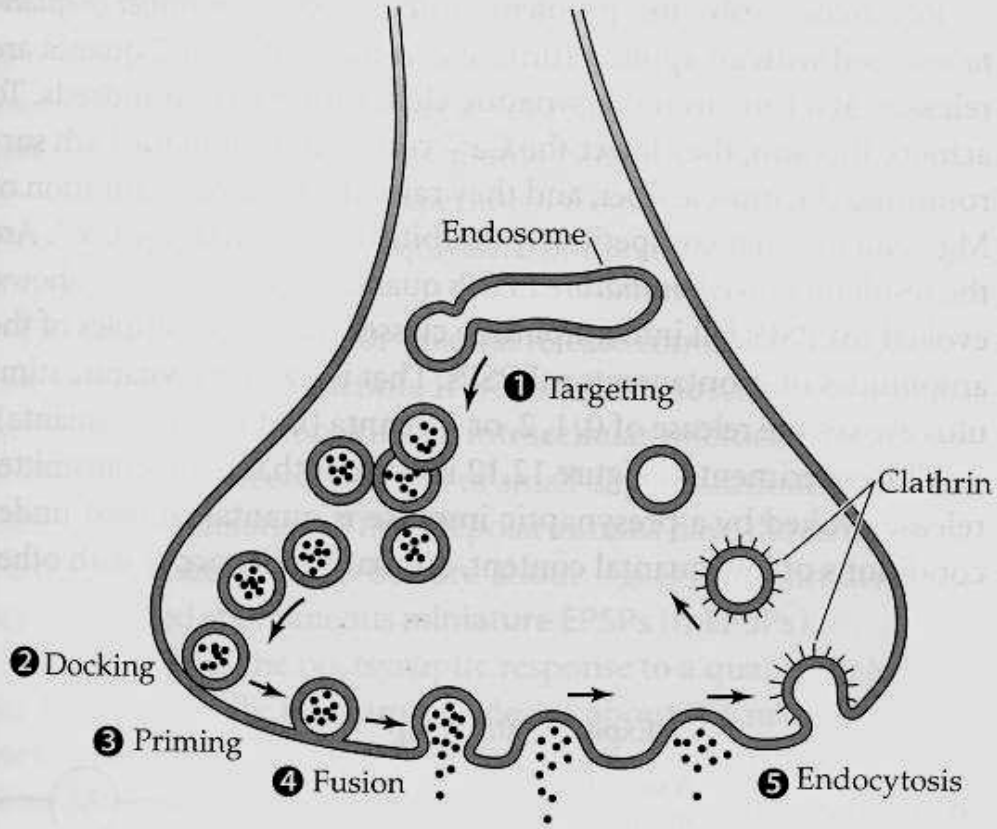
(c) Voltage-dependent conformational change



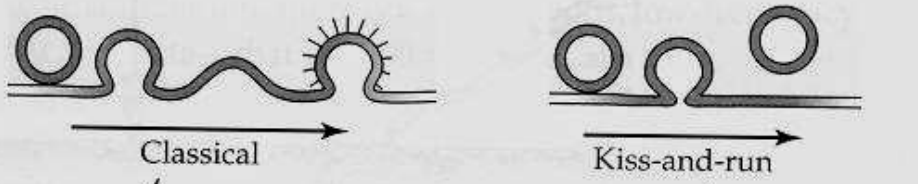

Vlákno axonu
AP
mV
0
Prahový potenciál
-55
-70
Klidový potenciál
Vzdálenost


a)
d)
b)
Ca^{2+}
Ca^{2+}
e)
Kationty
c)
f)

