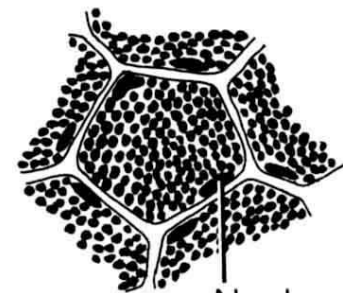
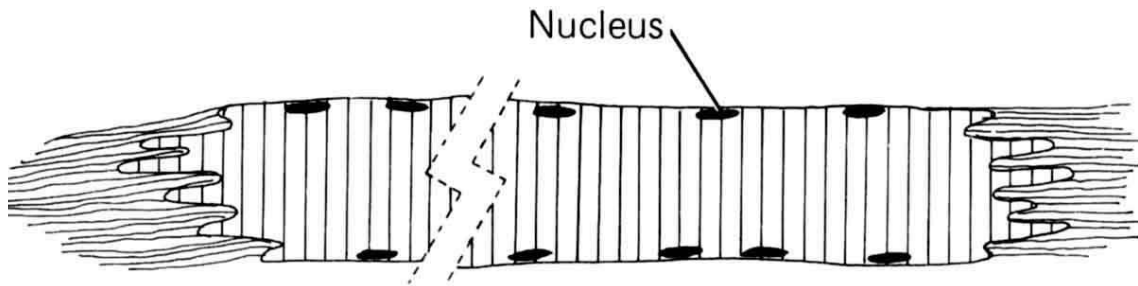


Tkáň svalová

- tvořena protáhlými elementy, jejichž základní vlastností je **schopnost kontrakce**
- svalové elementy vytvářejí intercelulární kontakty
- množství extracelulární matrix je relativně malé, mnohem menší než v pojivové tkáni, ale větší než v epitelové a nervové tkáni

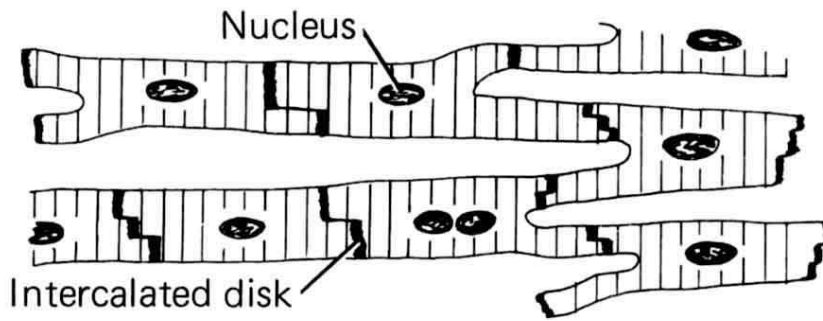
Svalové elementy

svalové vlákno
(syncytium)



Nucleus Nucleus

kardiomyocyty
(buňky)



Intercalated disk



Nucleus

hladké
svalové
buňky



Nucleus



LONGITUDINAL SECTIONS

CROSS SECTIONS

Příčně pruhovaná svalová tkáň kosterní

základní jednotka: SVALOVÉ VLÁKNO

mnohoaderný element - SYNCYTIUM

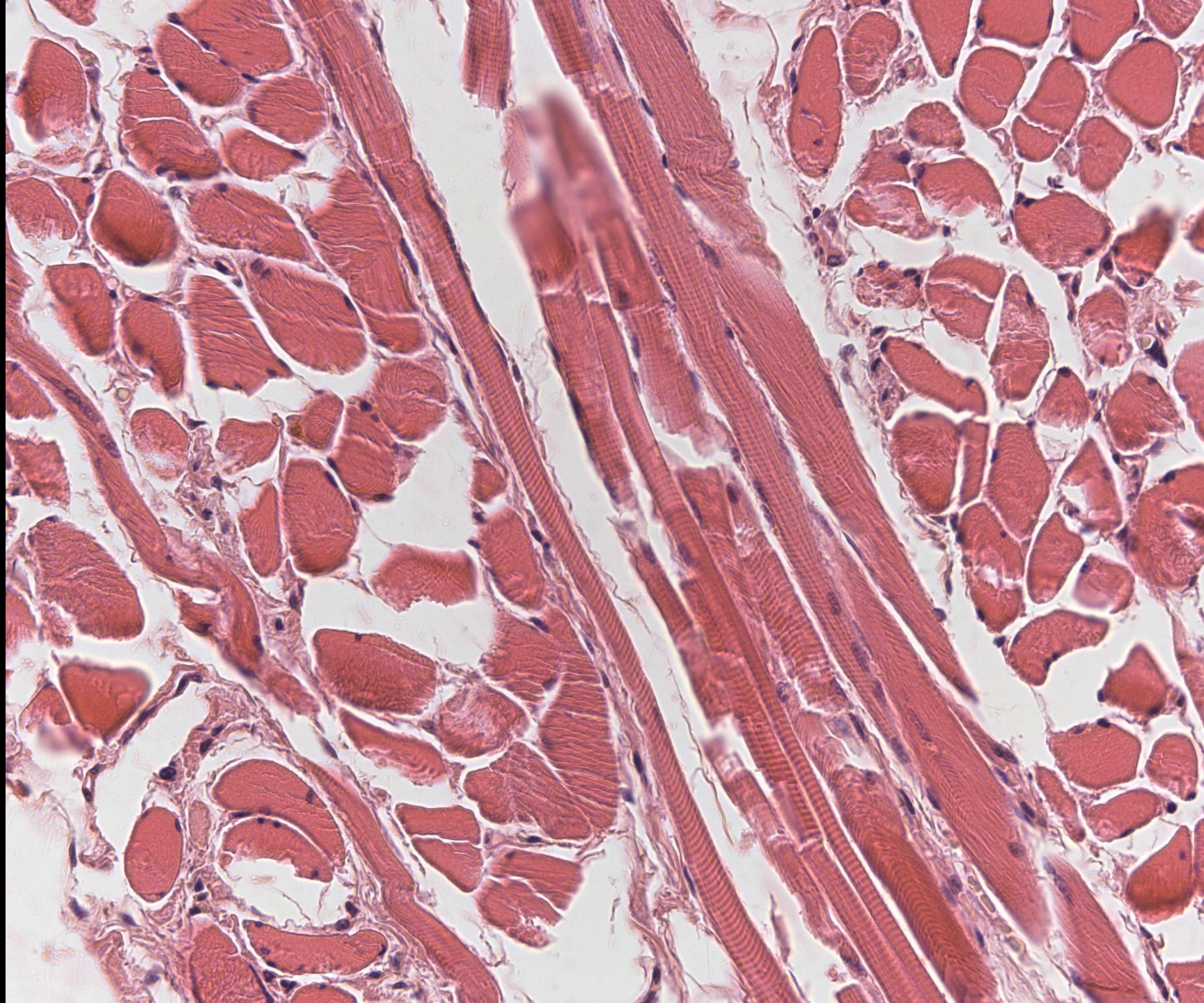
rychlá kontrakce ovládaná vůlí

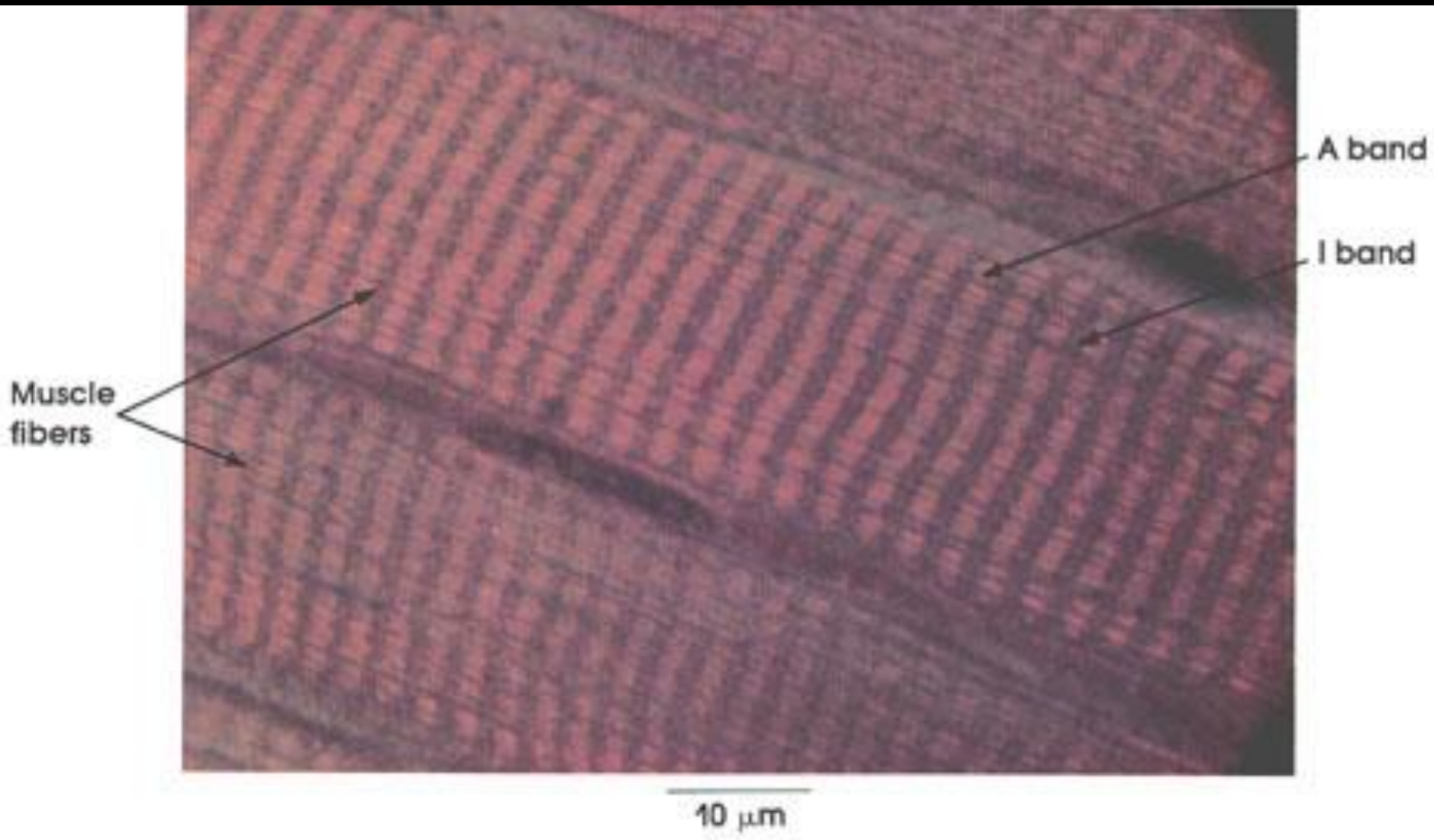
délka: milimetry až desítky centimetrů

průměr: 10 – 100 mikrometrů

jádra umístěná na periferii

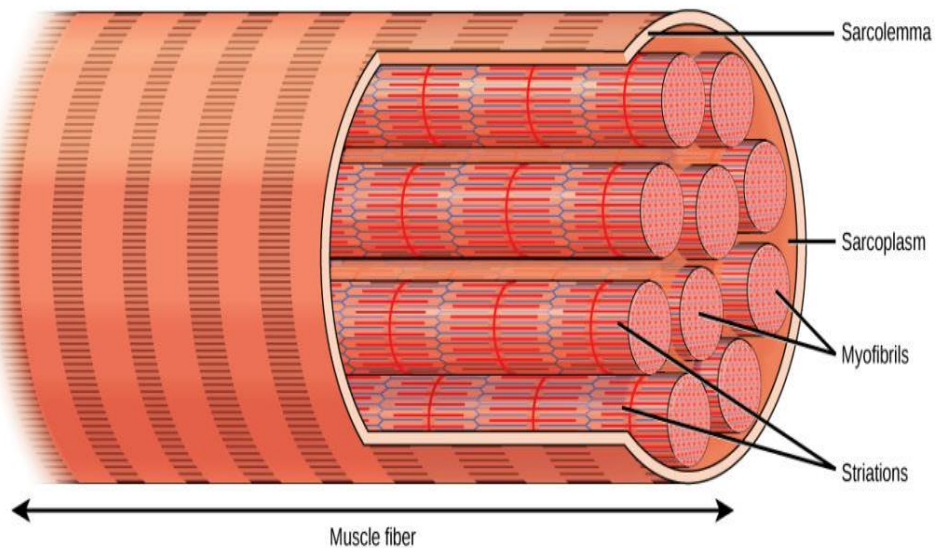
myofilamenta uspořádaná do myofibril



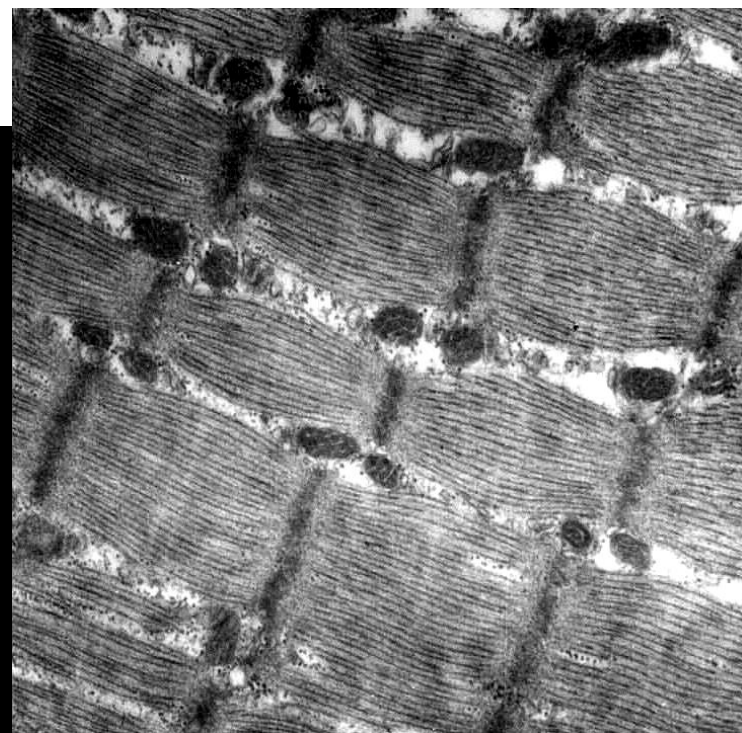
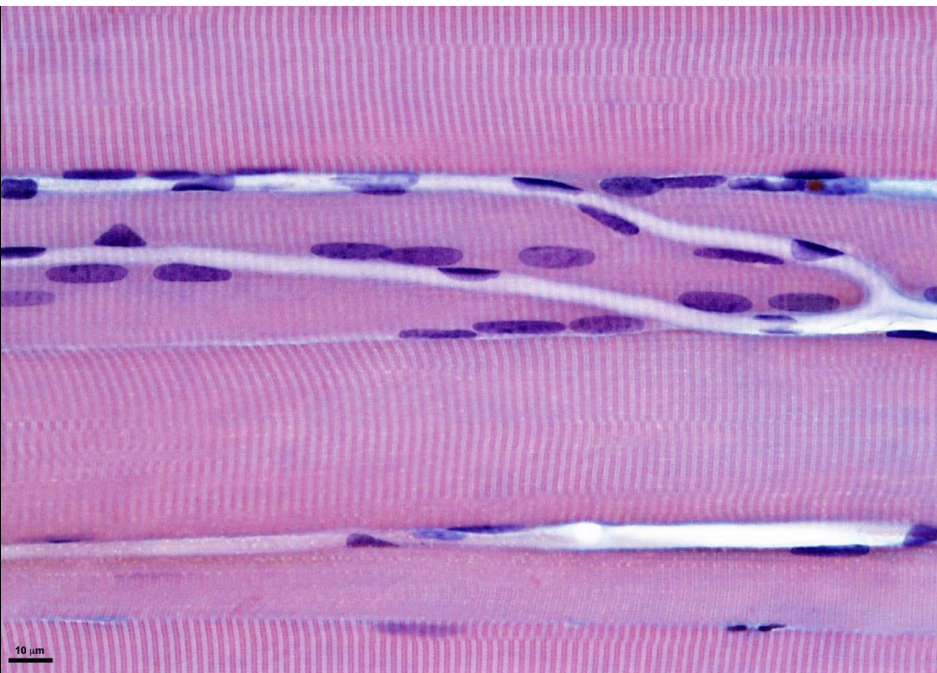
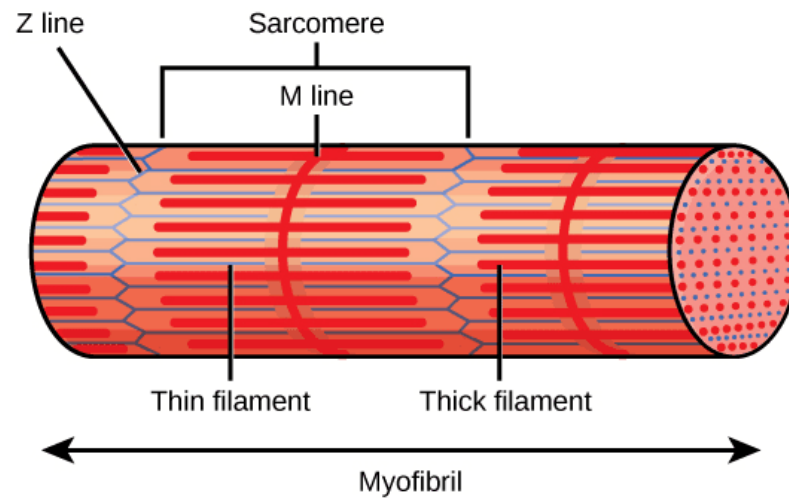


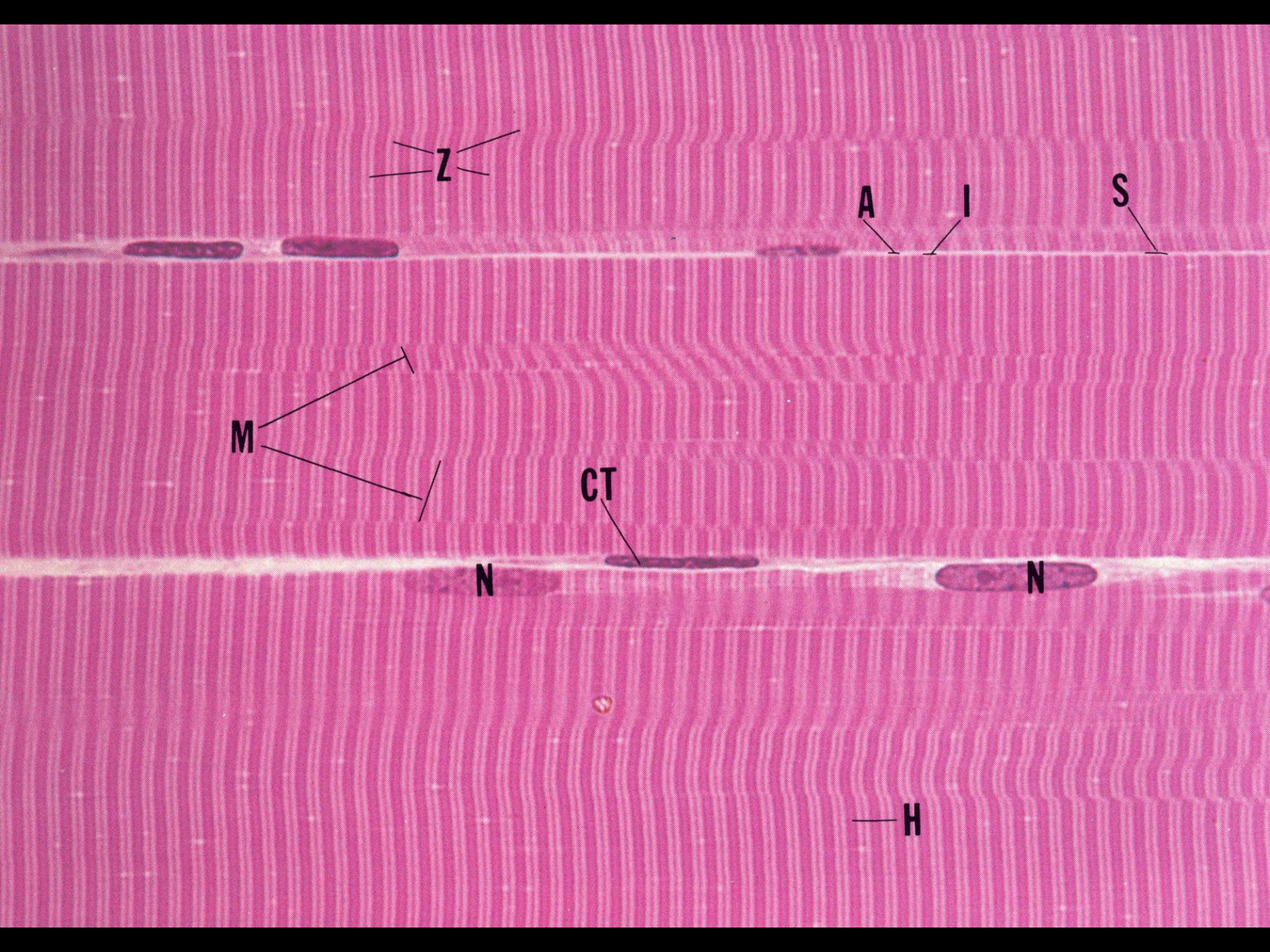
polarizační mikroskop

(Ø 10-100 µm)



(Ø 1-2 µm)





Z

A

I

S

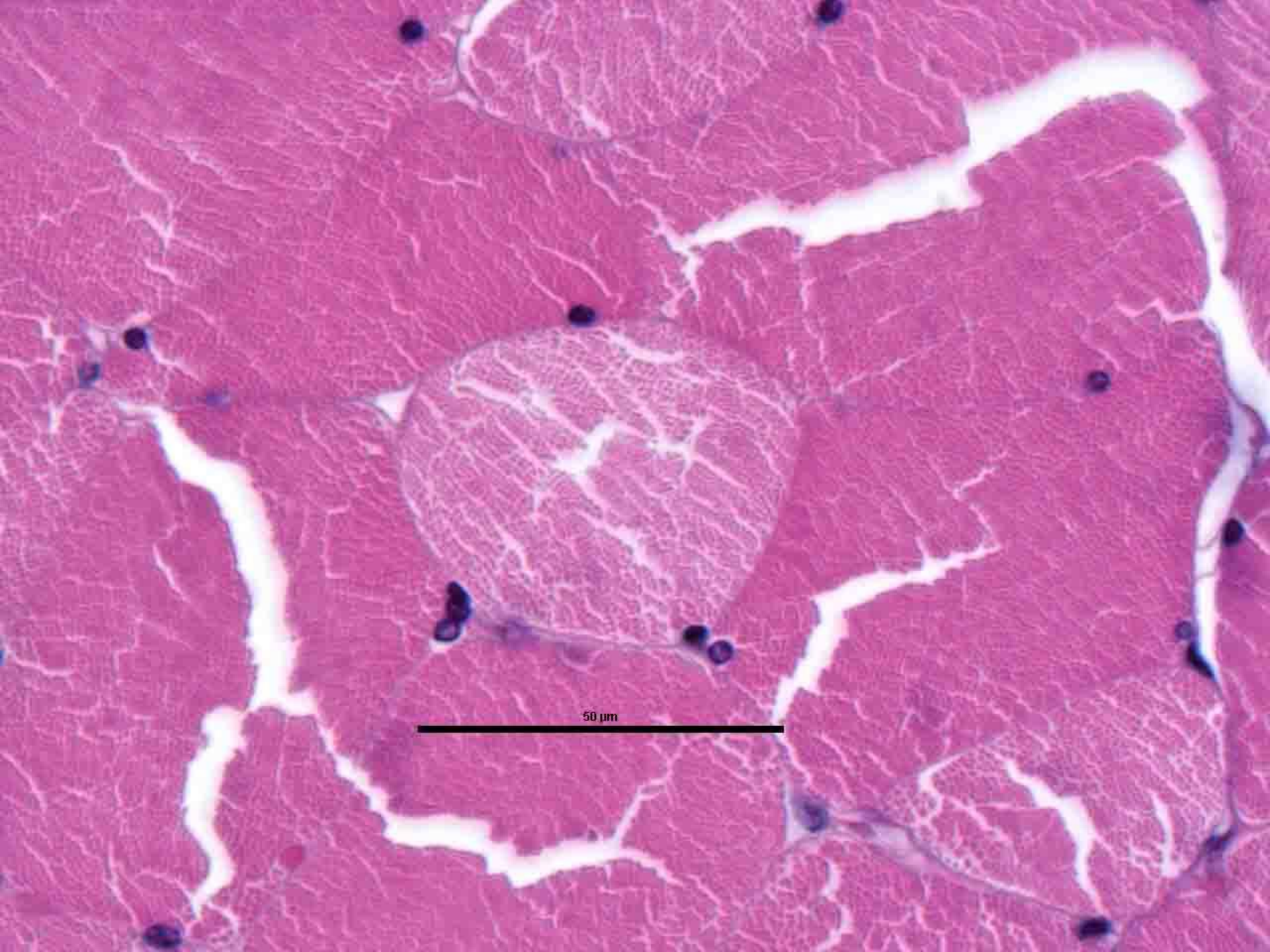
M

CT

N

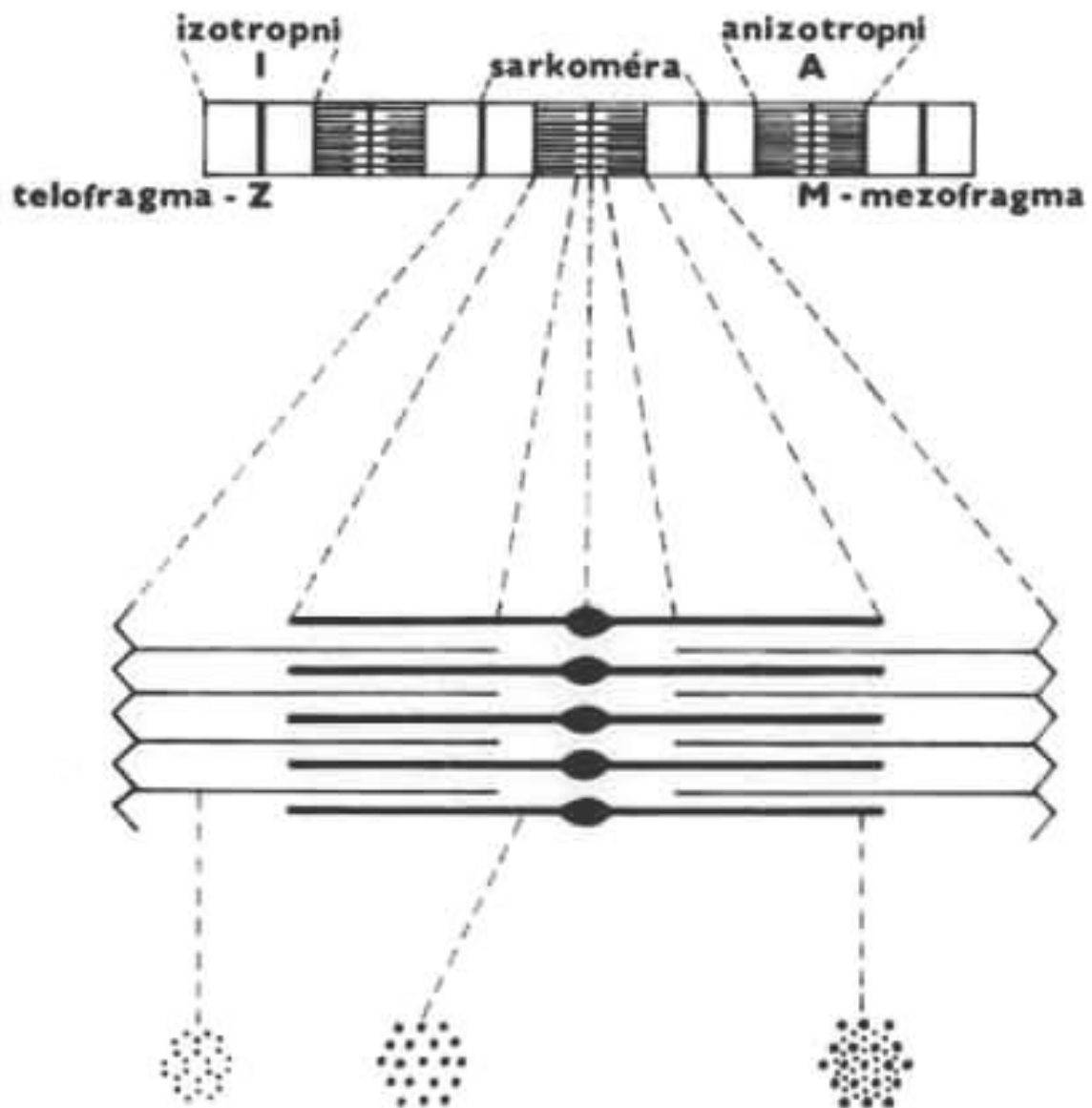
N

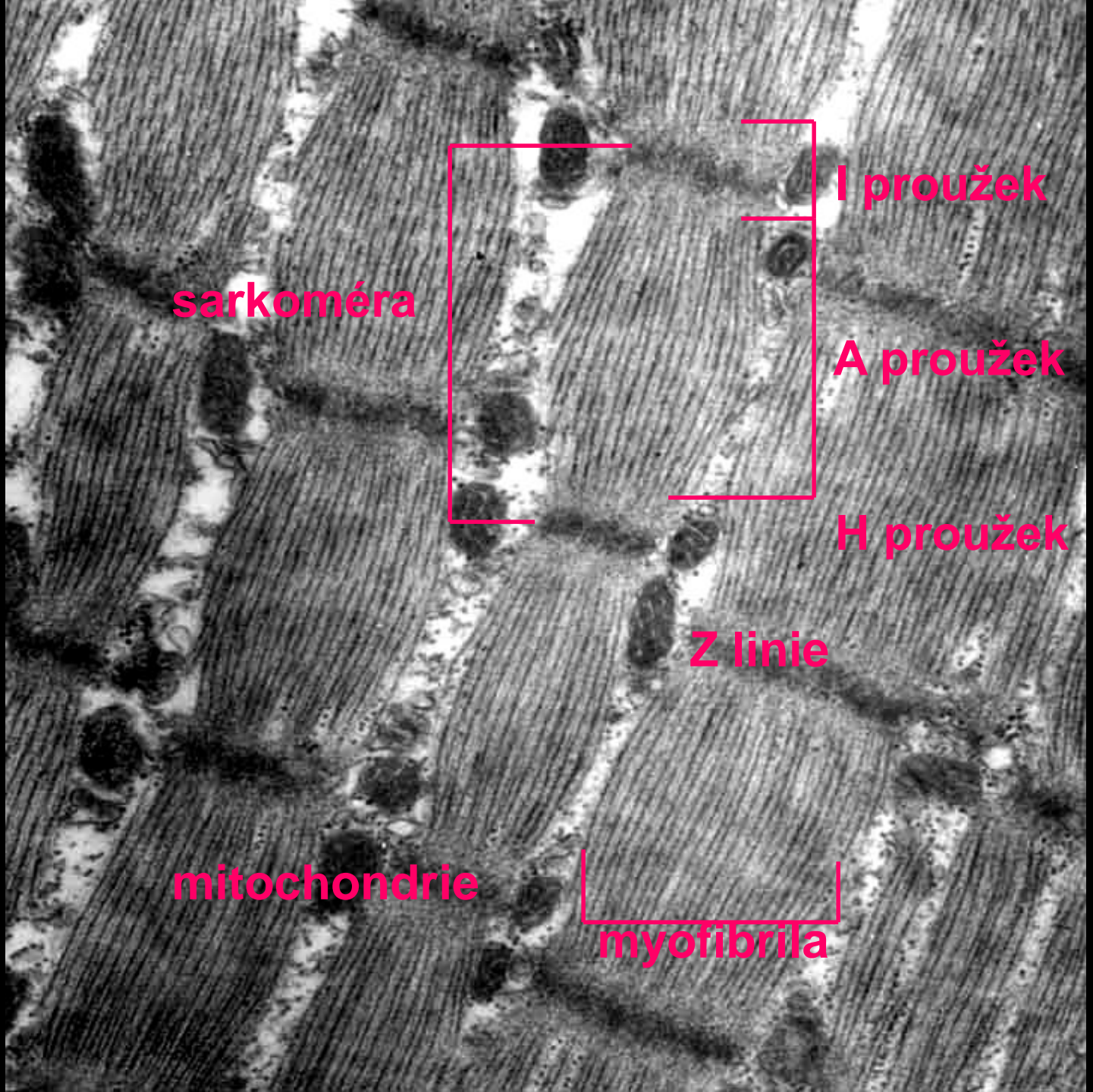
H



50 μm

Myofibrila





sarkoméra

I proužek

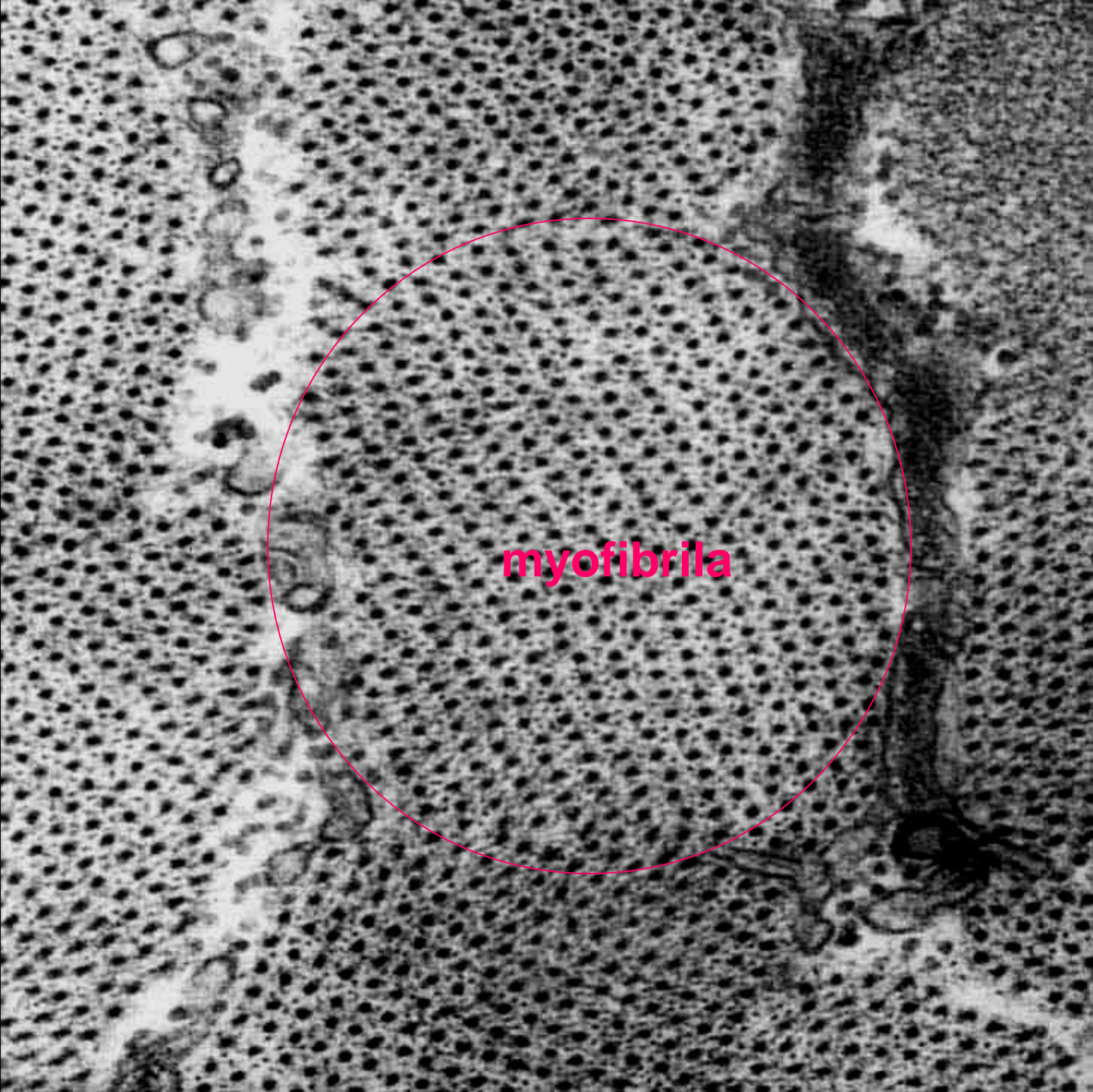
A proužek

H proužek

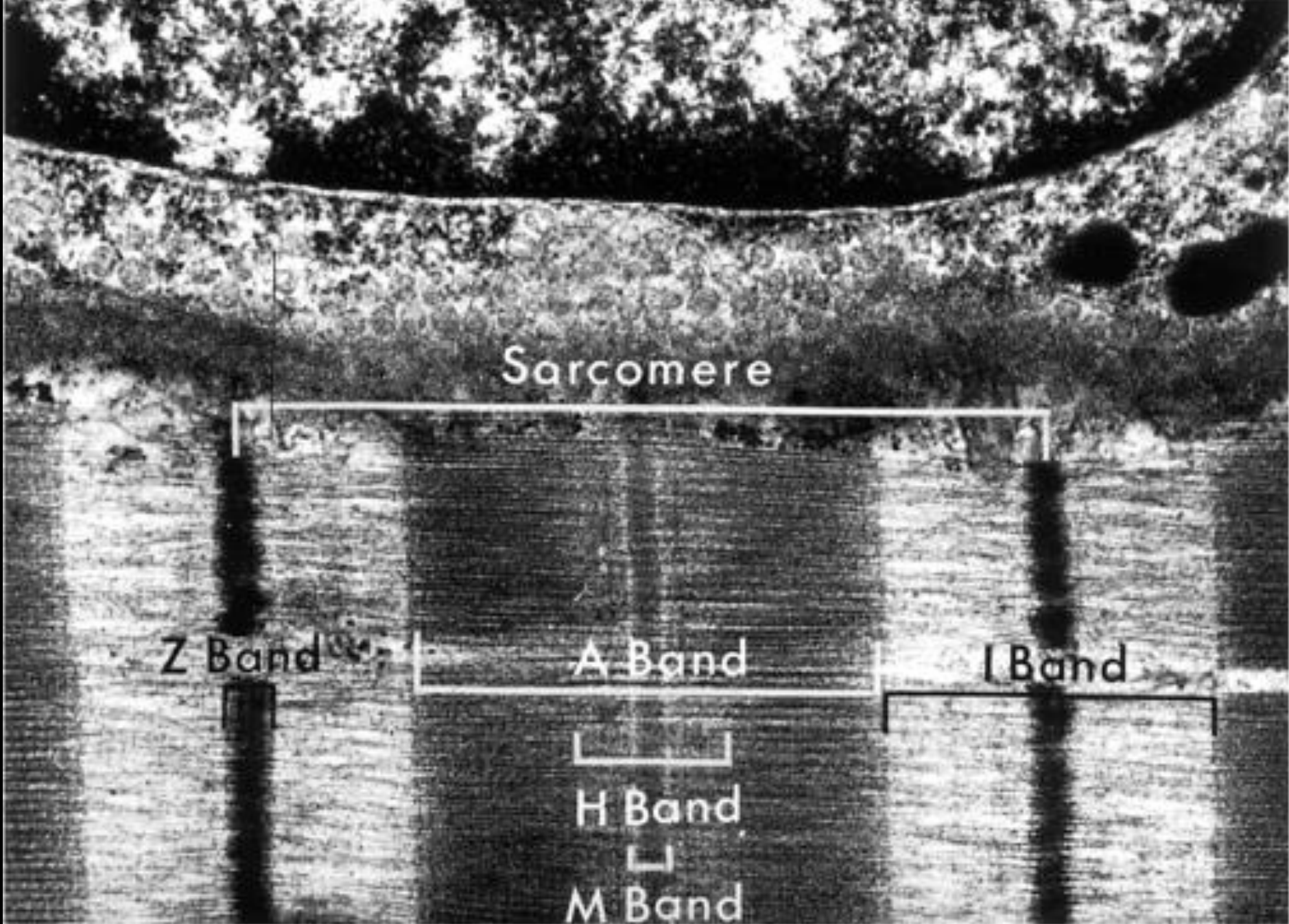
Z linie

mitochondrie

myofibrila



myofibrila



Sarcomere