(a) Overview of vesicle recycling

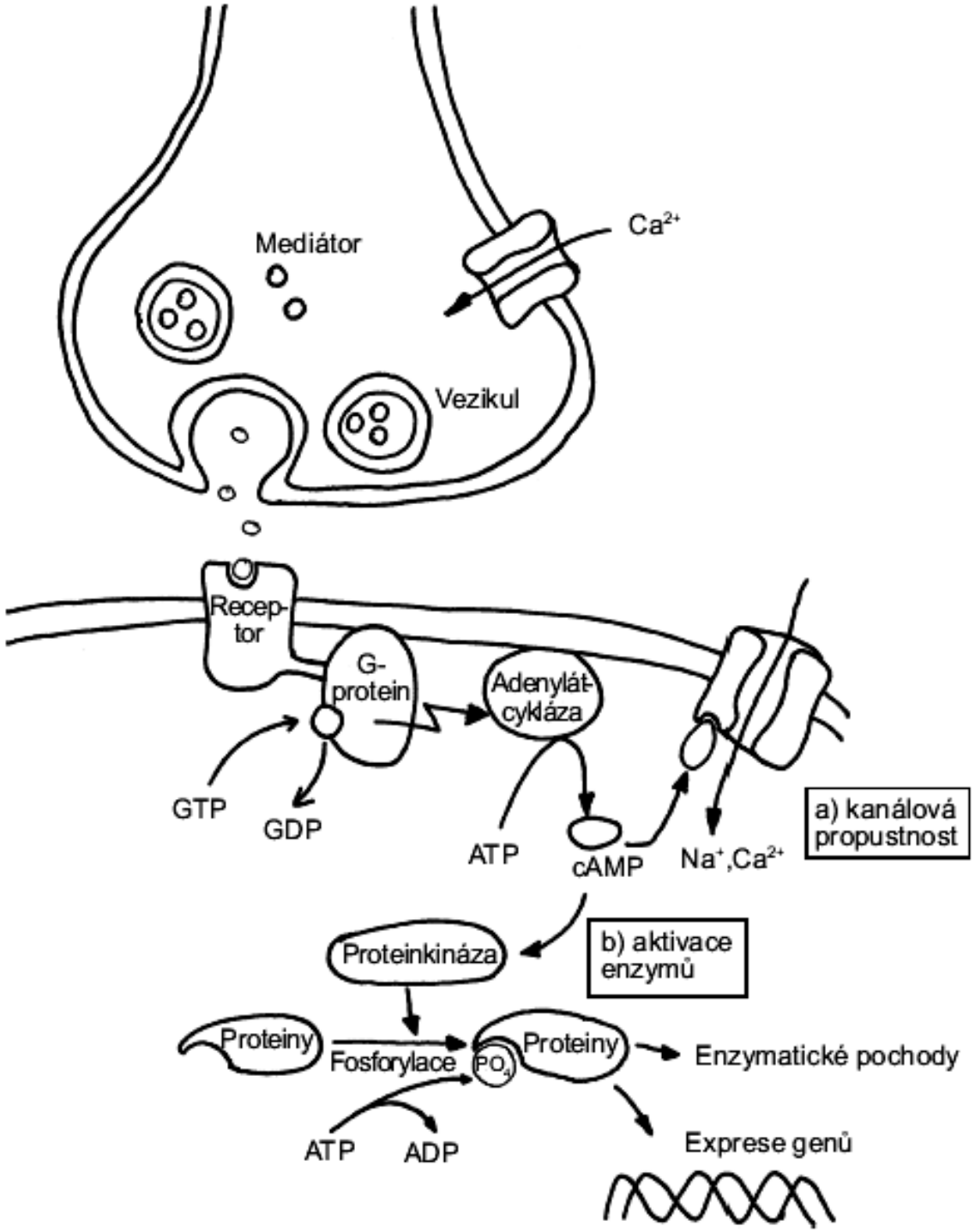


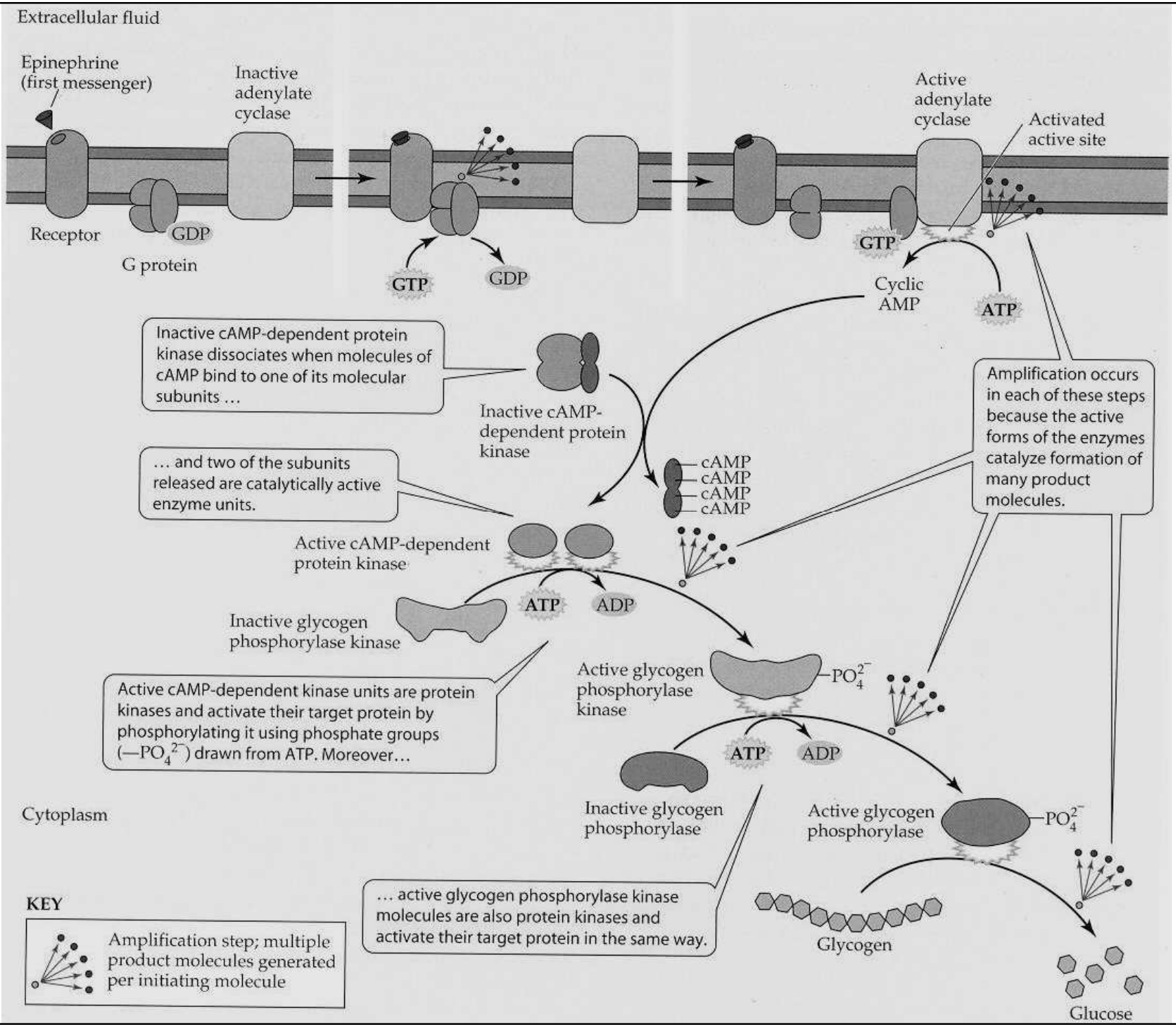
(b) Retrieval of the vesicular membrane

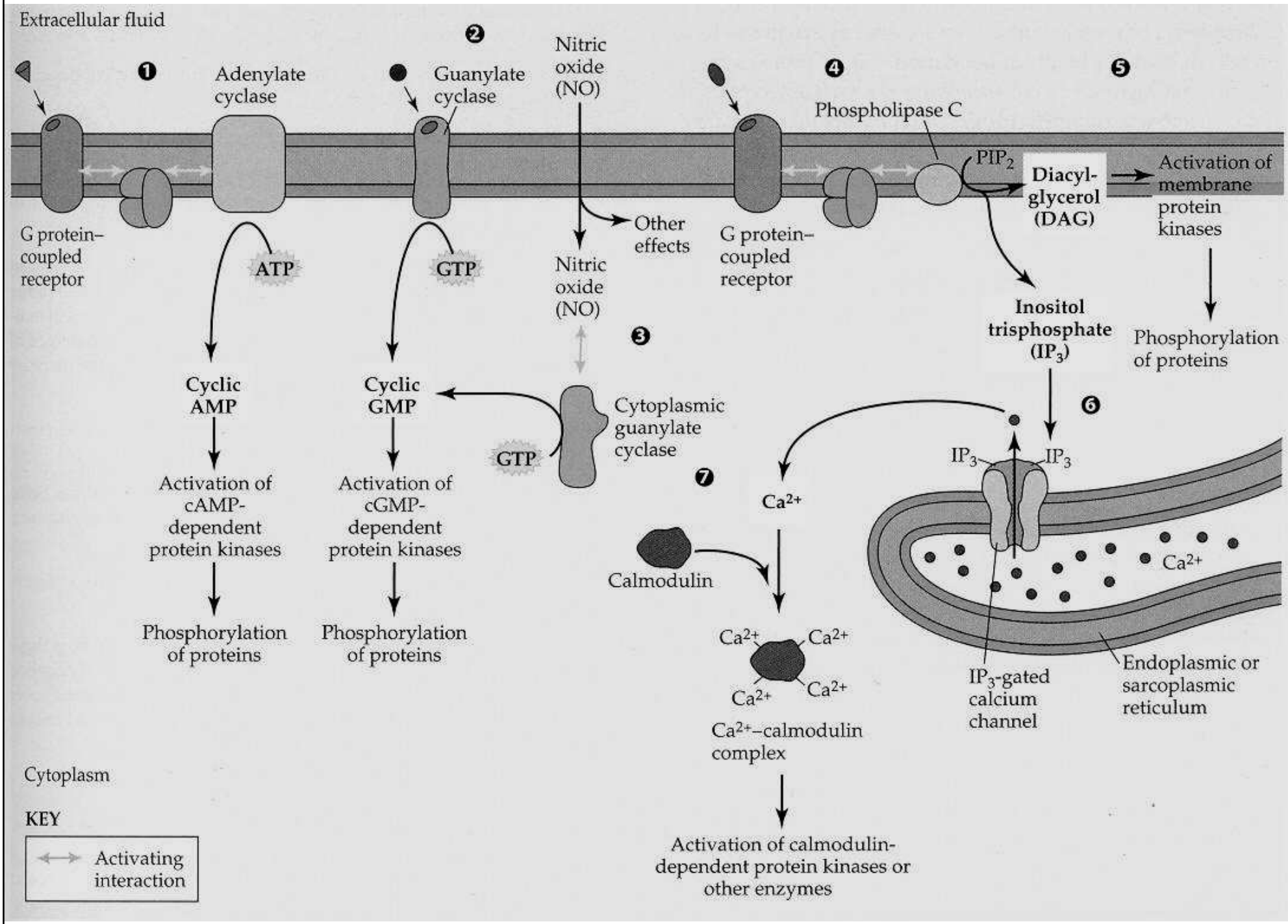


In the classical pathway, the vesicular membrane completely fuses with the presynaptic membrane, then is retrieved by endocytosis.

In the kiss-and-run pathway, synaptic vesicles fuse to the membrane only at a narrow fusion pore.