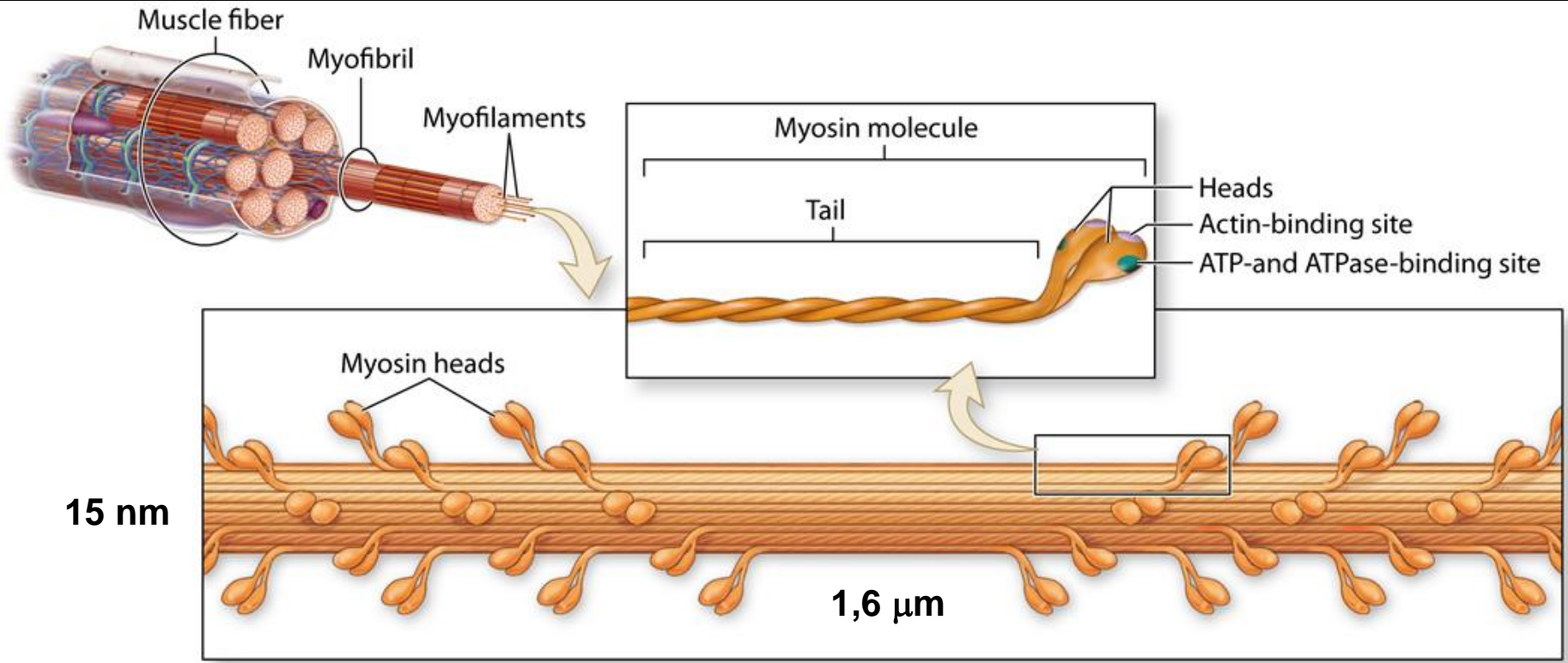
Z Band

A Band

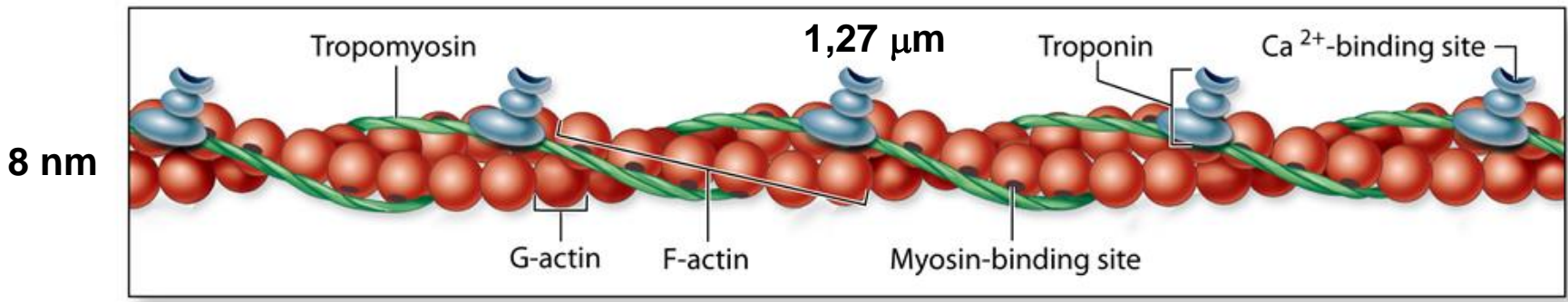
I Band

H Band

M Band

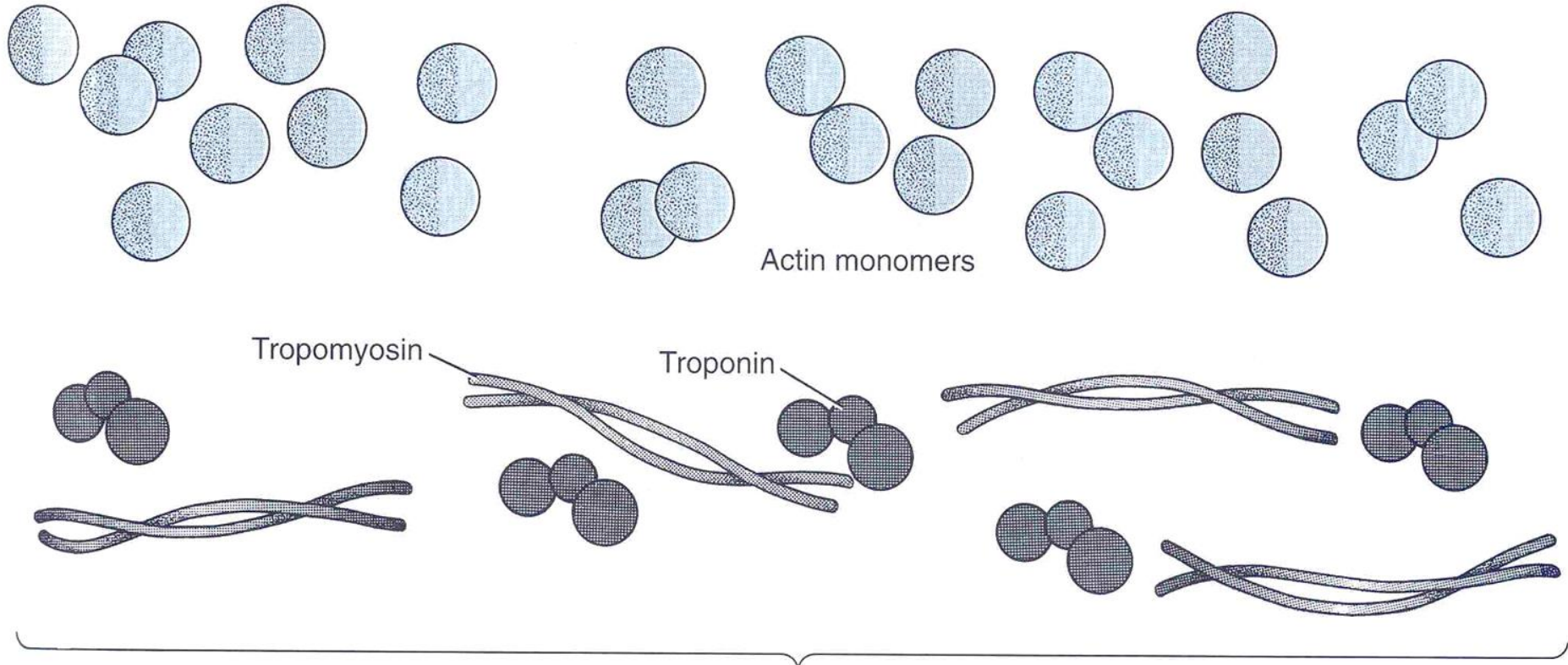


a Thick filament

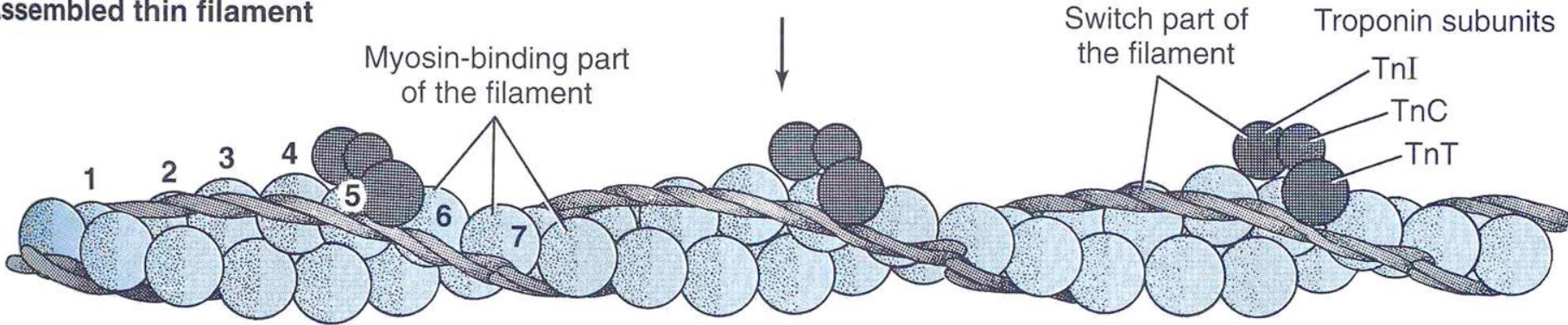


b Thin filament

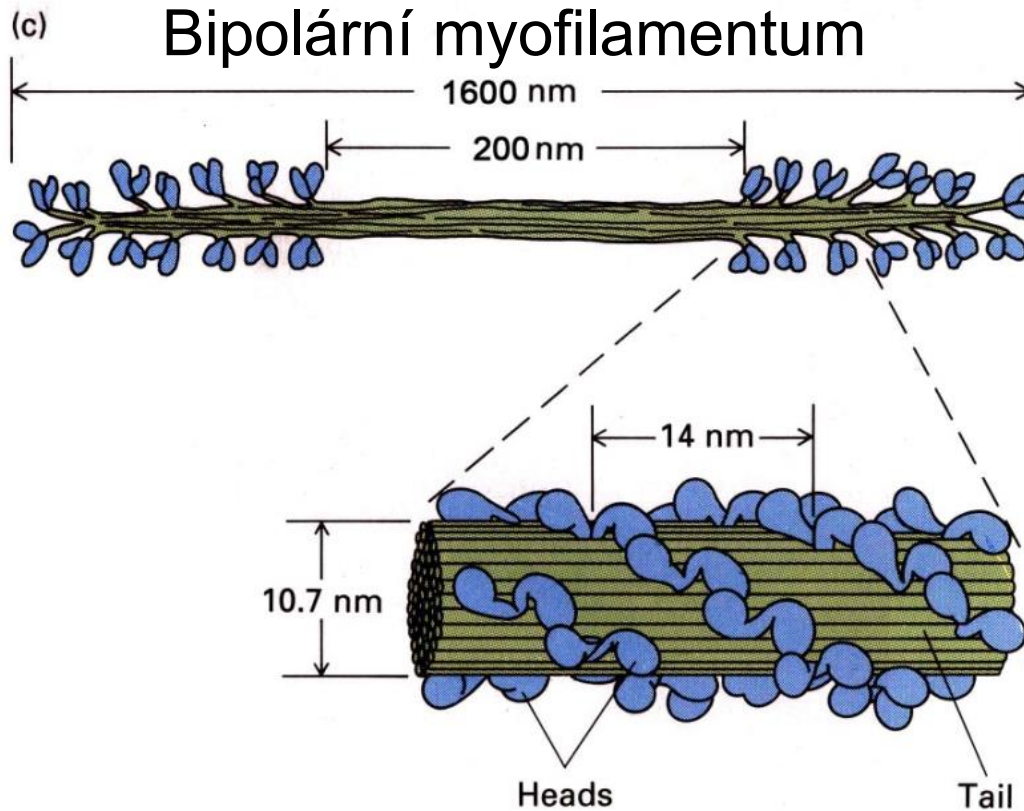
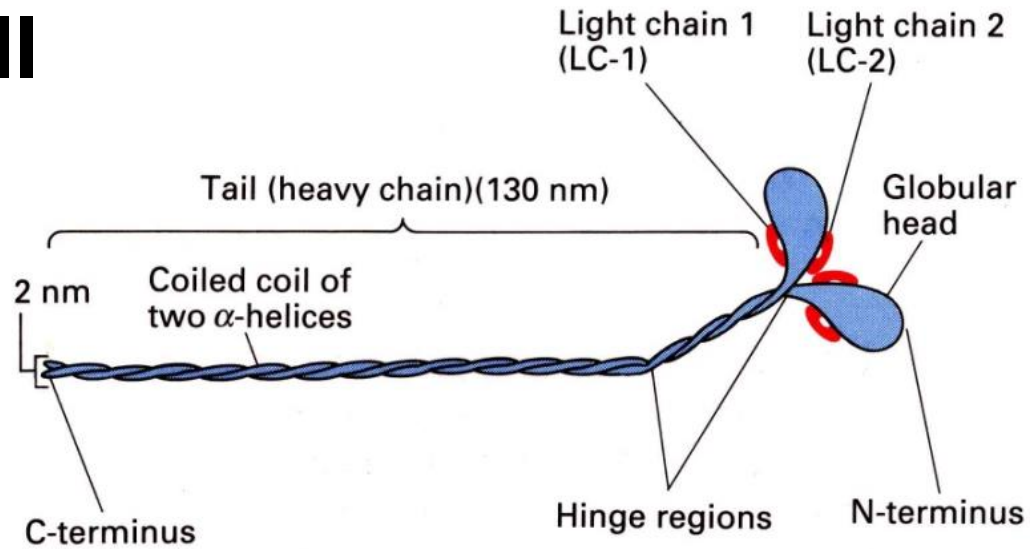
Disassembled components of the thin filament