Mediátor
Ca^{2+}
Vezikul
Recep-
tor
G-
protein
Adenylát-
cykláza
GTP
GDP
ATP
cAMP
Na^+,Ca^{2+}
a) kanálová
propustnost
Proteinkináza
b) aktivace
enzymů
Proteiny
Fosforylace
PO_4
Proteiny
Enzymatické pochody
ATP
ADP
Exprese genů


Extracellular fluid
Epinephrine (first messenger)
Inactive adenylate cyclase
Active adenylate cyclase
Activated active site
Receptor
GDP
G protein
GTP
GDP
GTP
Cyclic AMP
ATP
Inactive cAMP-dependent protein kinase dissociates when molecules of cAMP bind to one of its molecular subunits …
Inactive cAMP-dependent protein kinase
Amplification occurs in each of these steps because the active forms of the enzymes catalyze formation of many product molecules.
… and two of the subunits released are catalytically active enzyme units.
cAMP
cAMP
cAMP
cAMP
Active cAMP-dependent protein kinase
ATP
ADP
Inactive glycogen phosphorylase kinase
Active cAMP-dependent kinase units are protein kinases and activate their target protein by phosphorylating it using phosphate groups ($—PO_4^{2-}$) drawn from ATP. Moreover…
Active glycogen phosphorylase kinase
$—PO_4^{2-}$
ATP
ADP
Cytoplasm
Inactive glycogen phosphorylase
Active glycogen phosphorylase
$—PO_4^{2-}$
… active glycogen phosphorylase kinase molecules are also protein kinases and activate their target protein in the same way.
Glycogen
Glucose
KEY
Amplification step; multiple product molecules generated per initiating molecule


Extracellular fluid
1
2
3
4
5
6
7
Adenylate cyclase
Guanylate cyclase
Nitric oxide (NO)
Phospholipase C
G protein–coupled receptor
ATP
GTP
Other effects
Nitric oxide (NO)
G protein–coupled receptor
PIP2
Diacyl-glycerol (DAG)
Activation of membrane protein kinases
Phosphorylation of proteins
Inositol trisphosphate (IP3)
Cyclic AMP
Cyclic GMP
Cytoplasmic guanylate cyclase
GTP
Activation of cAMP-dependent protein kinases
Activation of cGMP-dependent protein kinases
Phosphorylation of proteins
Phosphorylation of proteins
Ca2+
Calmodulin
IP3
IP3
Ca2+
Ca2+
Ca2+
Ca2+
Ca2+
Ca2+–calmodulin complex
IP3-gated calcium channel
Endoplasmic or sarcoplasmic reticulum
Activation of calmodulin-dependent protein kinases or other enzymes
Cytoplasm
KEY
Activating interaction

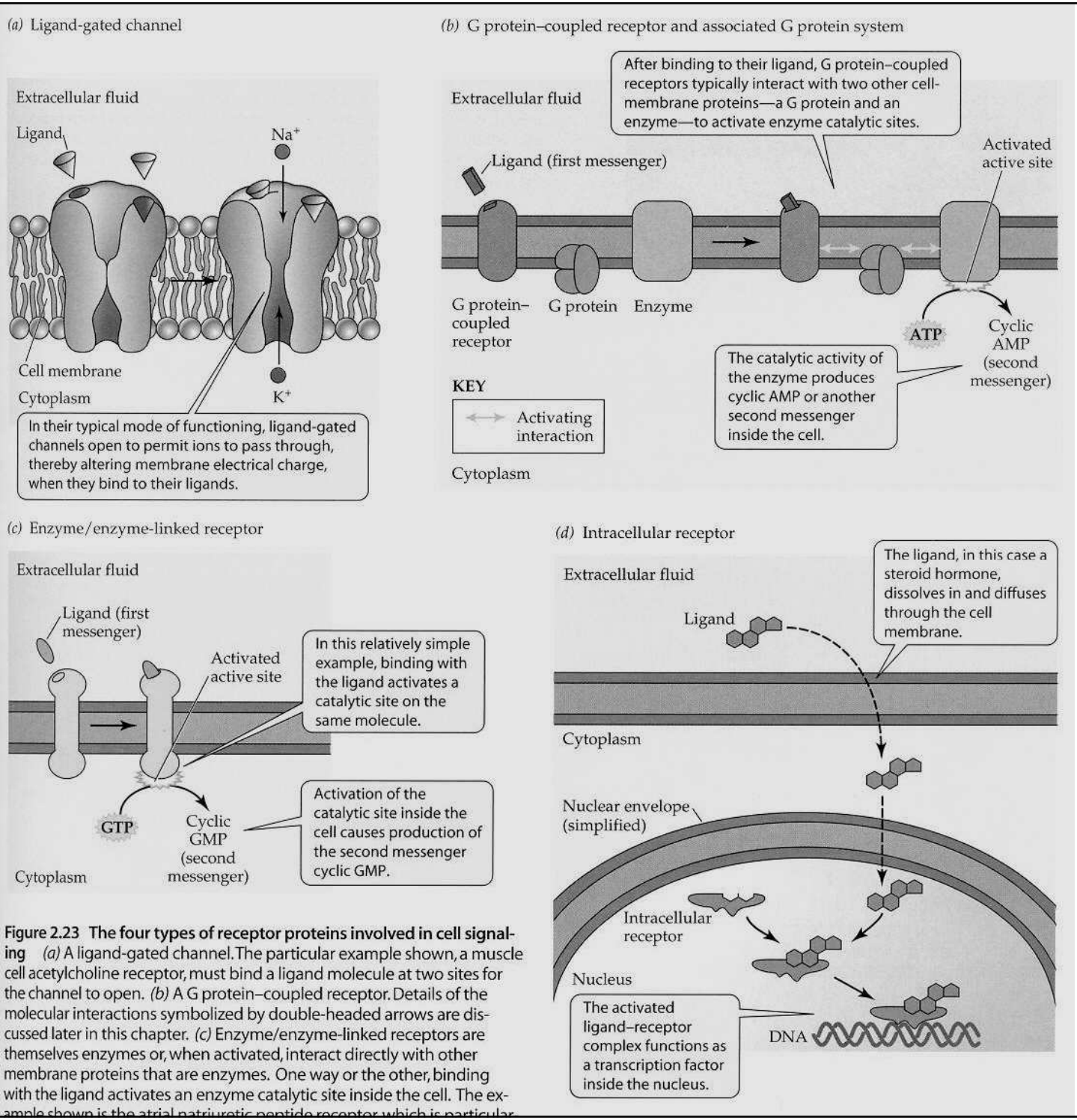
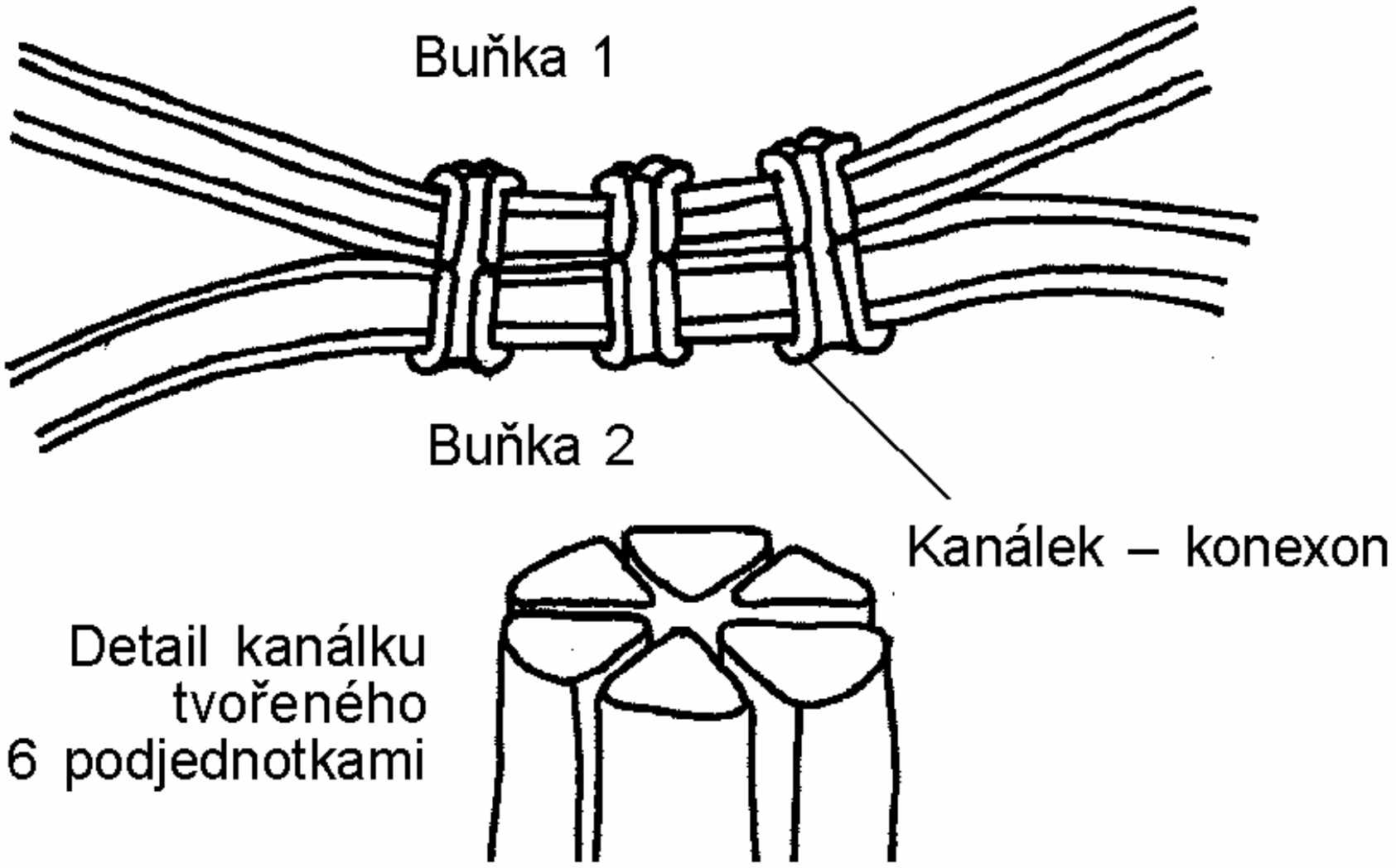