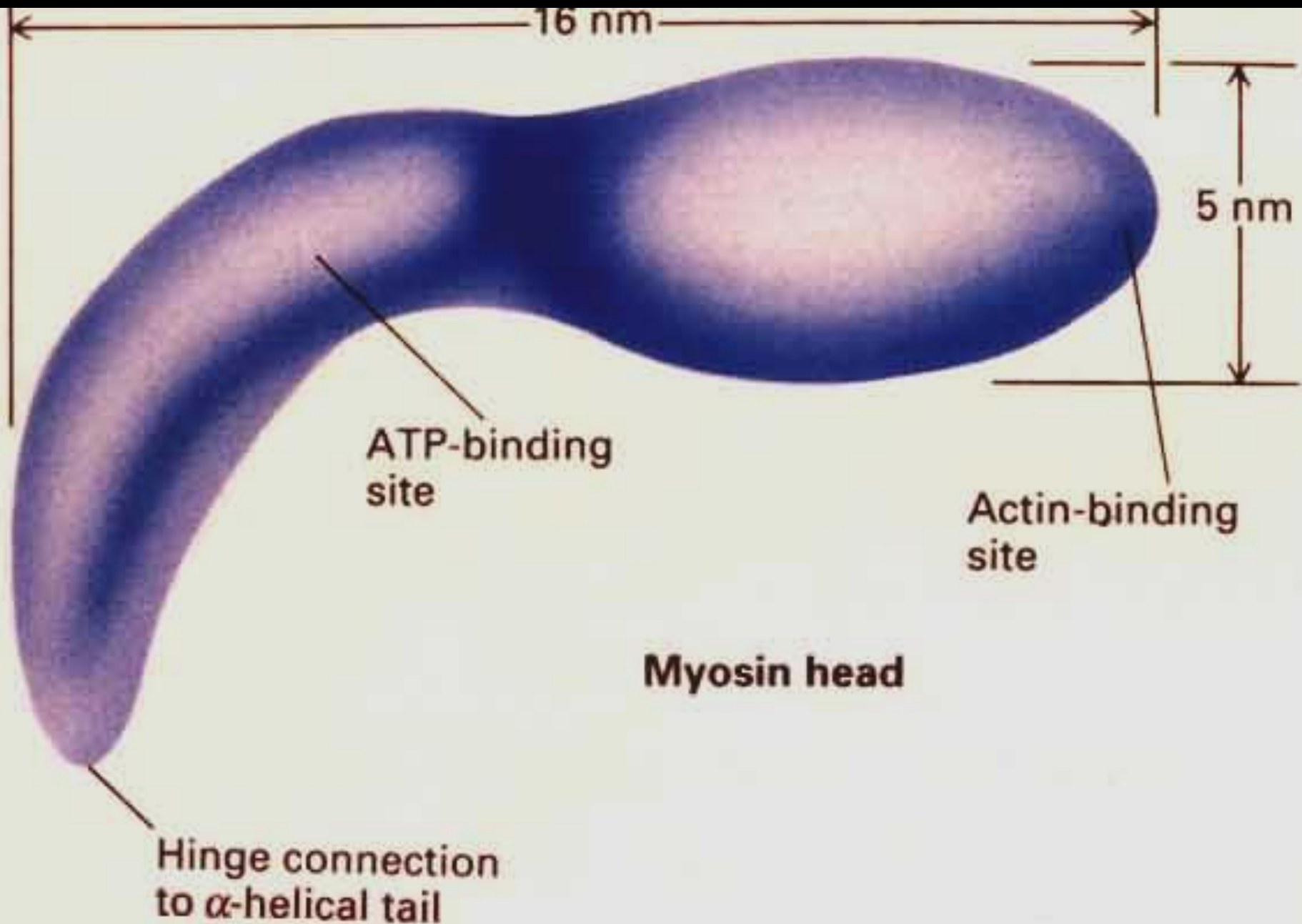


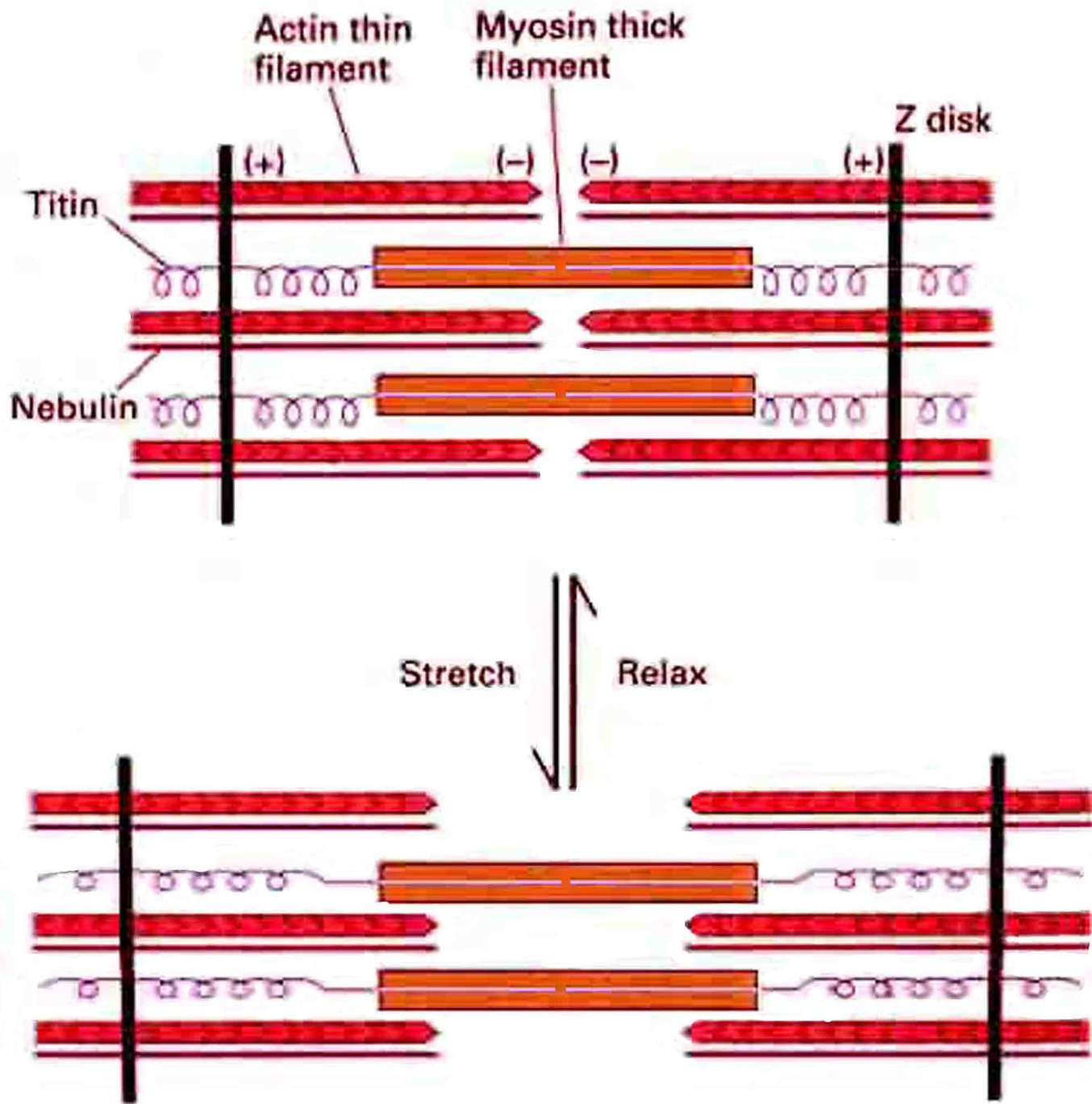
Assembled thin filament



Myosin II

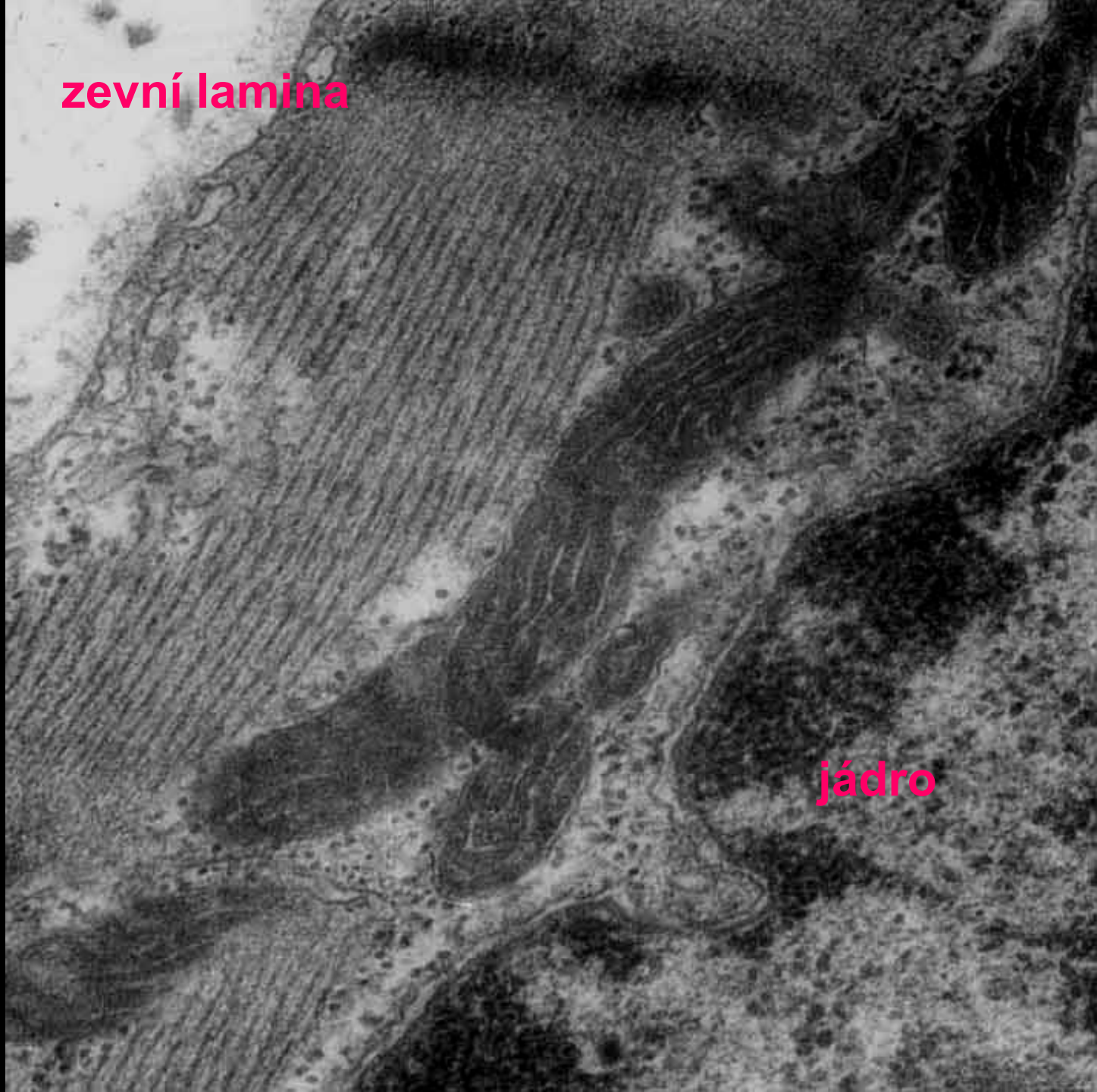






zevní lamina

jádro

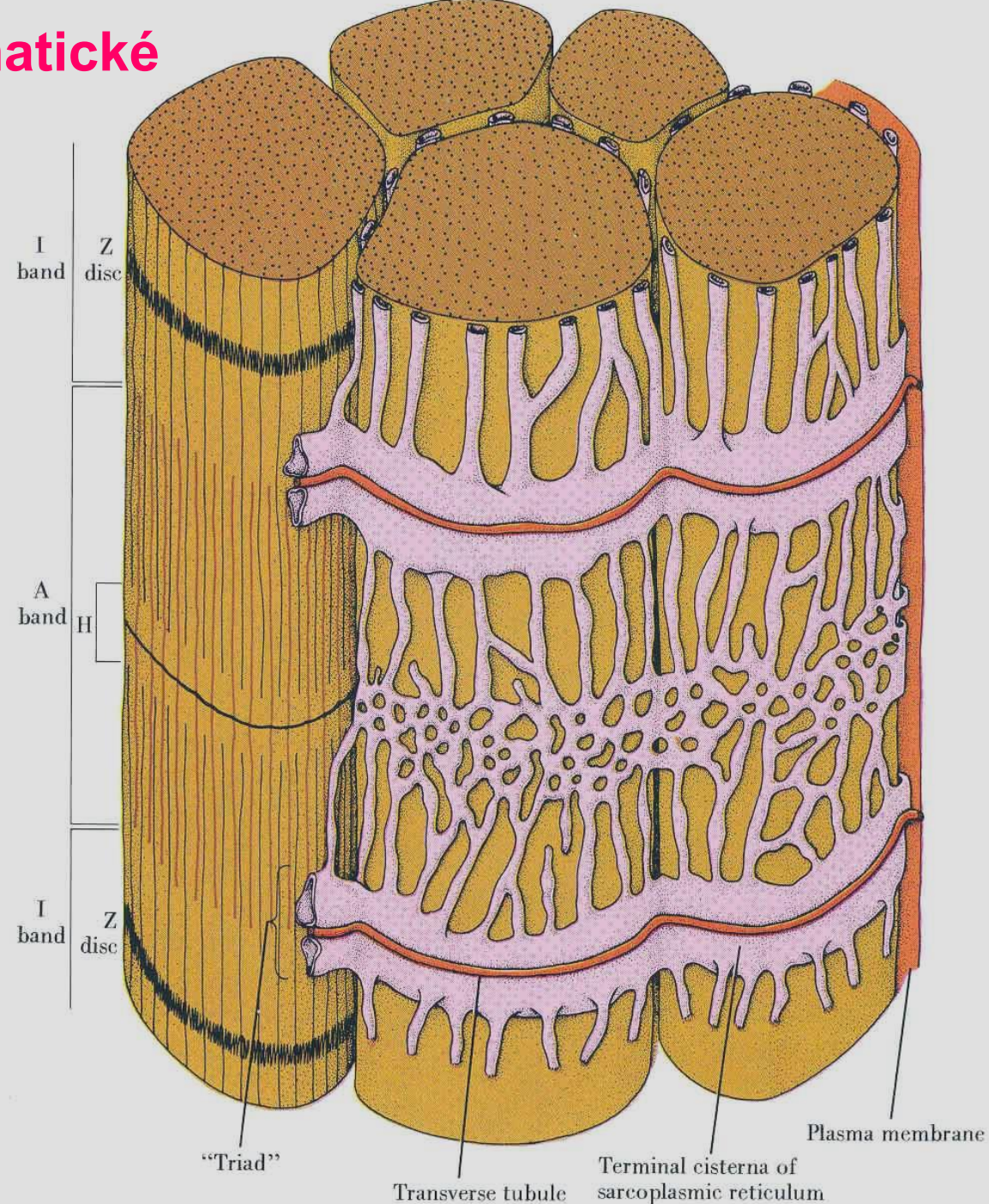


This is a high-magnification electron micrograph of muscle tissue. The image shows numerous mitochondria, which are dark, oval-shaped structures with internal folds called cristae. These mitochondria are distributed throughout the cytoplasm. On the right side of the image, there are large, organized bundles of myofibrils, which are the contractile units of muscle. The myofibrils exhibit a characteristic striated pattern with alternating light and dark bands. The overall texture is granular and highly detailed, typical of electron microscopy.

mitochondrie

myofibrila

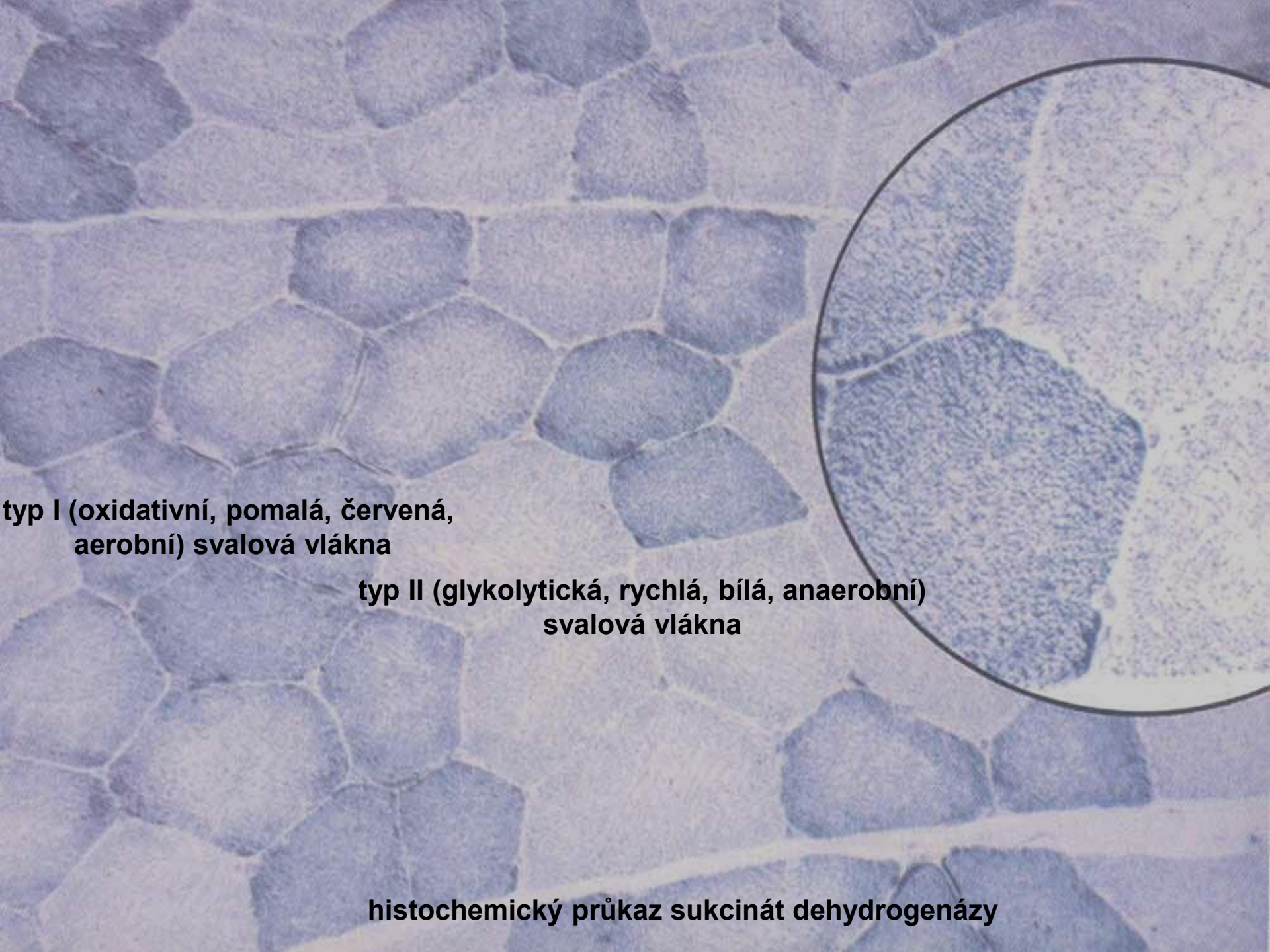
sarkoplasmické retikulum





triáda

This electron micrograph displays the ultrastructure of striated muscle tissue. The image shows multiple sarcomeres, the basic contractile units, characterized by their repeating pattern of dark and light bands. The dark bands represent the thick filaments (myosin), and the light bands represent the thin filaments (actin). The triads, labeled in red, are structures consisting of a central T-tubule flanked by two terminal cisternae of the sarcoplasmic reticulum, which are essential for the excitation-contraction coupling process. The overall appearance is highly organized and repetitive, typical of skeletal muscle fibers.



typ I (oxidativní, pomalá, červená,
aerobní) svalová vlákna

The image shows a histological section of skeletal muscle tissue stained for succinate dehydrogenase. The muscle fibers are arranged in parallel bundles. Type I fibers are characterized by their smaller size and darker staining, while Type II fibers are larger and stain lighter. A circular inset on the right provides a magnified view of a single fiber, highlighting the internal striations and the distribution of the enzyme. The overall appearance is that of a well-developed skeletal muscle with a clear distinction between the two fiber types.

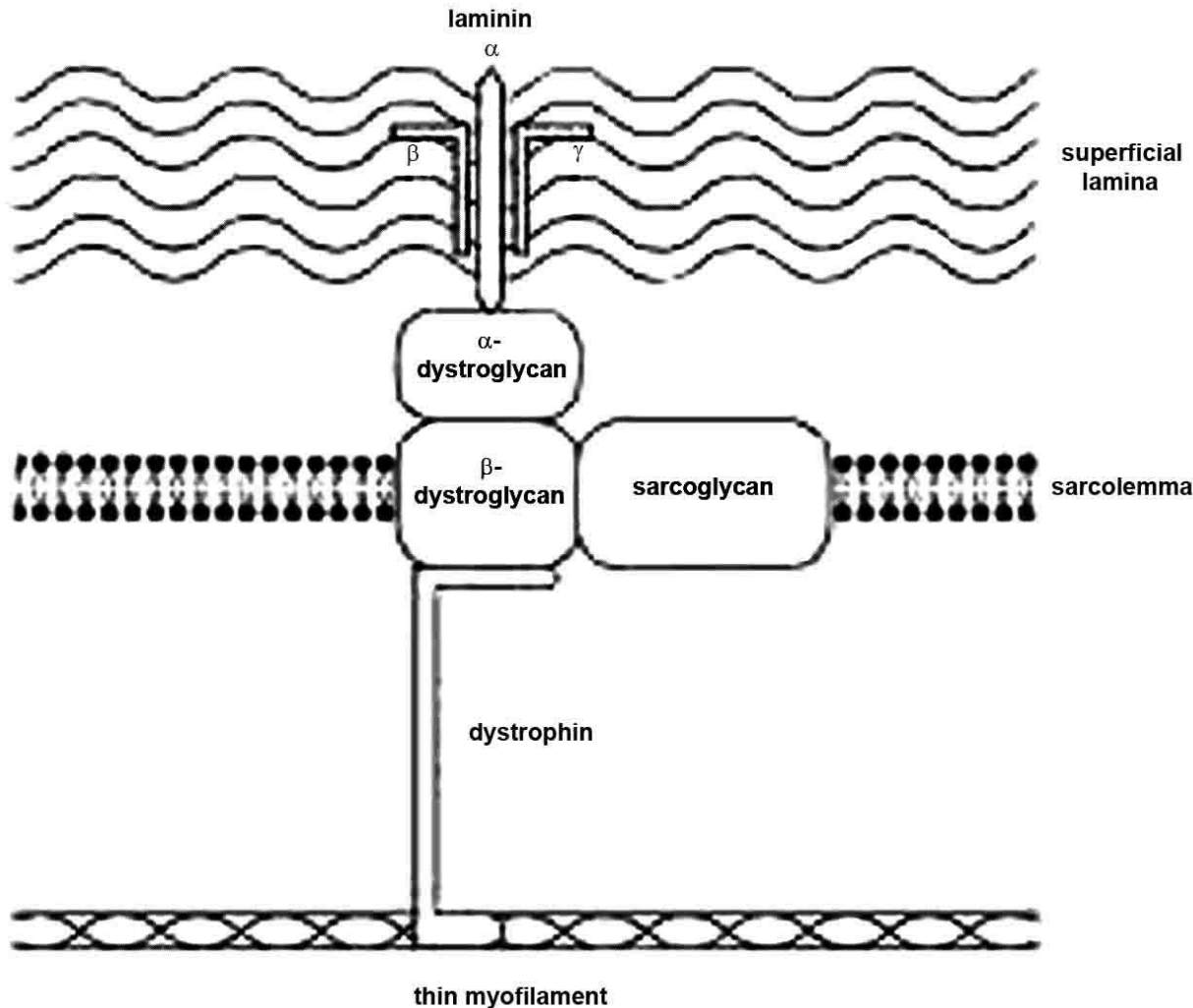
typ II (glykolytická, rychlá, bílá, anaerobní)
svalová vlákna

histochemický průkaz sukcinát dehydrogenázy

kontrakce myofibril musí být přenesena na sarkolemu a do endomysia periferní myofibrily propojeny se sarkolemou u Z-linie

ZJEDNODUŠENÉ SCHEMA KOSTAMERY („ŽEBROVÍ“)

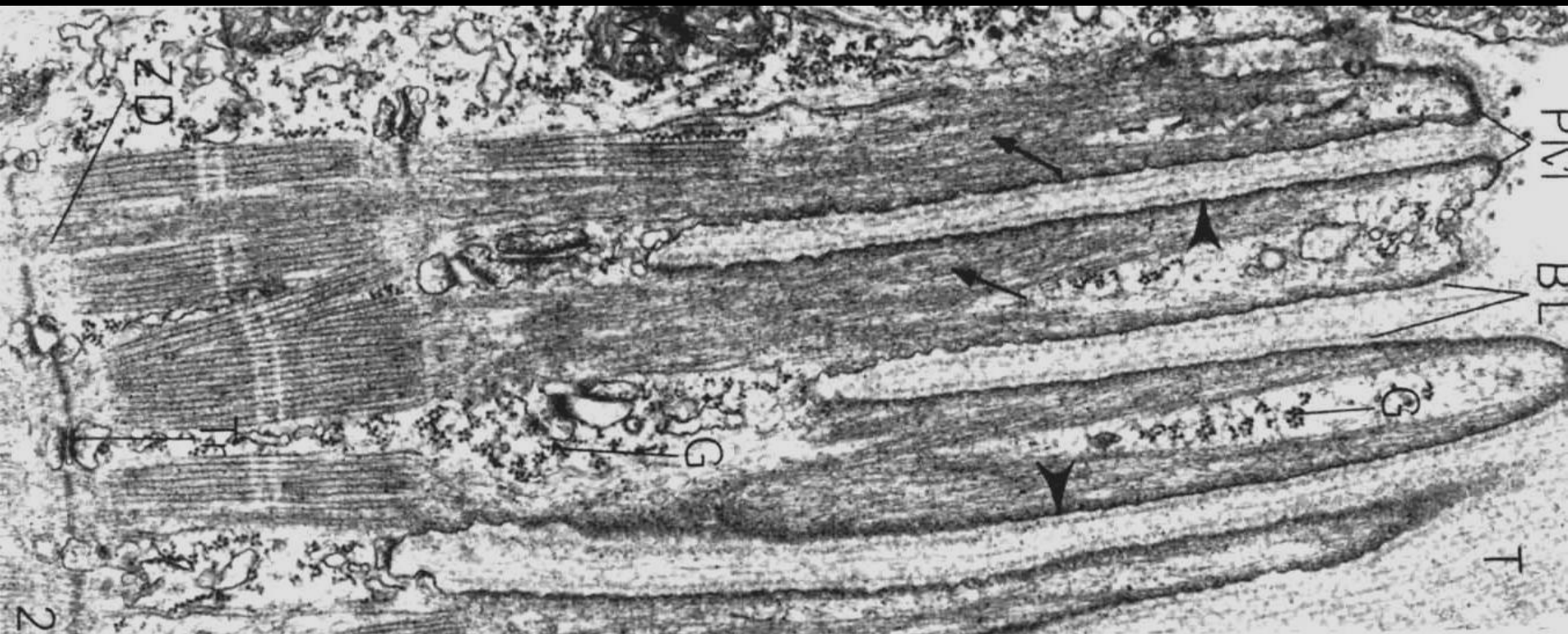
SIMPLIFIED SCHEME OF A COSTAMERE



kostamera („žebroví“)

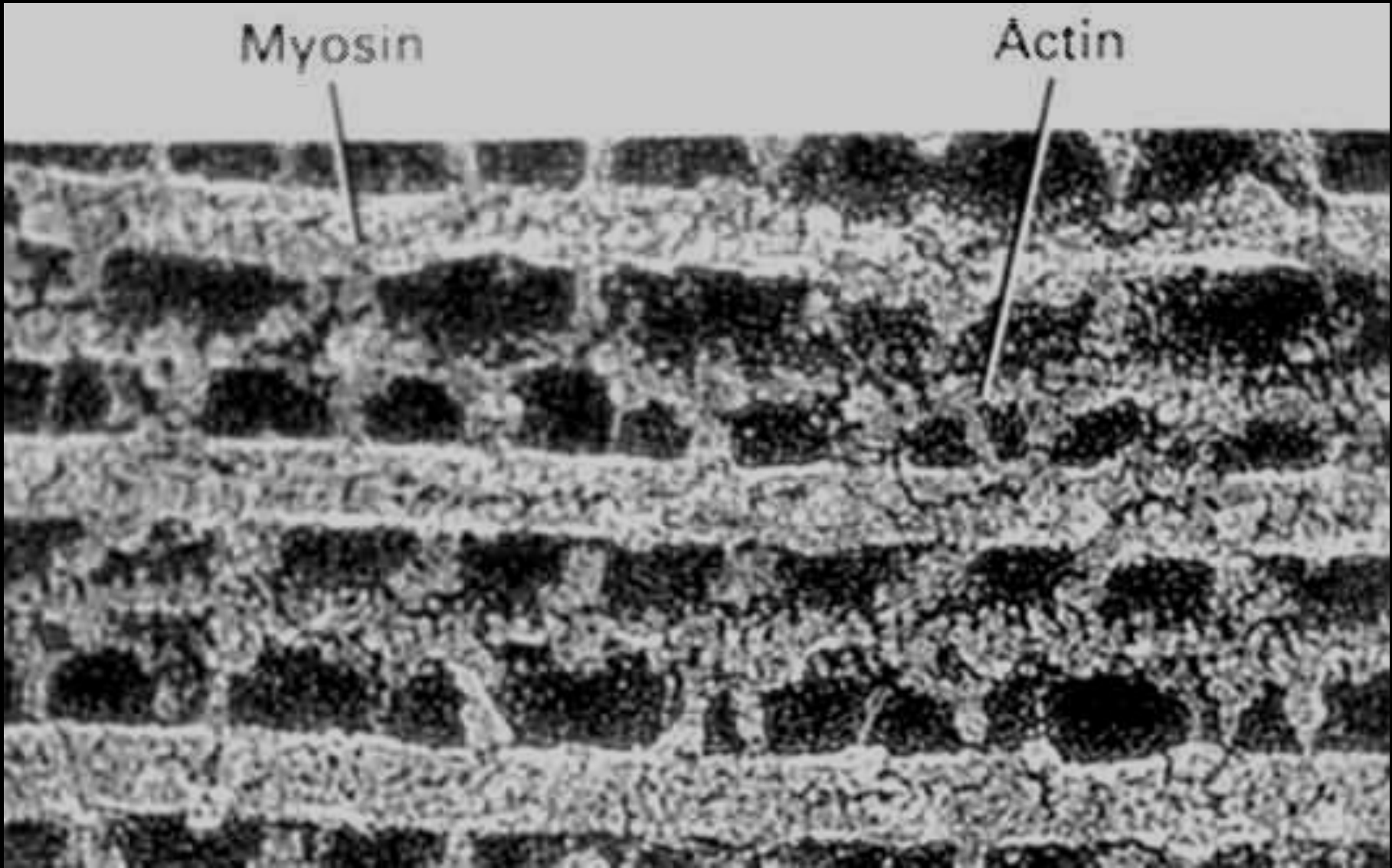
dystrofin
dystroglykan
sarkoglykan
synemin
synkoilin
dystrobrevin
sarkospan

Spojení svalového vlákna a šlachy



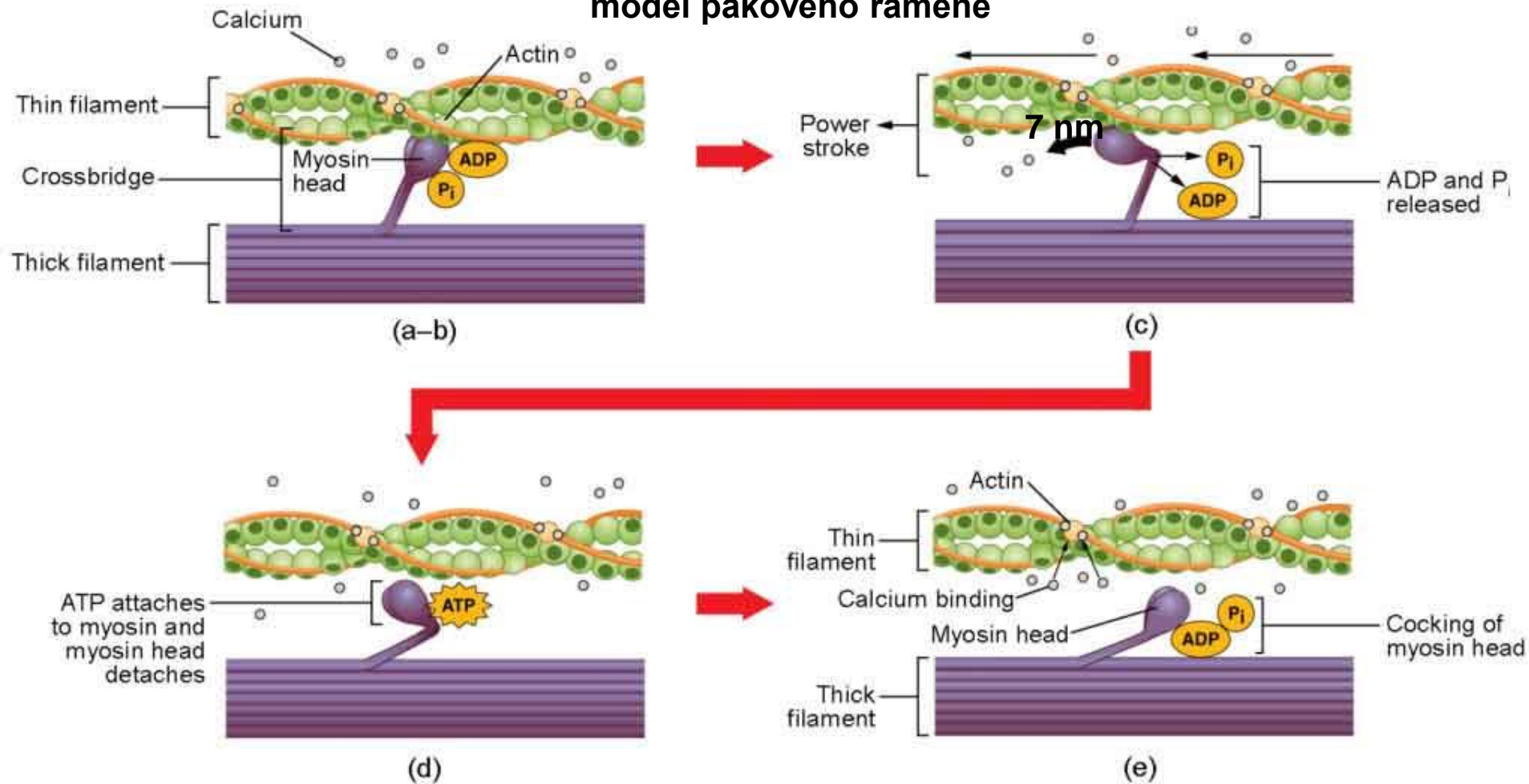
Kontraktilita

- interakce aktinu a myosinu
- oba proteiny tvoří filamenta = tenká a tlustá **myofilamenta**



Příčně pruhovaná svalovina (srdeční a svalová)

model pákového ramene



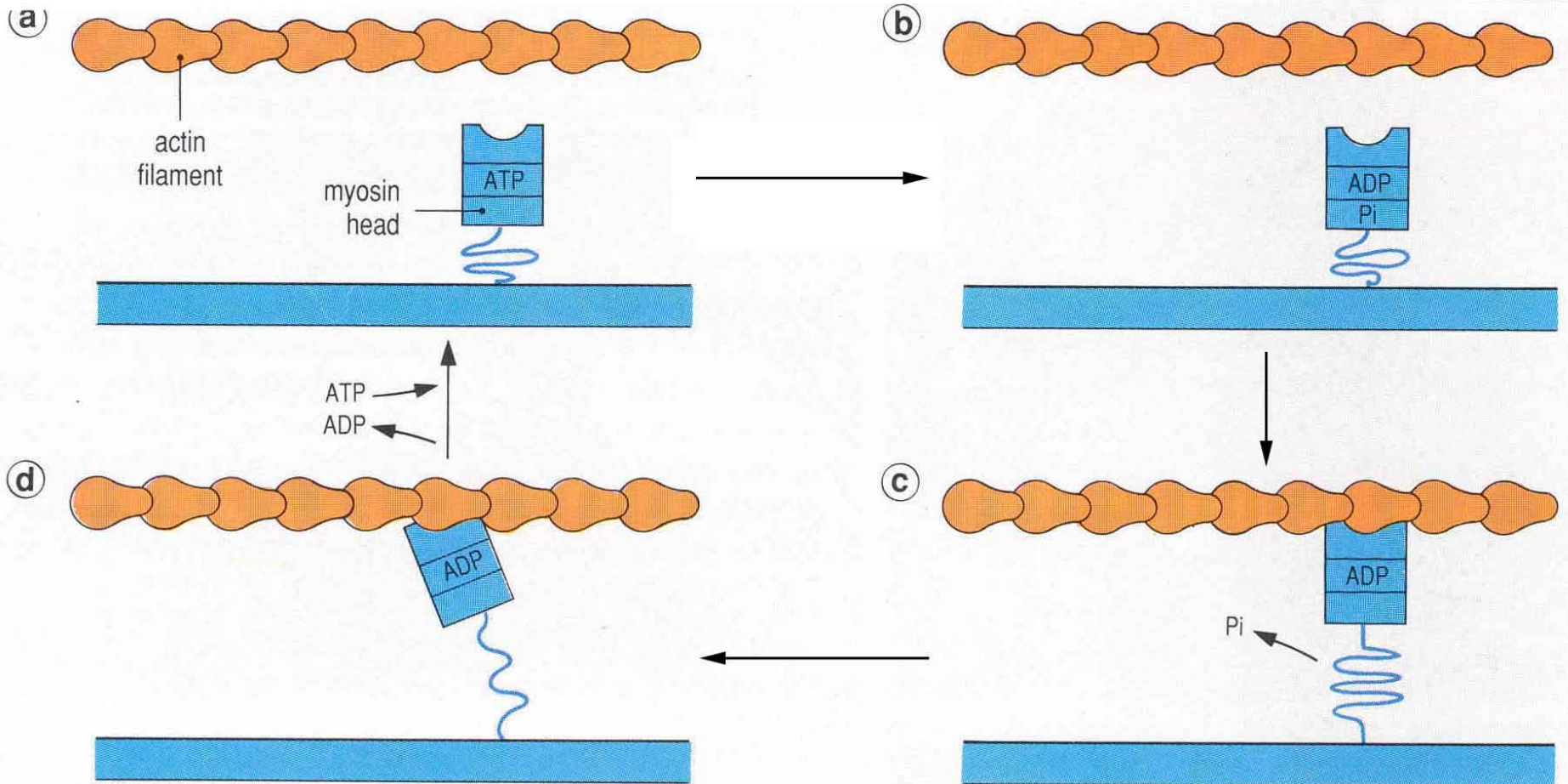
**1) ATP je dostupný a navázaný na myosin,
Ca²⁺ není dostupný – klidový stav**

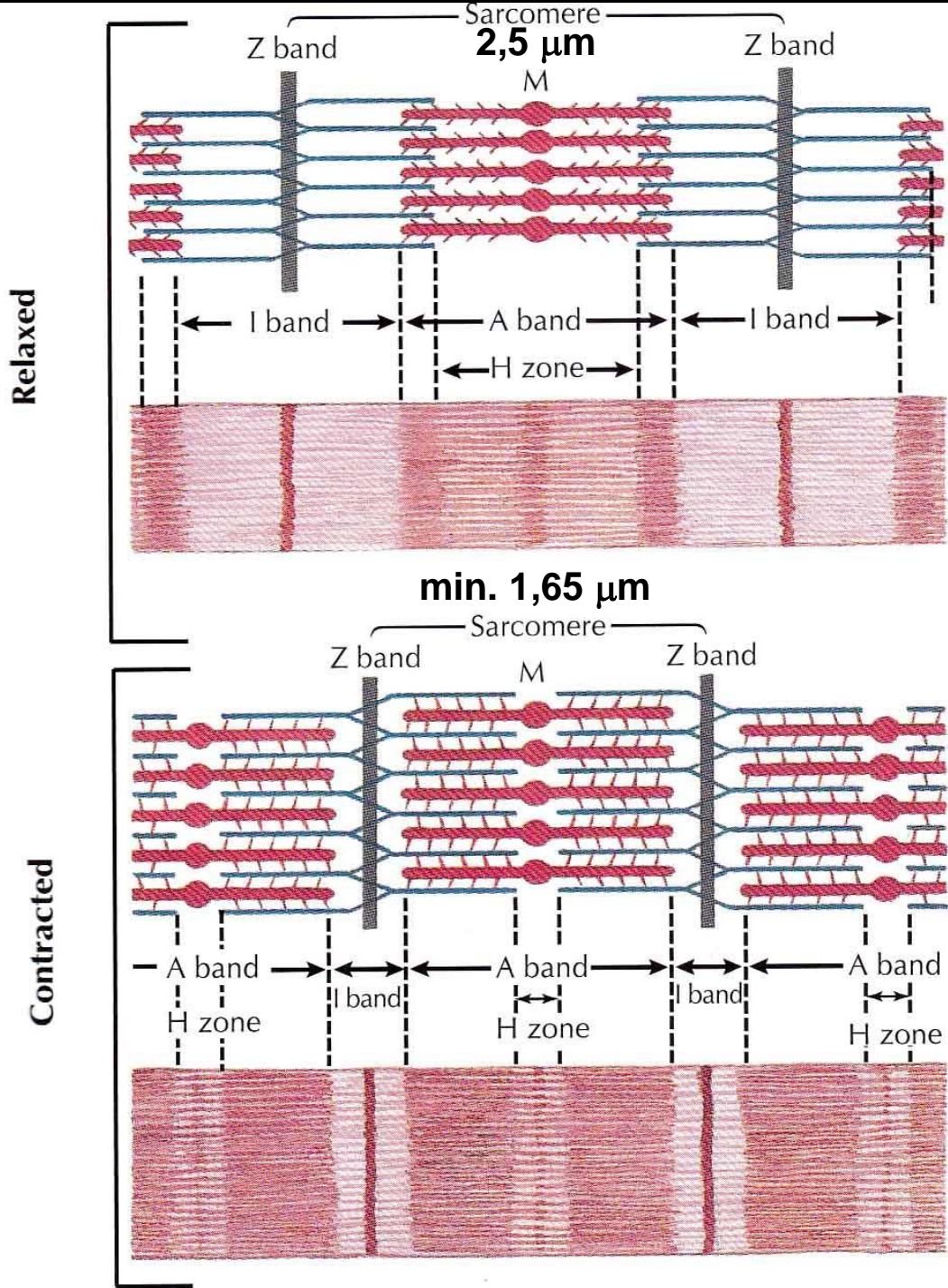
**2) štěpení ATP na ADP a Pi bez uvolnění štěpných
produktů, Ca²⁺ dostupný, TnI uvolní vazebné místo a
myosin se naváže na aktin (aktin je třeba jako kofaktor
pro uvolnění štěpných produktů)**

**3) uvolněná energie posunuje pákové raménko
o necelých 7 nm**

**4) navázání další molekuly ATP na myosin oslabí
aktinomyosinový můstek,
cyklus se opakuje, dokud je k dispozici Ca²⁺**

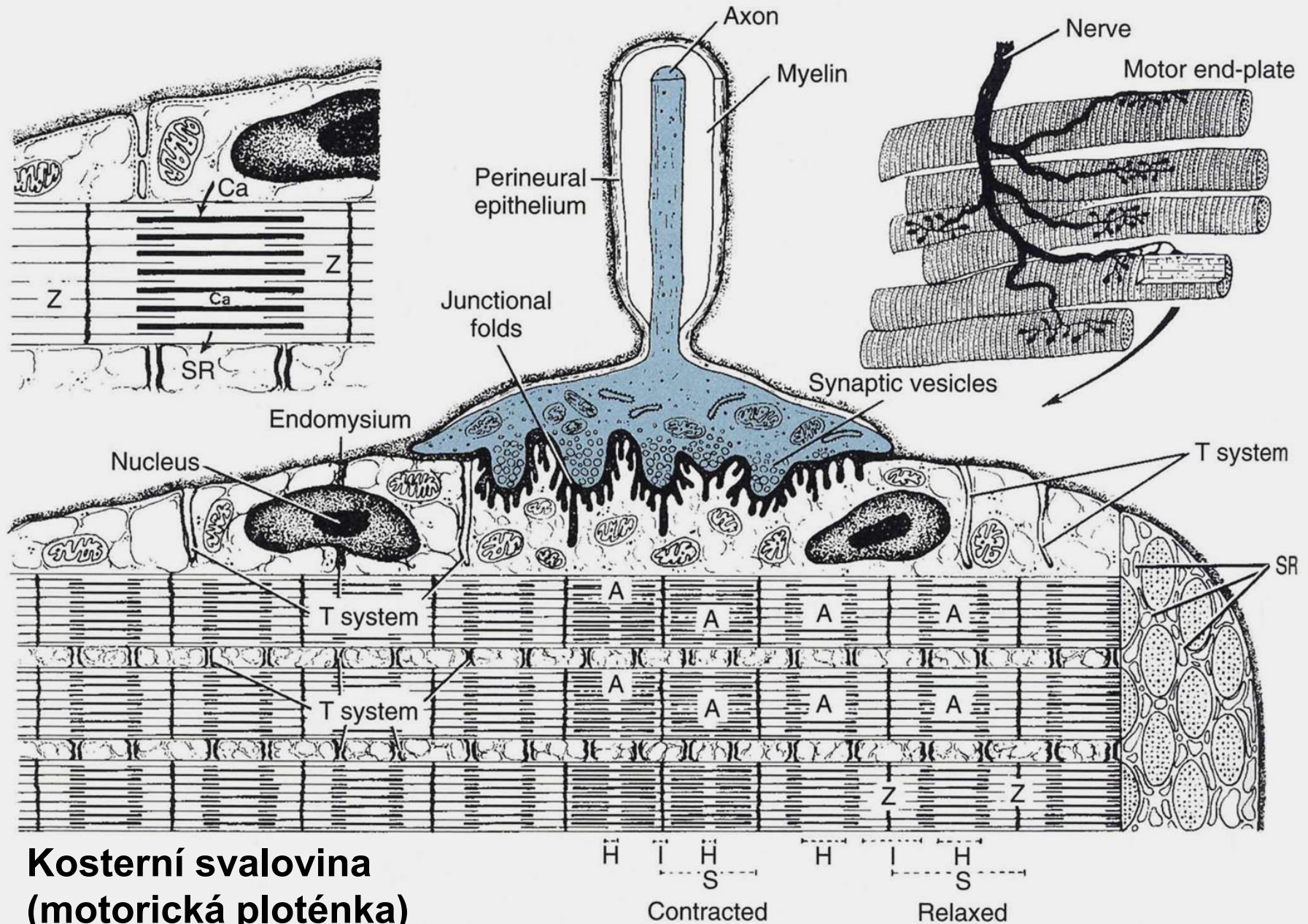
**RIGOR MORTIS: ATP není dostupný, Ca²⁺ je dostupný -
myosinové hlavy ve vazbě na aktin zůstávají**