Figure 2.23 The four types of receptor proteins involved in cell signaling *(a)* A ligand-gated channel. The particular example shown, a muscle cell acetylcholine receptor, must bind a ligand molecule at two sites for the channel to open. *(b)* A G protein–coupled receptor. Details of the molecular interactions symbolized by double-headed arrows are discussed later in this chapter. *(c)* Enzyme/enzyme-linked receptors are themselves enzymes or, when activated, interact directly with other membrane proteins that are enzymes. One way or the other, binding with the ligand activates an enzyme catalytic site inside the cell. The example shown is the atrial natriuretic peptide receptor which is particular


Buňka 1
Buňka 2
Kanálek – konexon
Detail kanálku tvořeného 6 podjednotkami

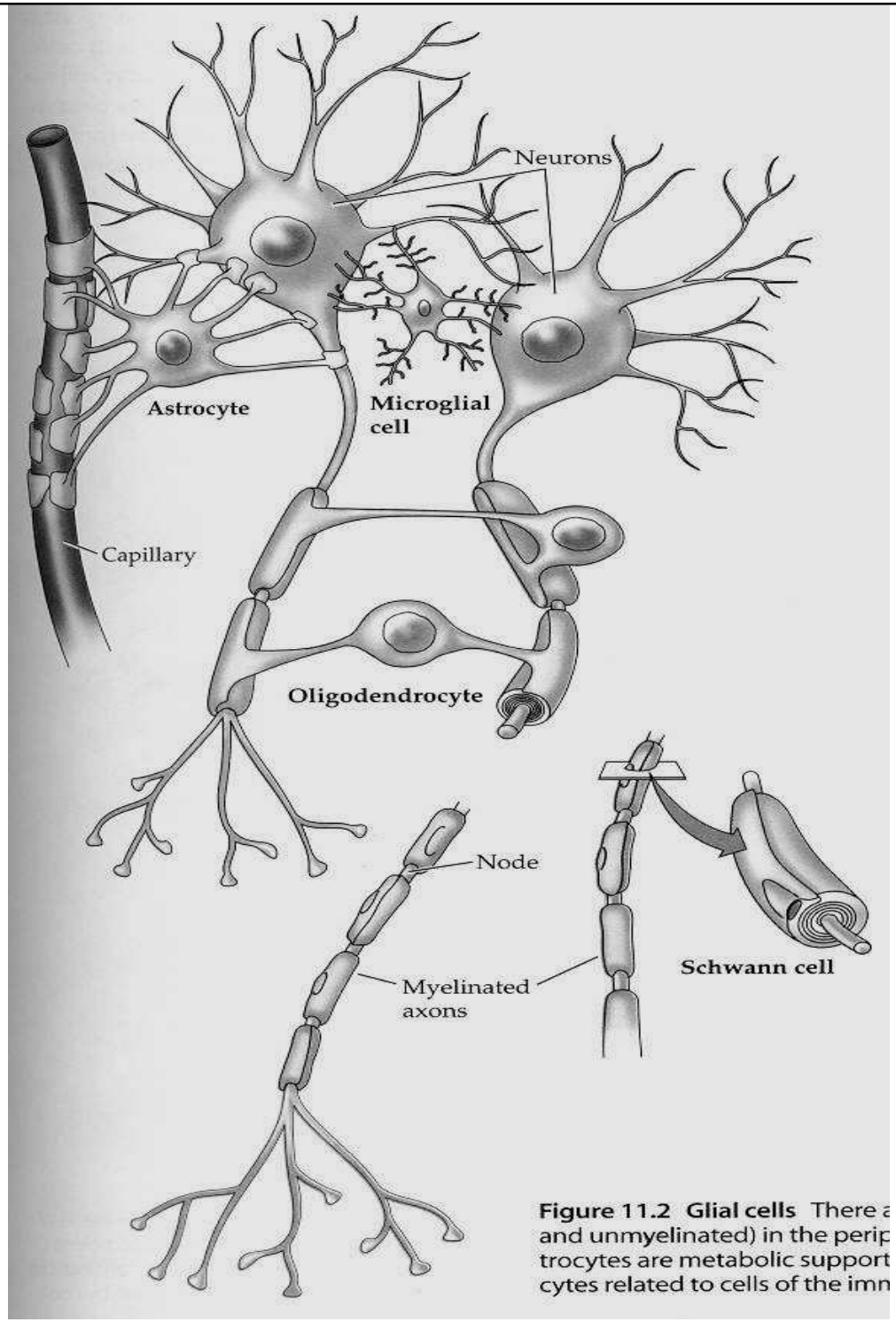
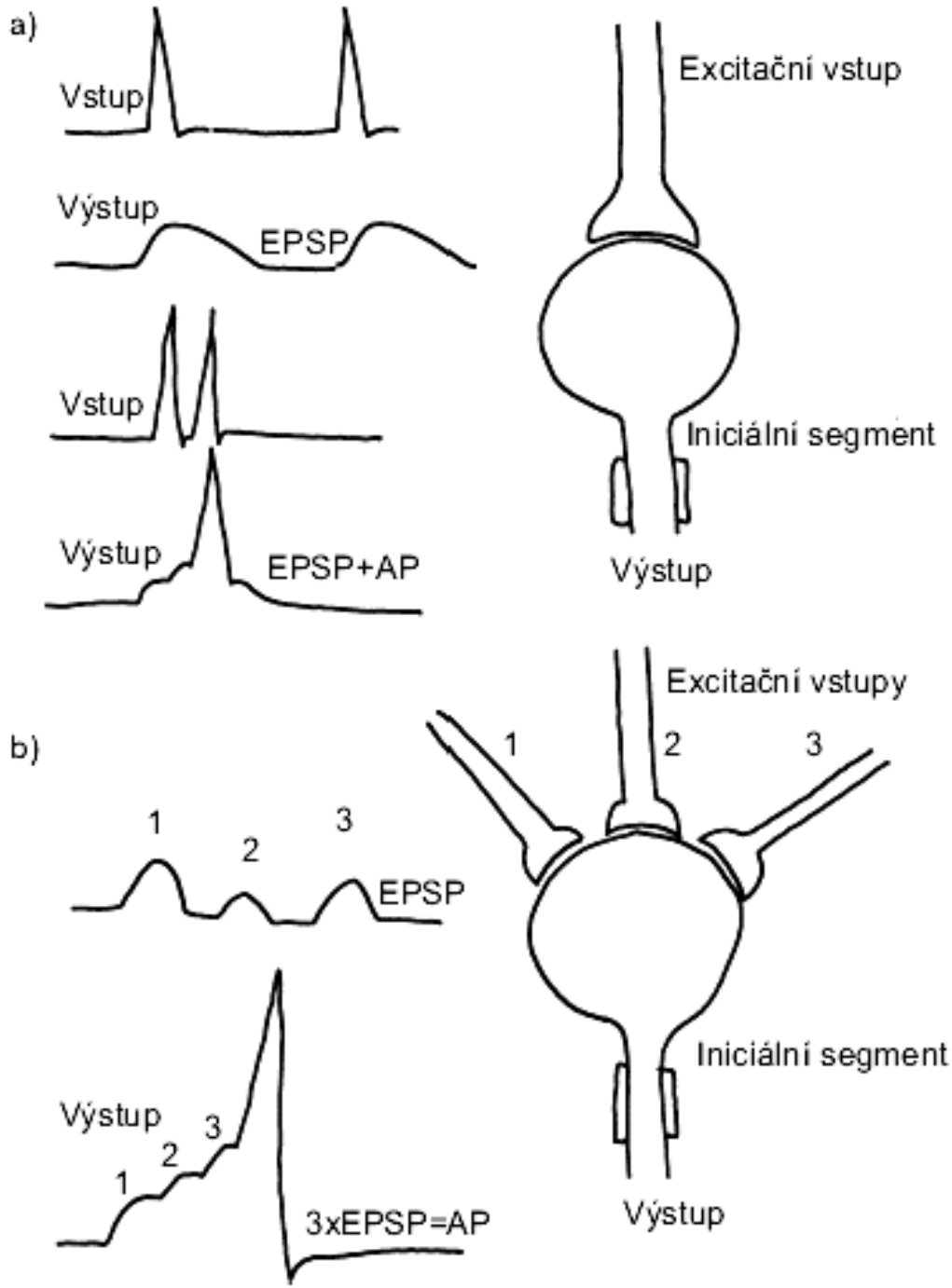
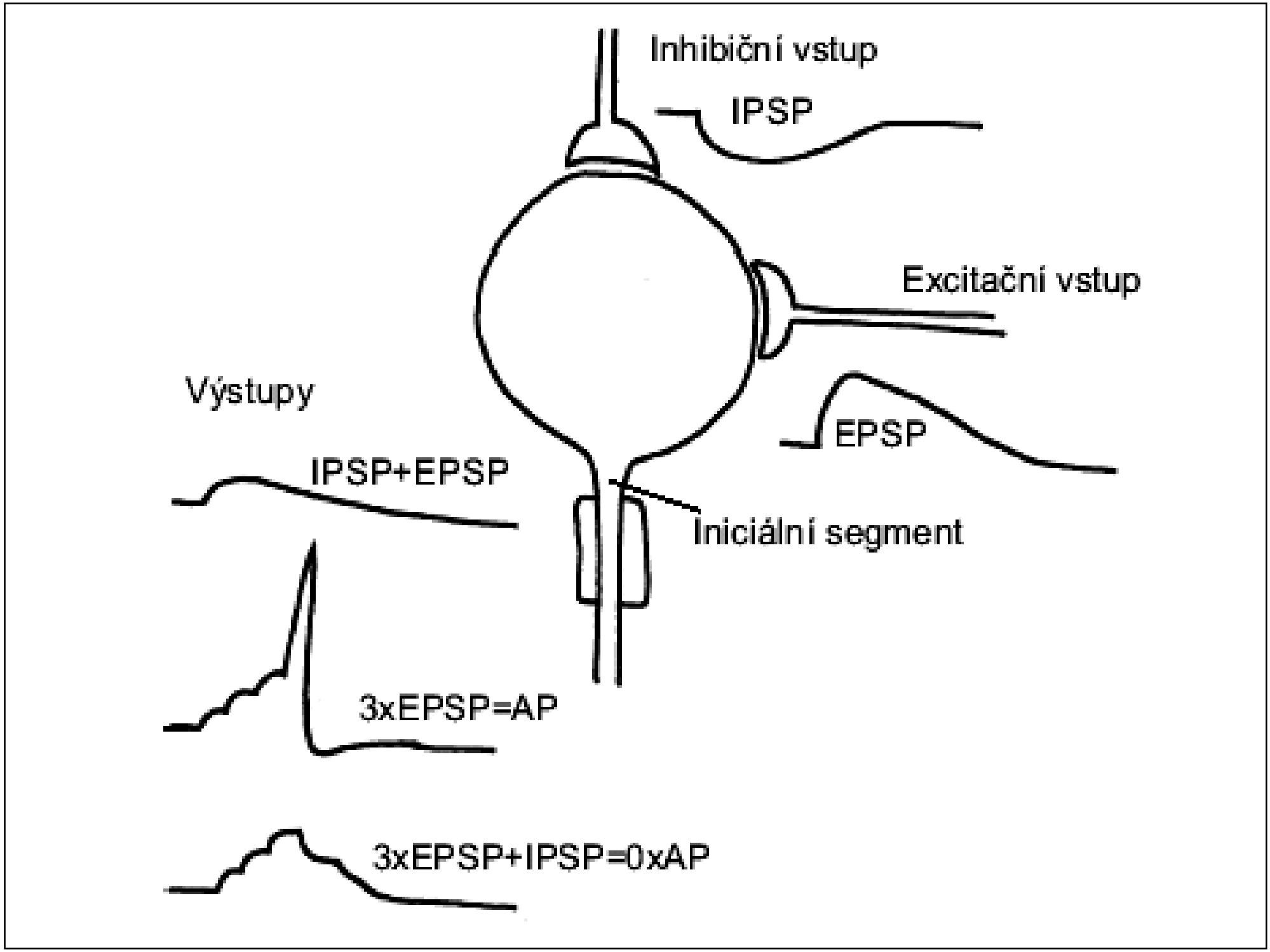
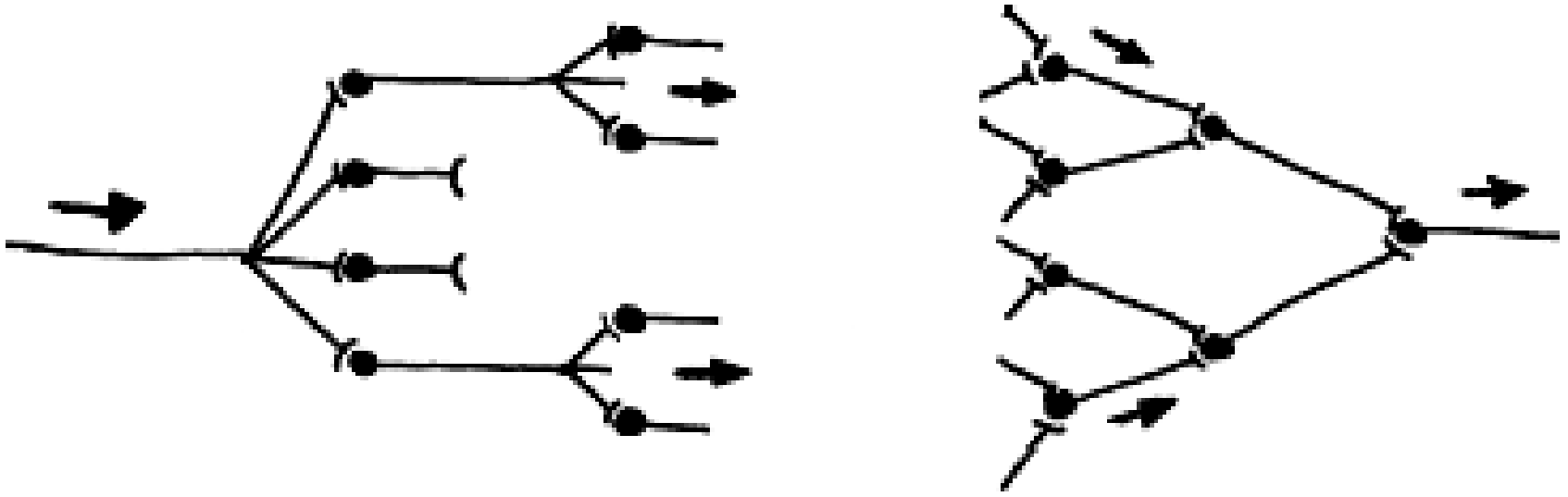


Figure 11.2 Glial cells There a
and unmyelinated) in the perip
trocytes are metabolic support
cytes related to cells of the imn

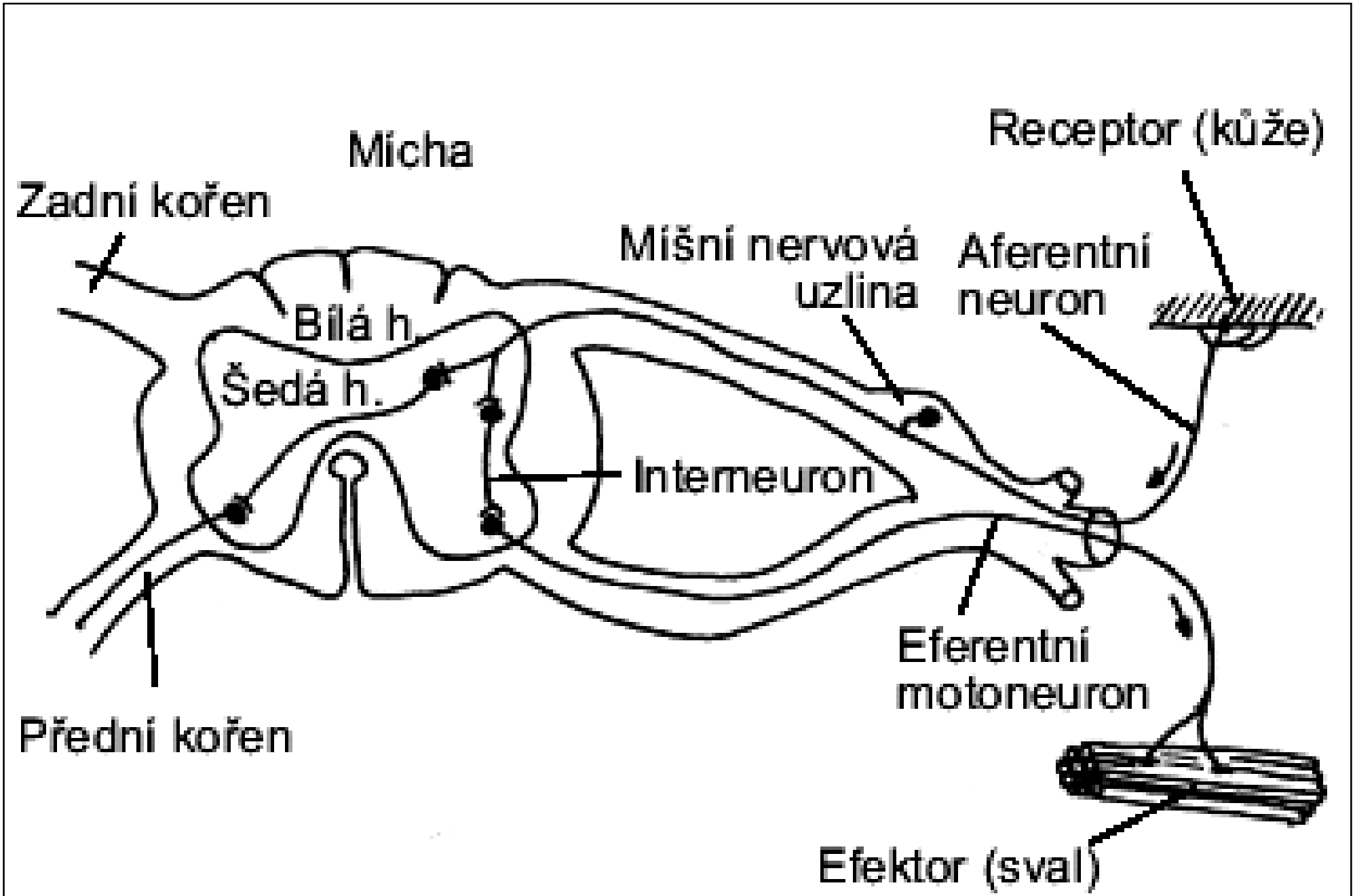

a)
Vstup
Výstup
EPSP
Vstup
Výstup
EPSP+AP
Excitační vstup
Iniciální segment
Výstup
b)
1
2
3
EPSP
Výstup
1
2
3
3xEPSP=AP
Excitační vstupy
1
2
3
Iniciální segment
Výstup

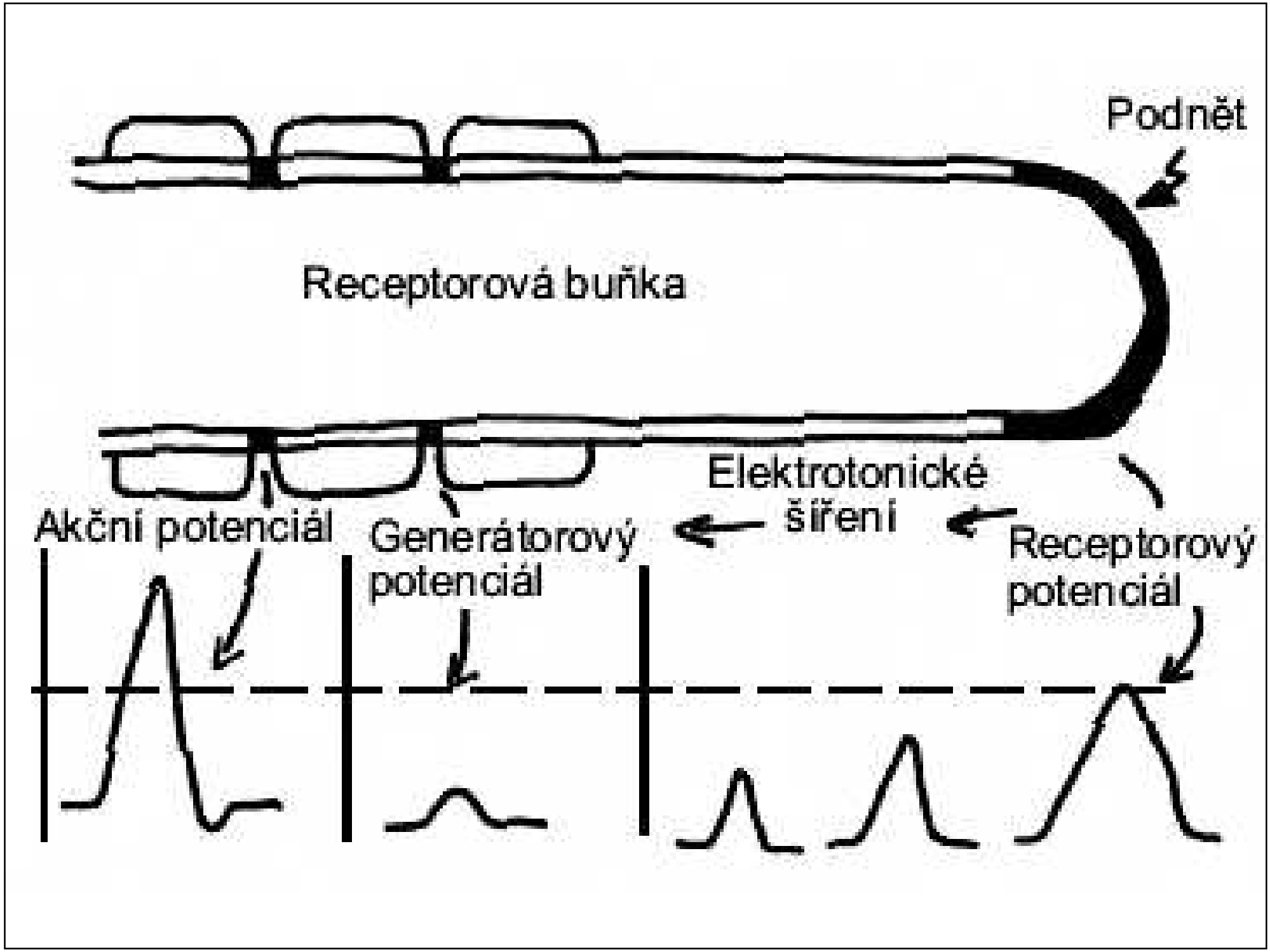

Inhibiční vstup
IPSP
Excitační vstup
EPSP
Výstupy
IPSP+EPSP
Iniciální segment
3xEPSP=AP
3xEPSP+IPSP=0xAP