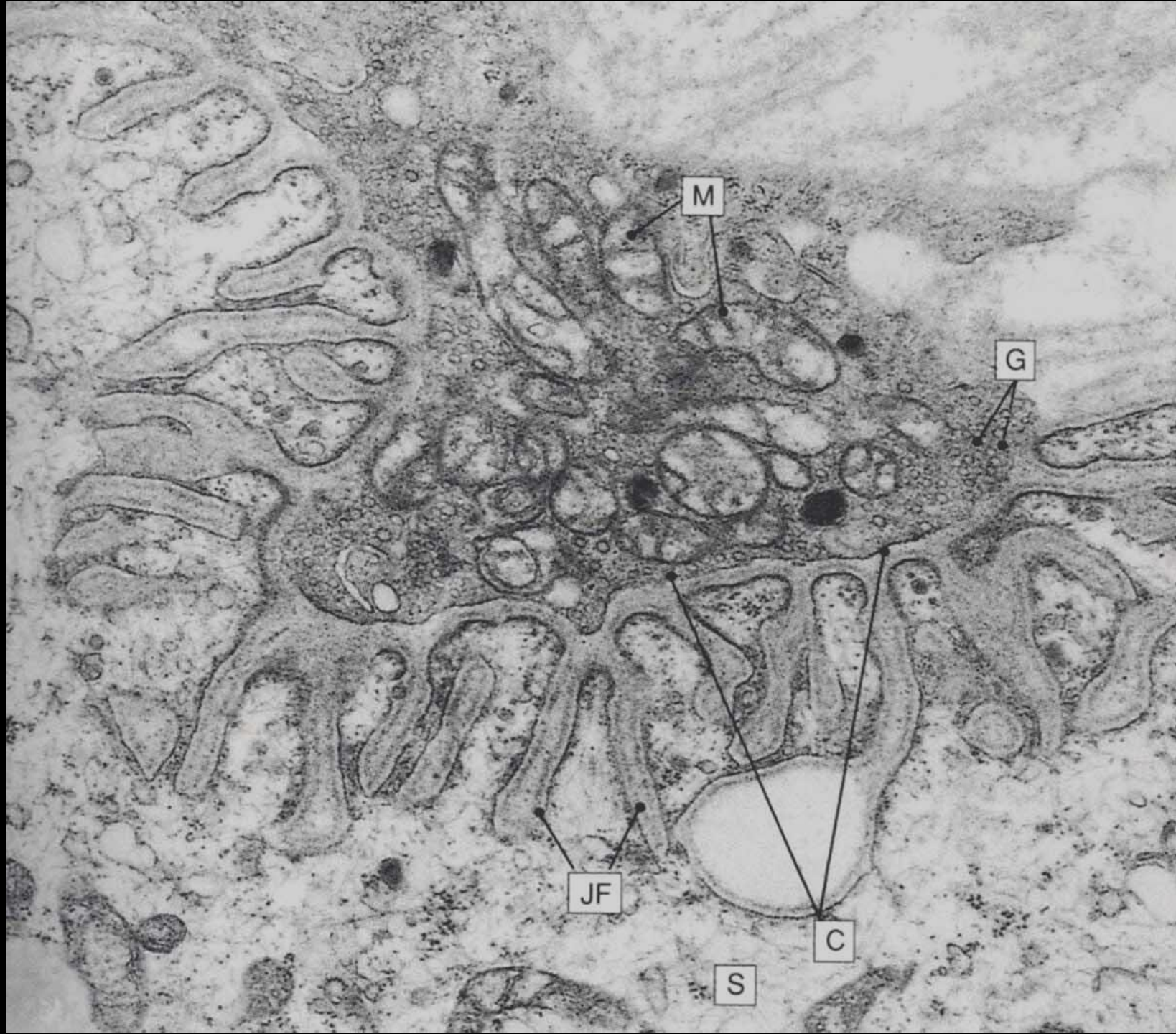


Ovalle W.K.,
 Nahirney P.C.:
 Netter's Essential
 Histology. 2nd Ed.,
 Elsevier 2013

Řízení svalové kontrakce



**Kosterní svalovina
(motorická ploténka)**

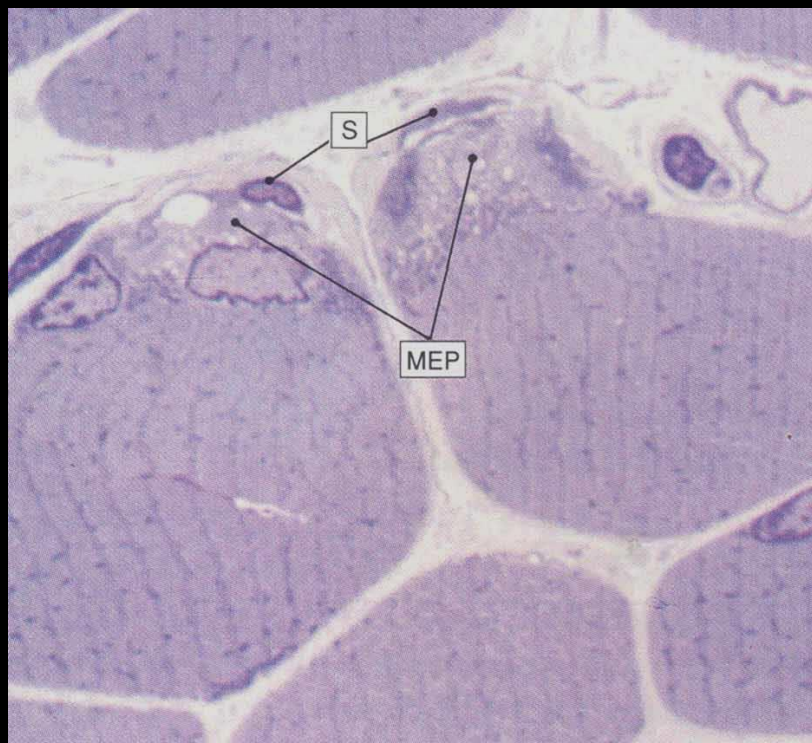


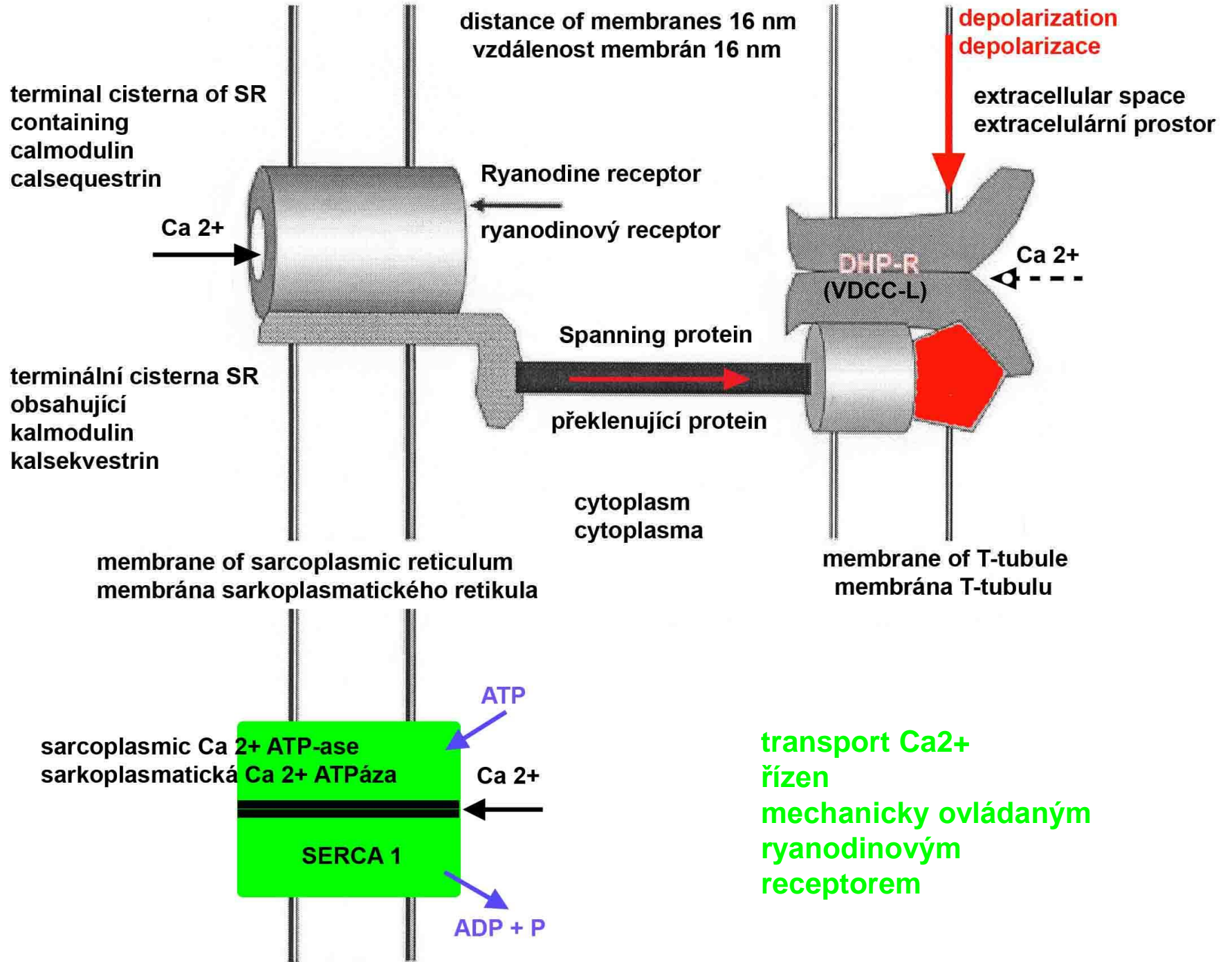


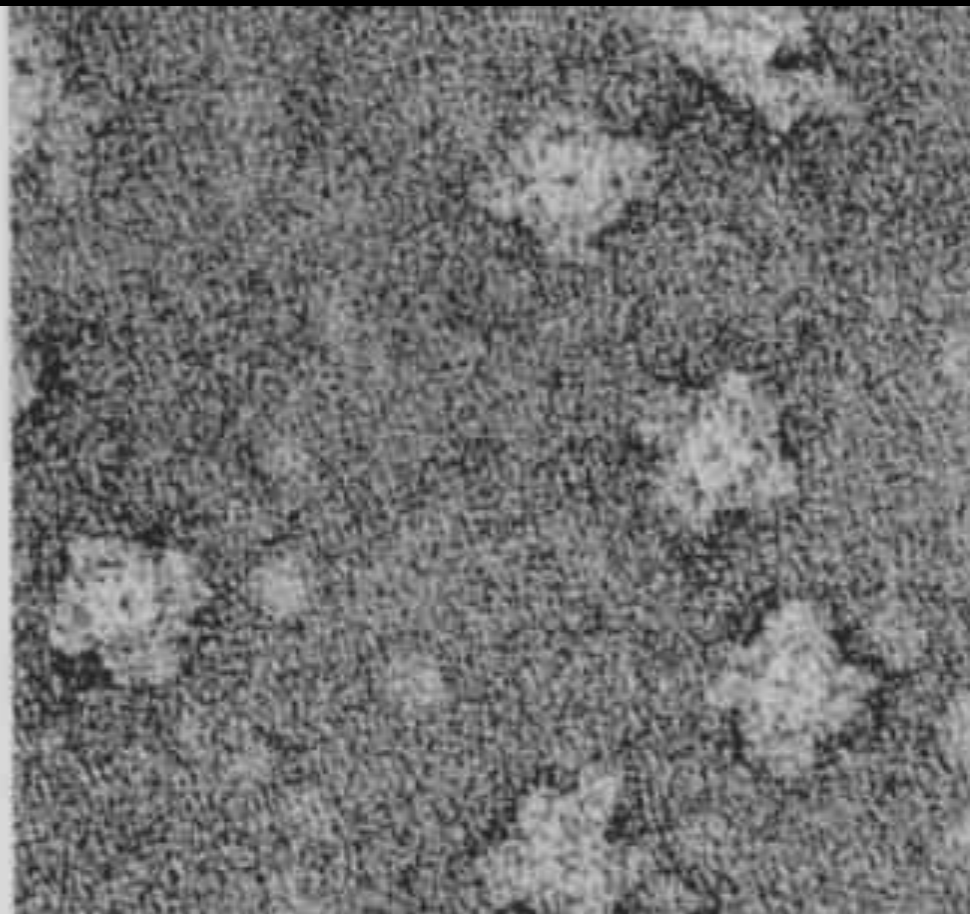
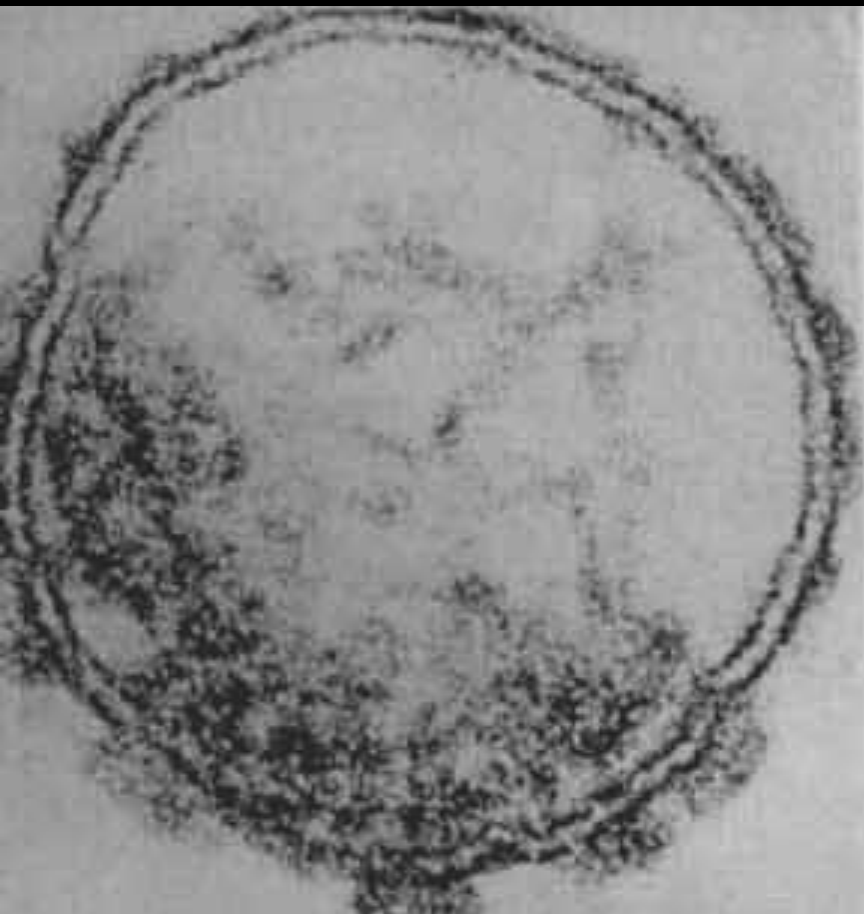
impregnace Ag



histochemický průkaz acetylcholinesterázy

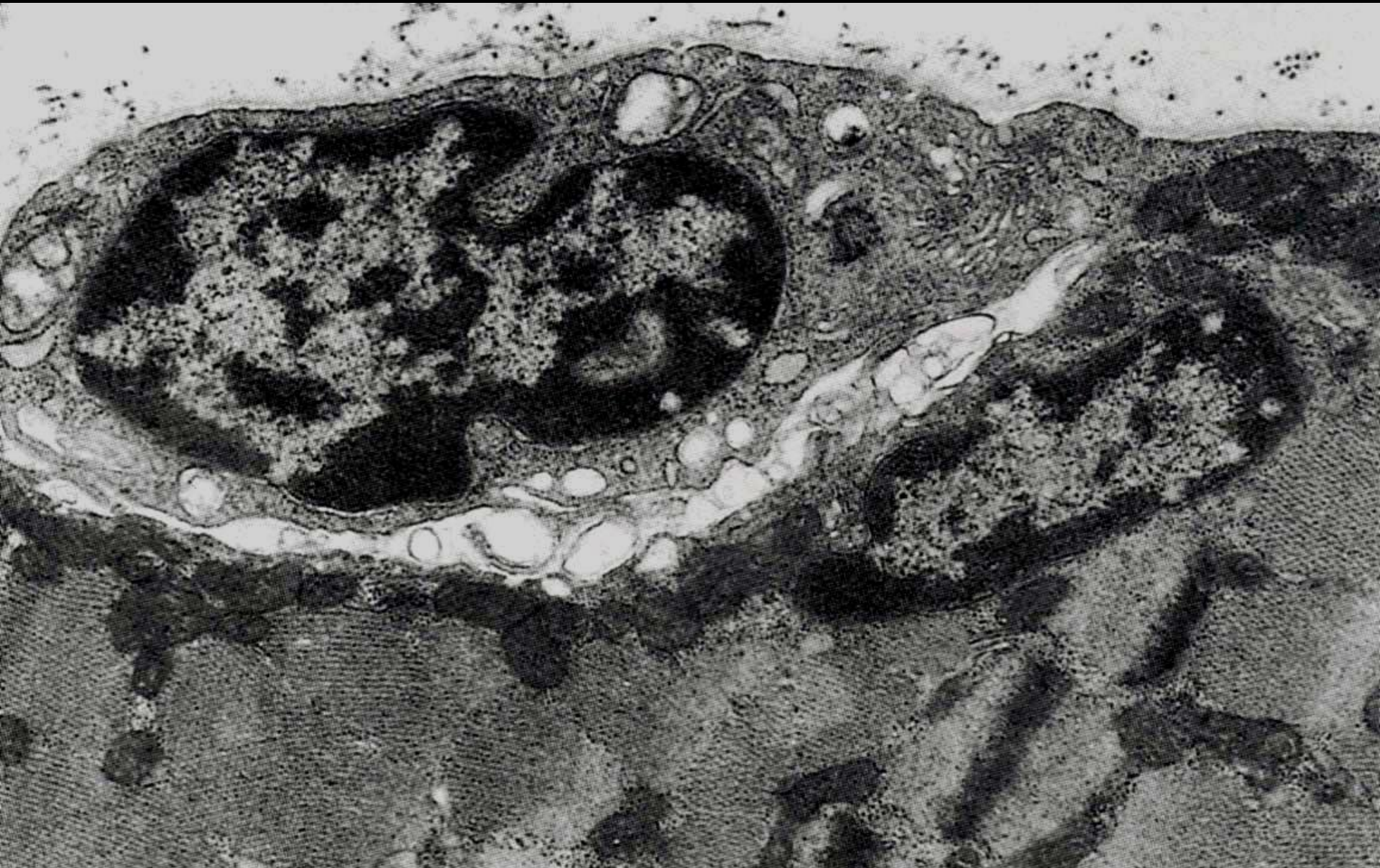






Regenerace kosterní svalové tkáně

satelitová buňka (myoblast)



Příčně pruhovaná svalová tkáň srdeční

základní jednotka: KARDIOMYOCYT

**většinou cylindrický, často rozvětvený element s jedním,
řídce se dvěma jádry – BUŇKA**

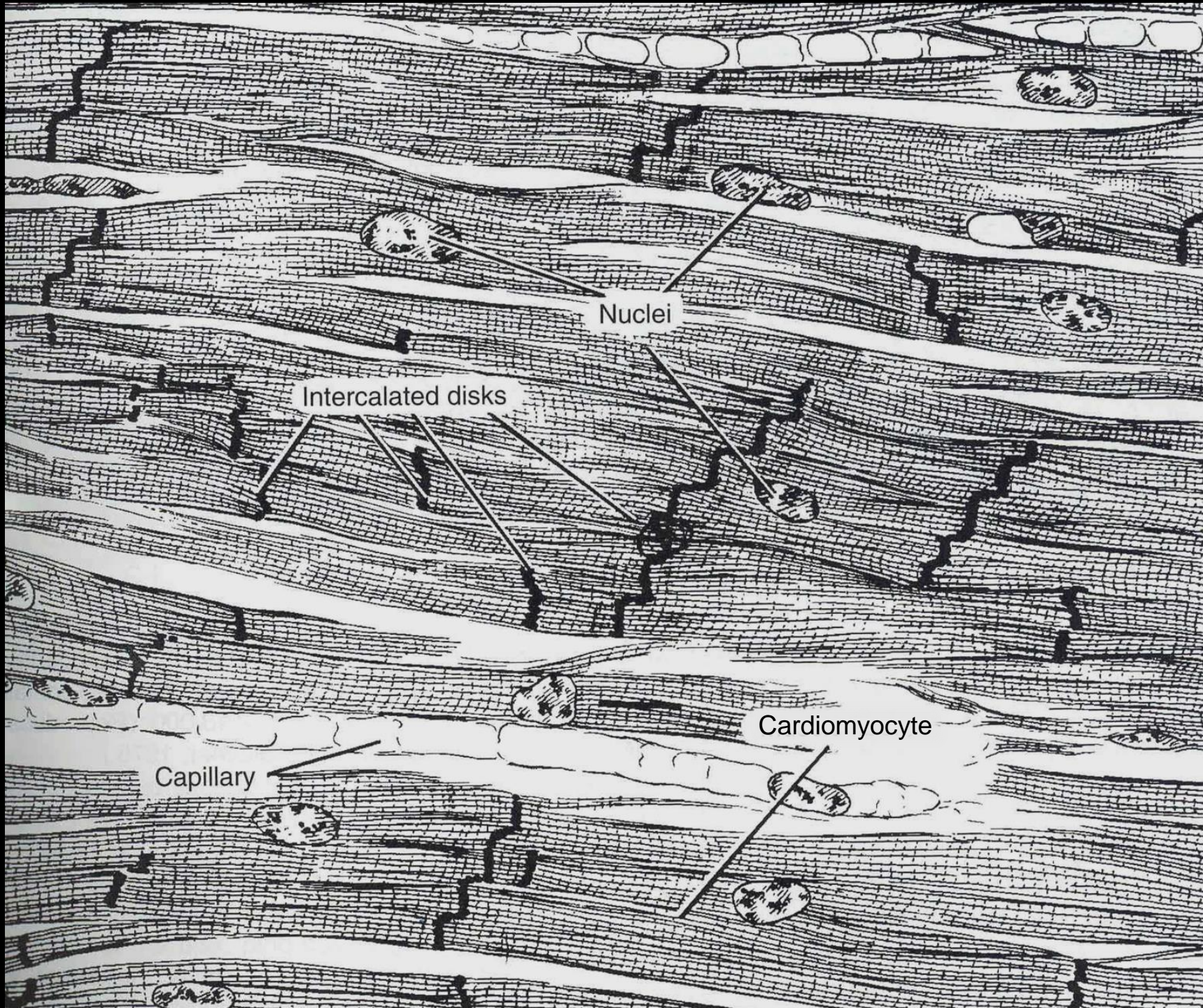
rytmická kontrakce bez volní kontroly

délka: kolem stovky mikrometrů

průměr: 15 - 20 mikrometrů

jádro umístěné ve středu buňky

myofilamenta uspořádána do myofibril

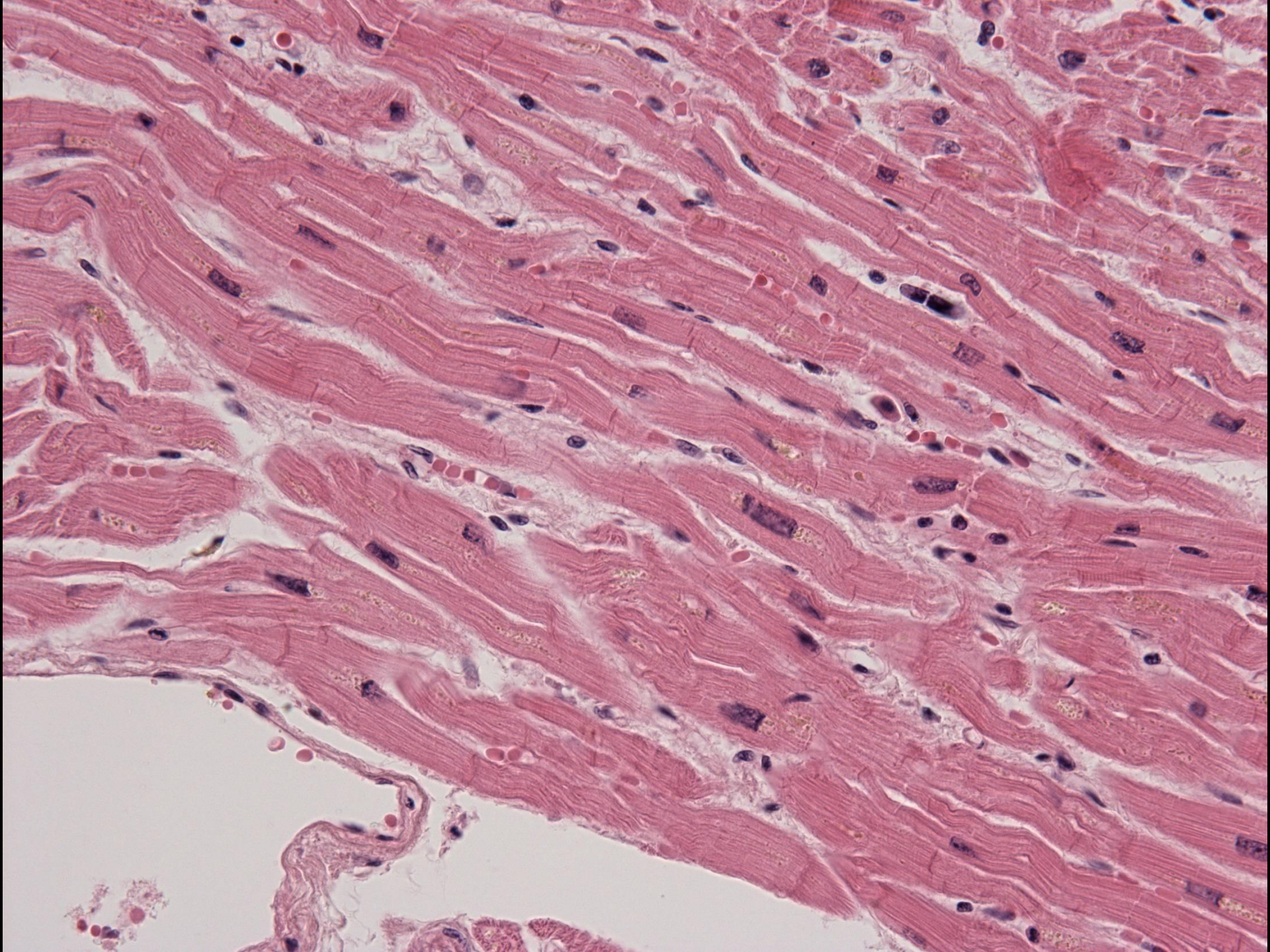


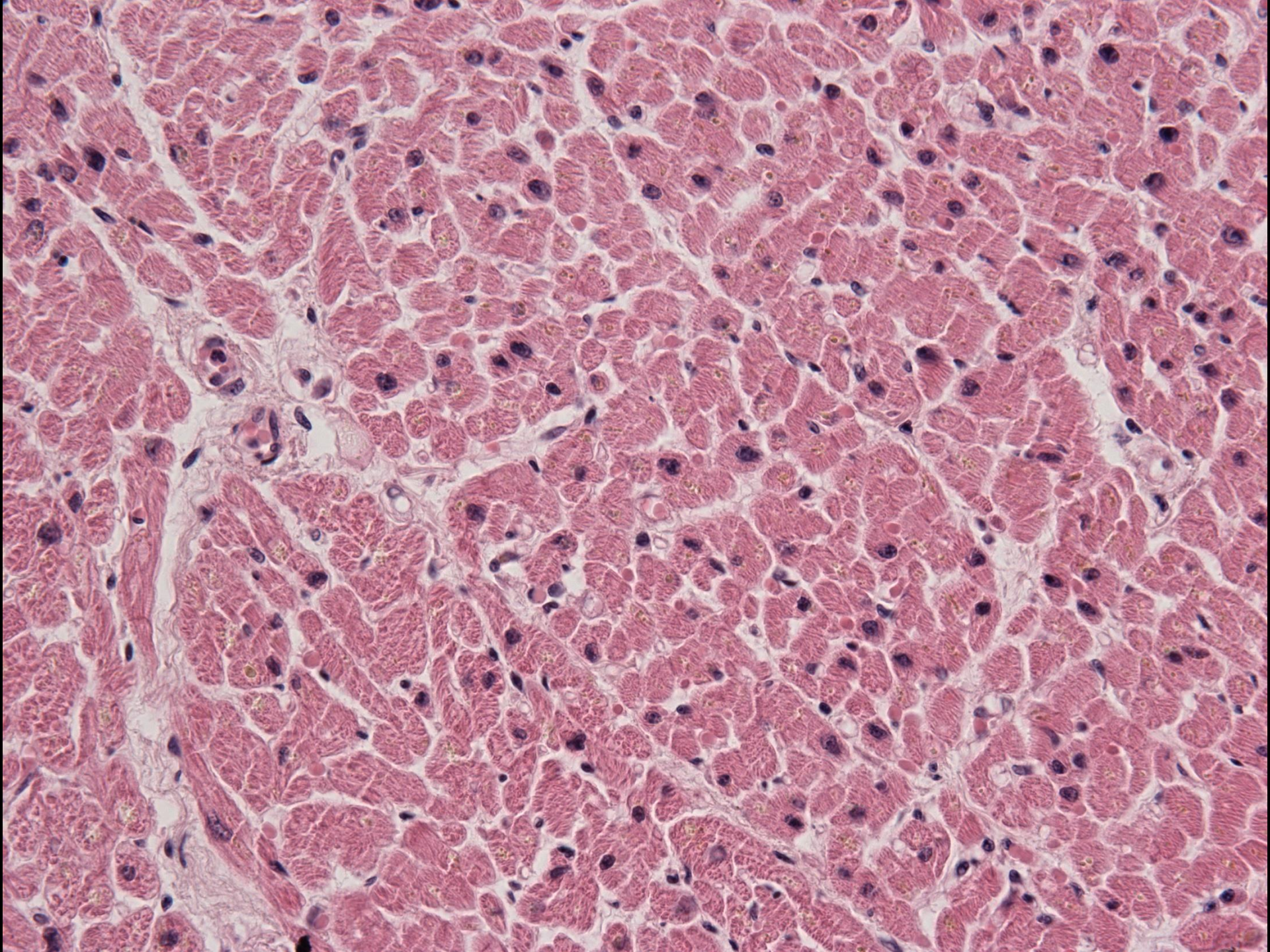
Nuclei

Intercalated disks

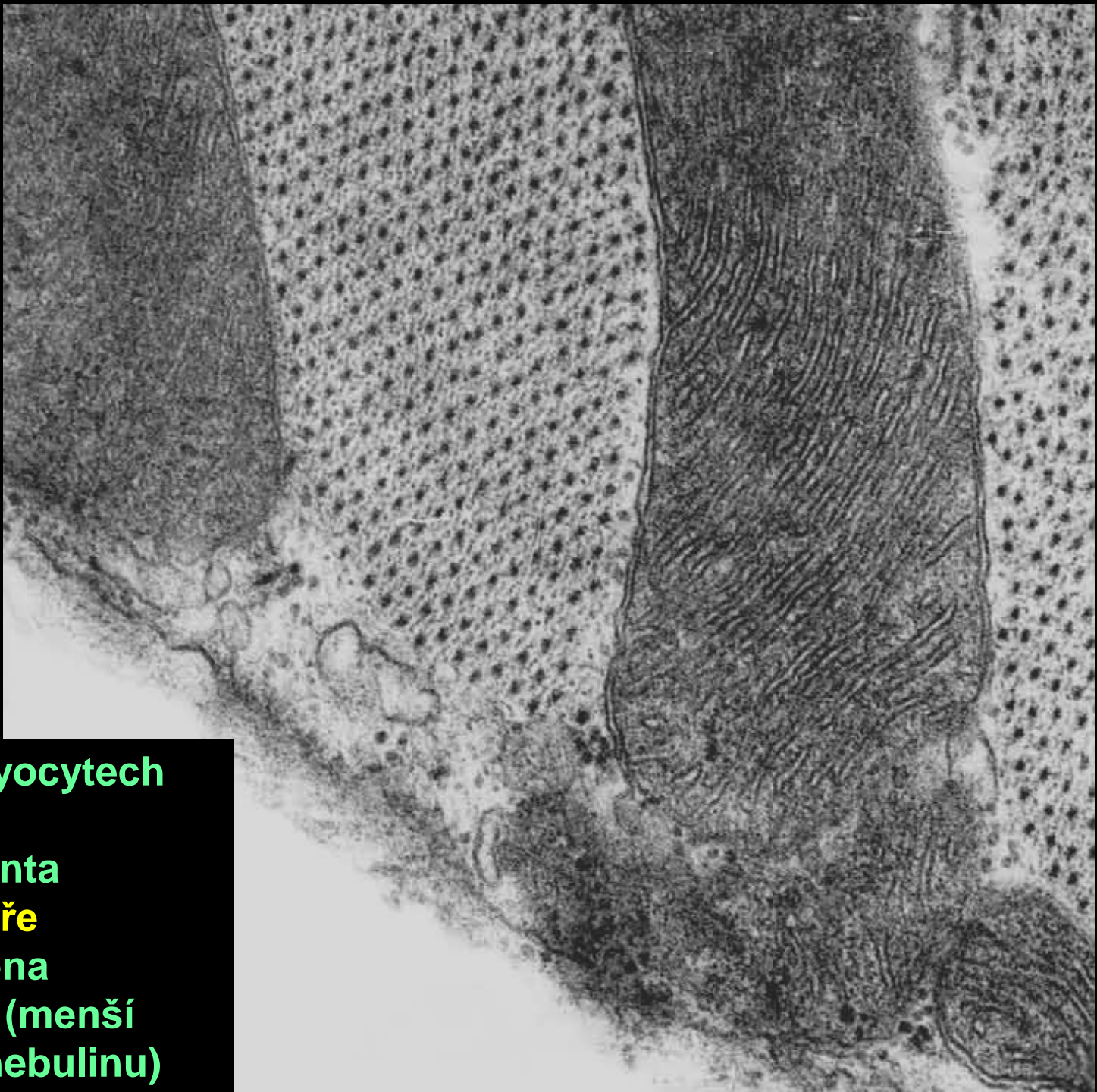
Cardiomyocyte

Capillary





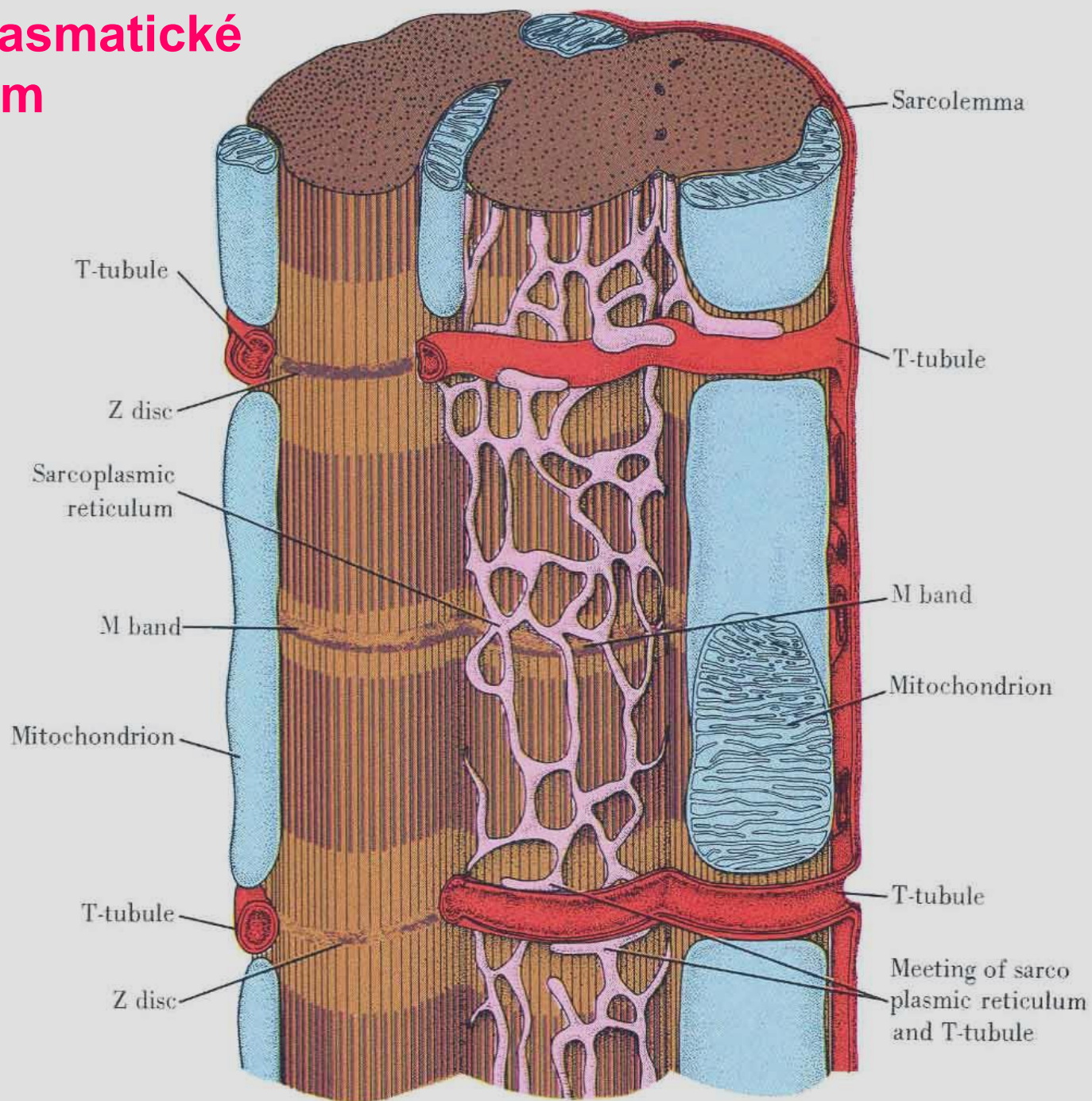


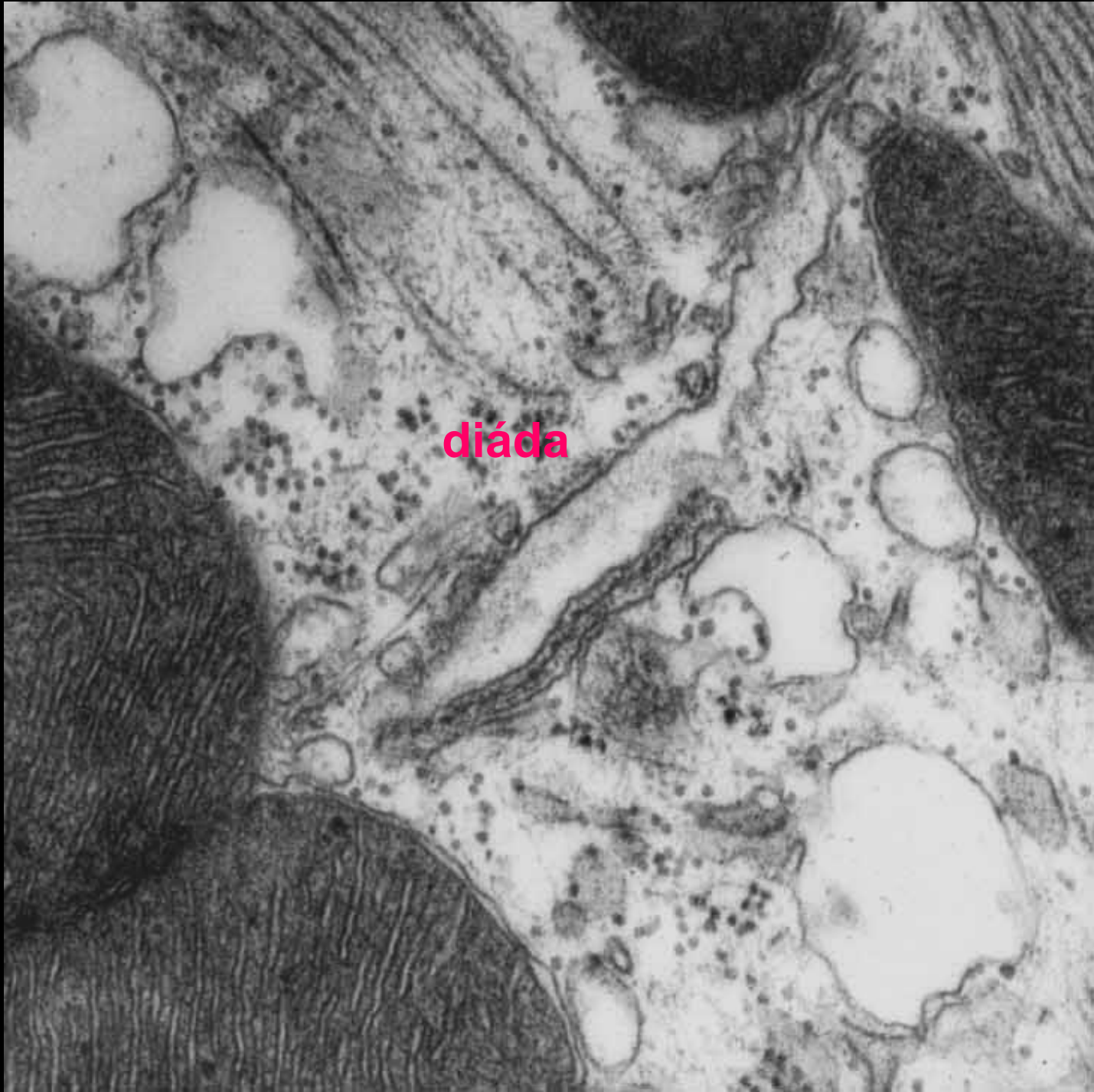


v kardiomyocytech
jsou tenká
myofilamenta
v sarkomeře
doprovázena
nebuletou (menší
izoforma nebulinu)



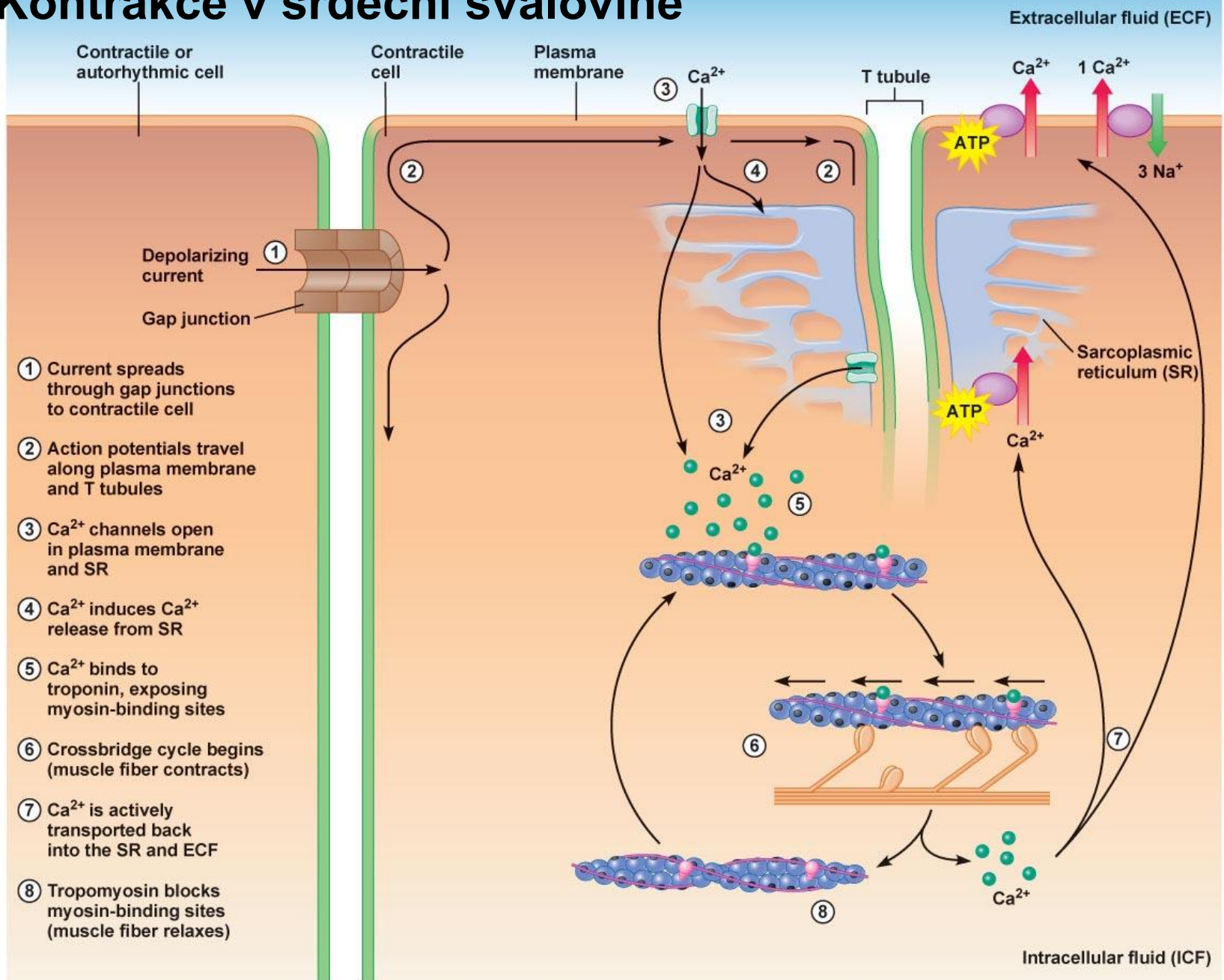
sarkoplasmické retikulum





diáda

Kontrakce v srdeční svalovině



terminal cisterna of SR
containing
calmodulin
calsequestrin