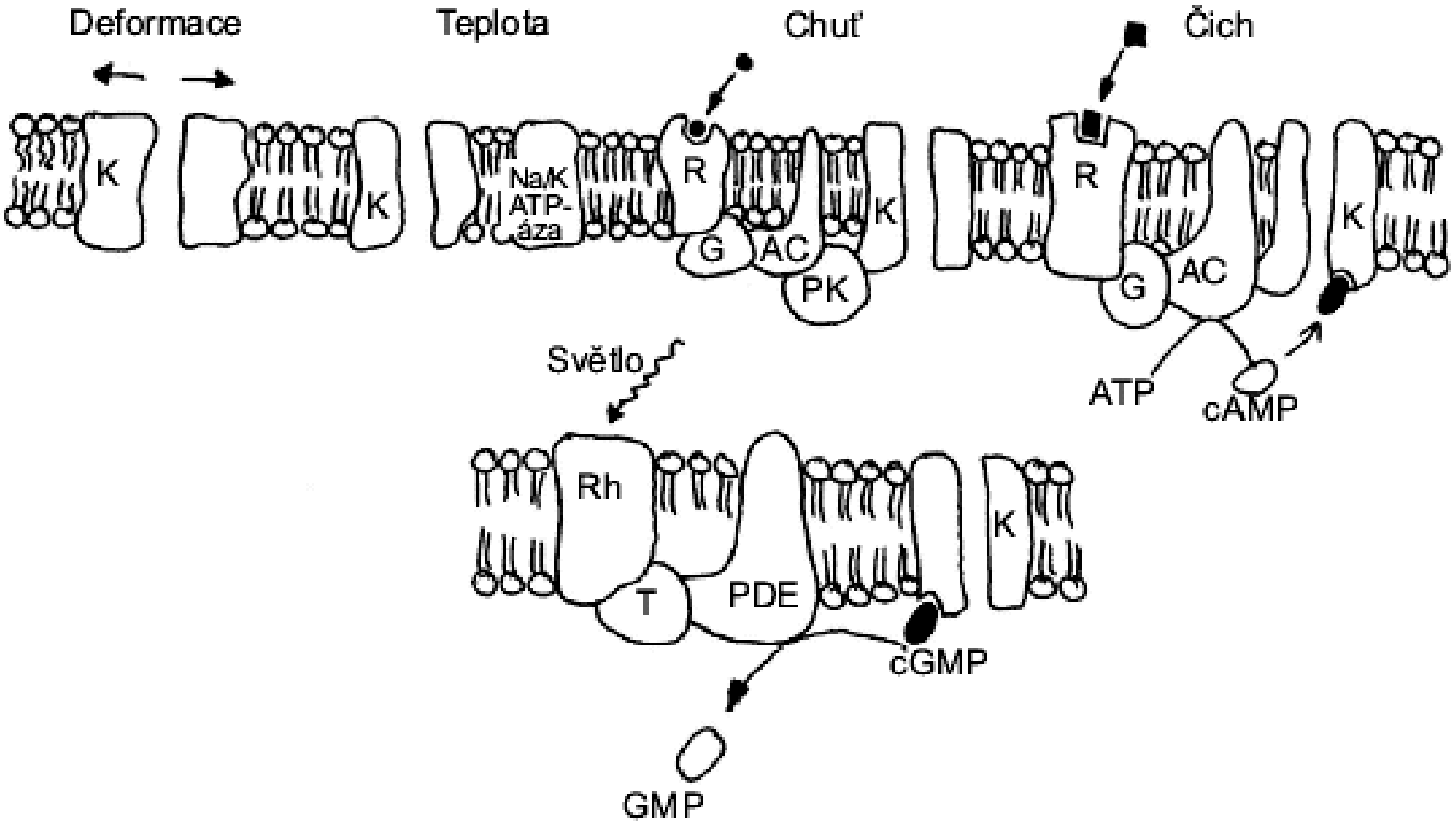


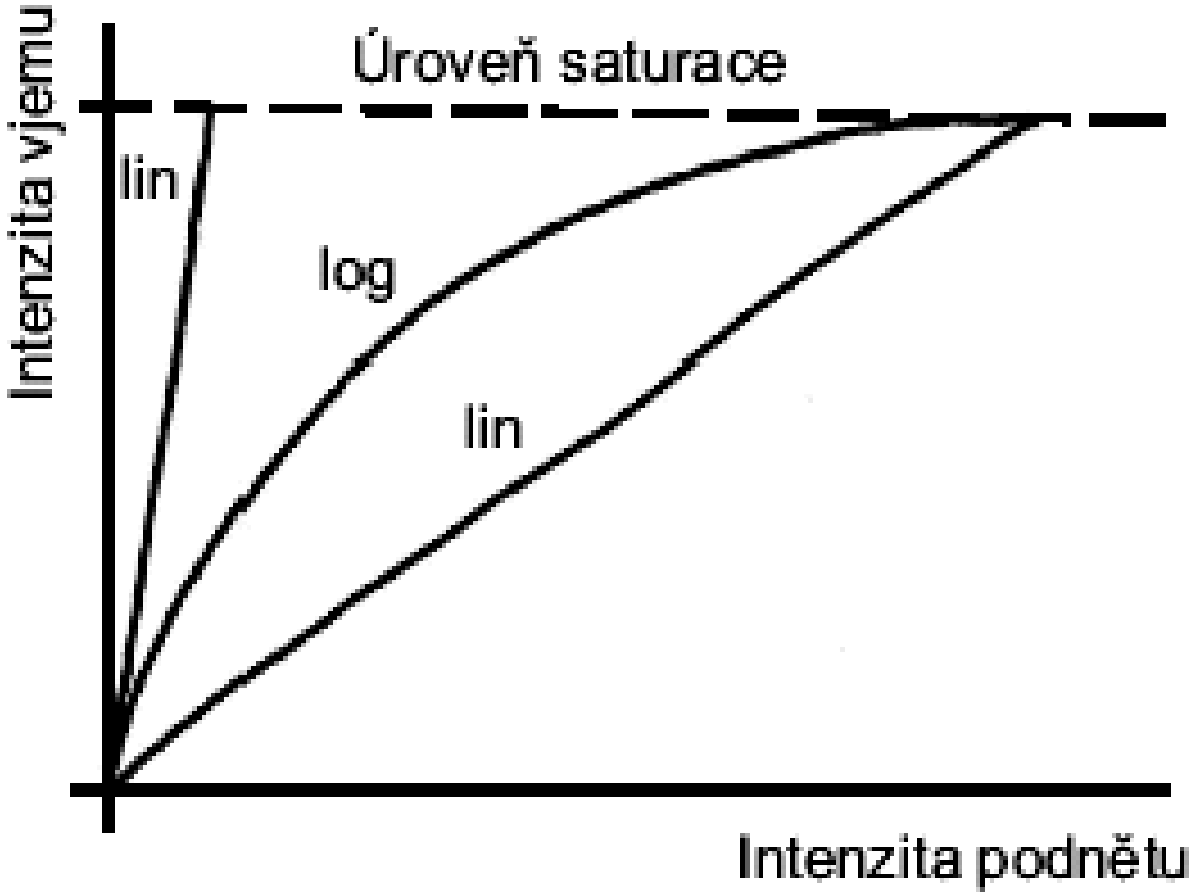
a)

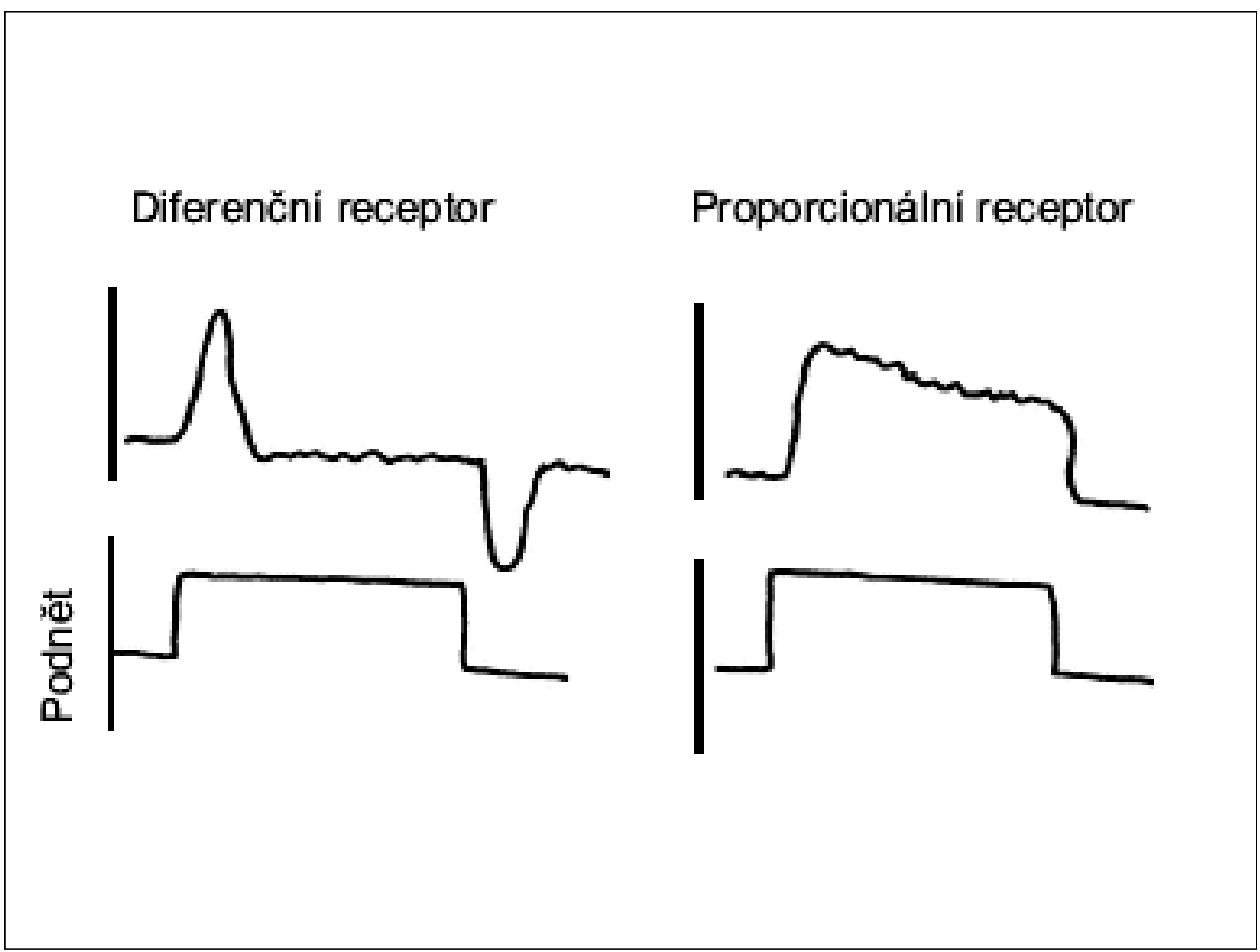
b)

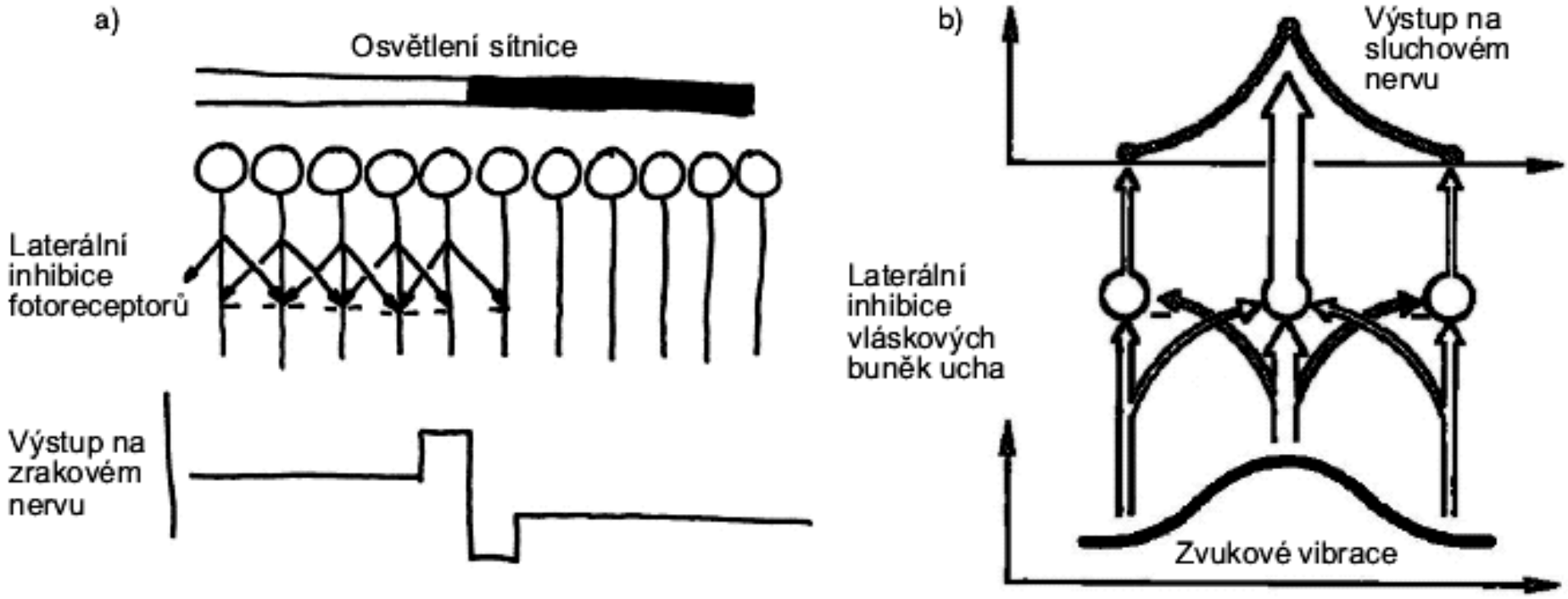

Micha
Receptor (kůže)
Zadní kořen
Míšní nervová uzlina
Aferentní neuron
Bílá h.
Šedá h.
Interneuron
Eferentní motoneuron
Přední kořen
Efektor (sval)


Podnět
Receptorová buňka
Elektrotonické
šíření
Akční potenciál
Generátorový
potenciál
Receptorový
potenciál


Deformace
Teplota
Chuť
Čich
K
K
Na/K
ATP-
áza
R
G
AC
PK
K
R
G
AC
K
ATP
cAMP
Světlo
Rh
T
PDE
K
cGMP
GMP


Úroveň saturace
lin
log
lin
Intenzita vjemu
Intenzita podnětu


Diferenční receptor
Proporcionální receptor
Podnět


a)
Osvětlení sítnice
Laterální inhibice fotoreceptorů
Výstup na zrakovém nervu
b)
Výstup na sluchovém nervu
Laterální inhibice vláskových buněk ucha
Zvukové vibrace