Ca²⁺

Ryanodine receptor

ryanodinový receptor

Ca²⁺

terminální cisterna SR
obsahující
kalmodulin
kalsekvestrin

membrane of sarcoplasmic reticulum
membrána sarkoplasmatického retikula

cytoplasm
cytoplasma

depolarization
depolarizace

extracellular space
extracelulární prostor



membrane of T-tubule
membrána T-tubulu

phospholamban (when dephosphorylated, inhibits SERCA 2)
fosfolamban (po defosforylaci inhibuje SERCA 2)

sarcoplasmic Ca²⁺ ATP-ase
sarkoplasmatická Ca²⁺ ATPáza

ATP

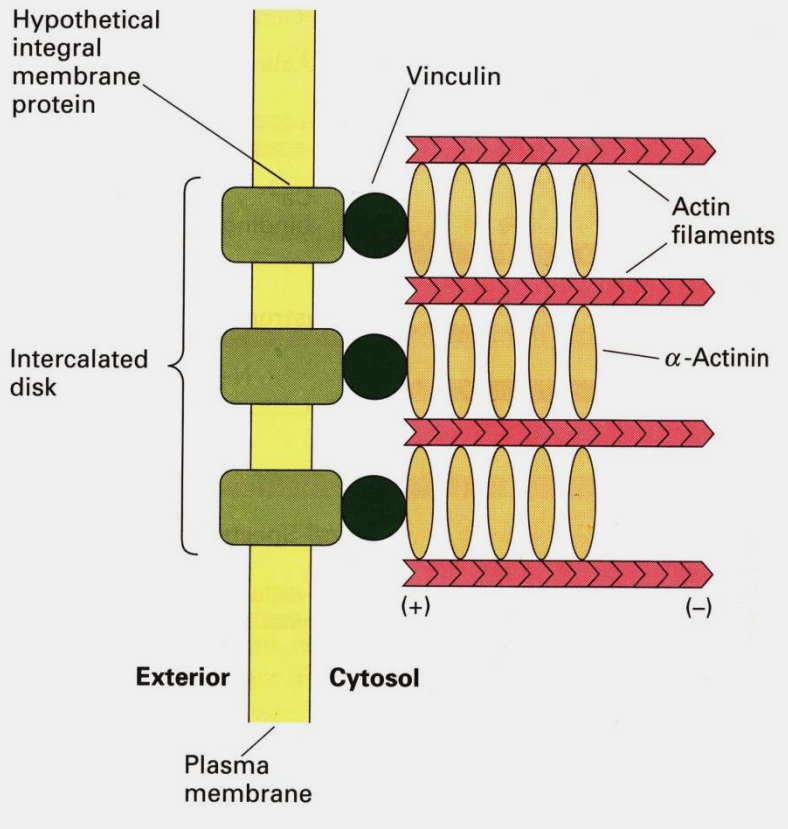
Ca²⁺

SERCA 2

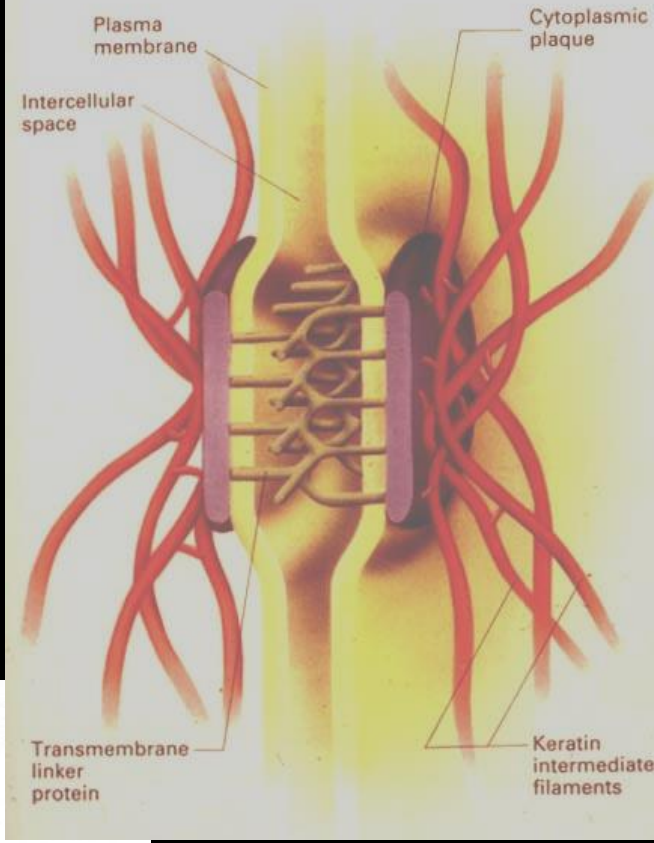
ADP + P

transport Ca²⁺ řízen
Ca²⁺ - dependentním
ryanodinovým receptorem

Spojení kardiomyocytů

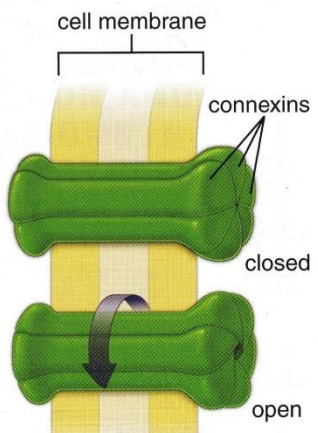
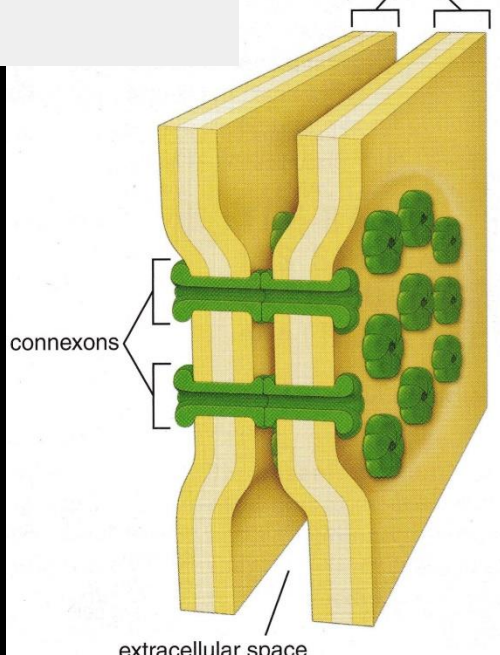


Nexus



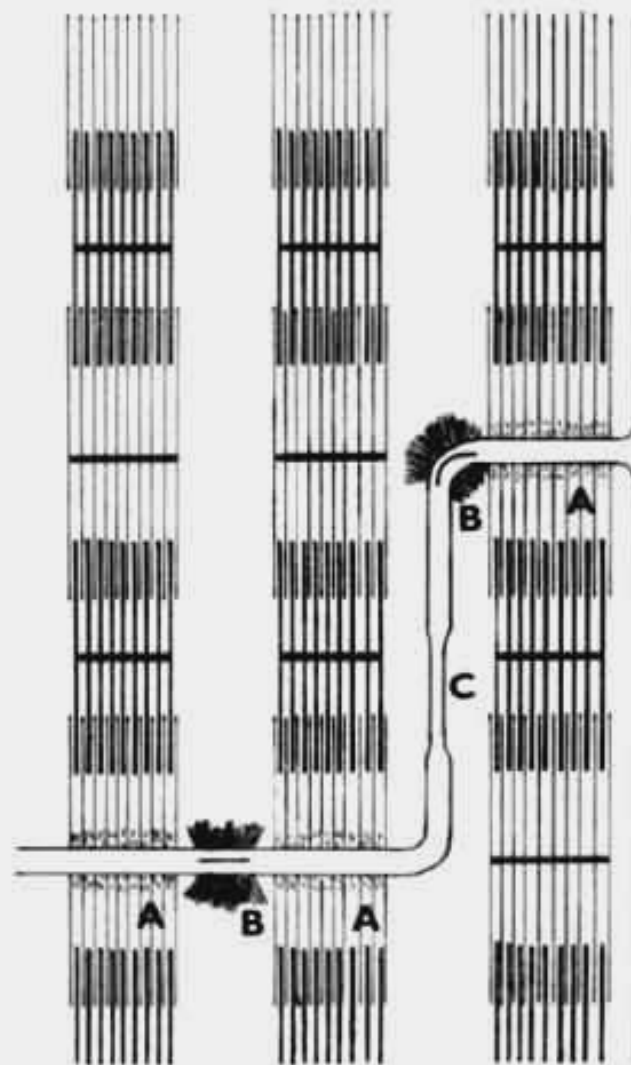
membranes of adjacent cells

Fascia adhaerens

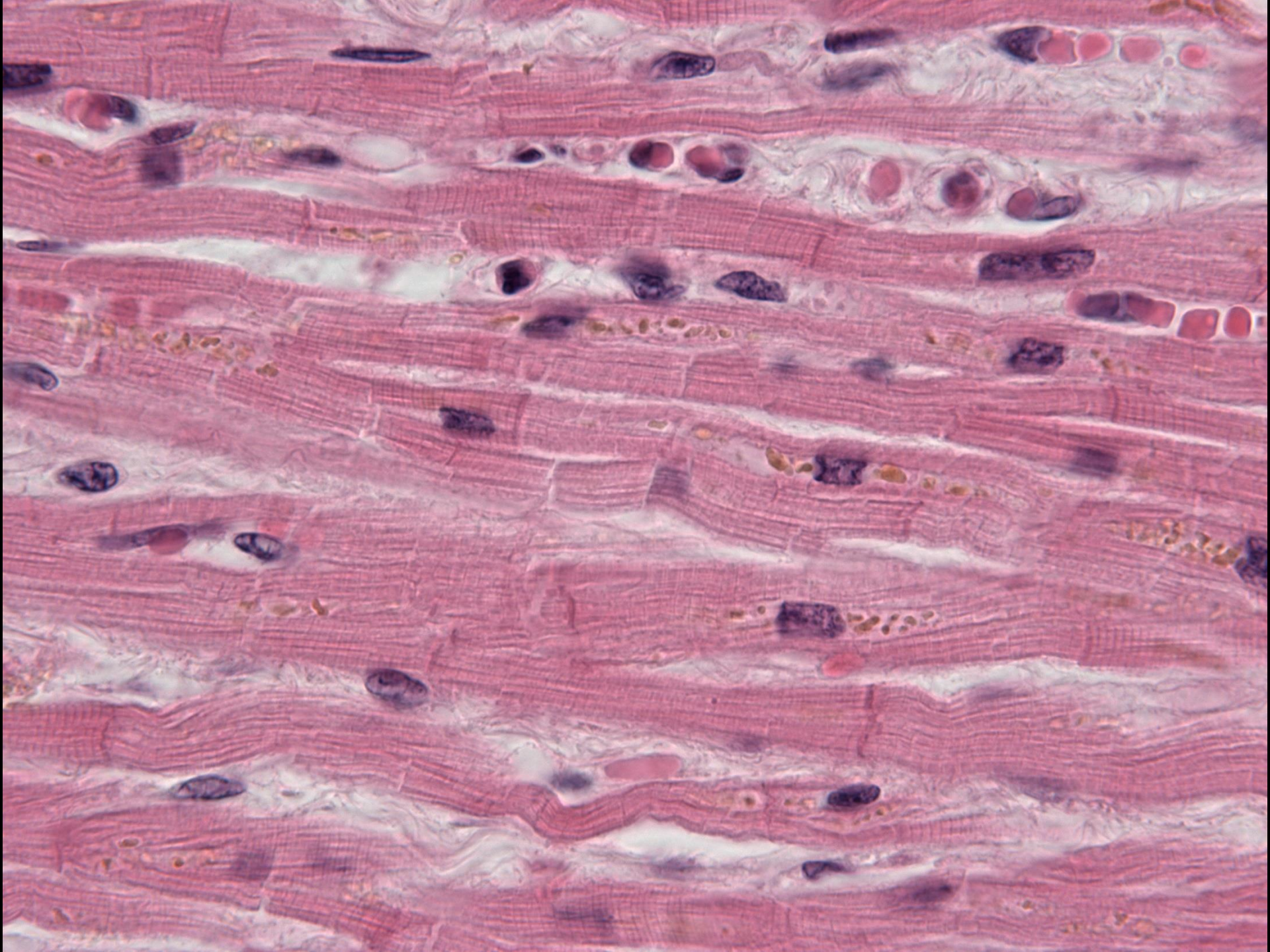


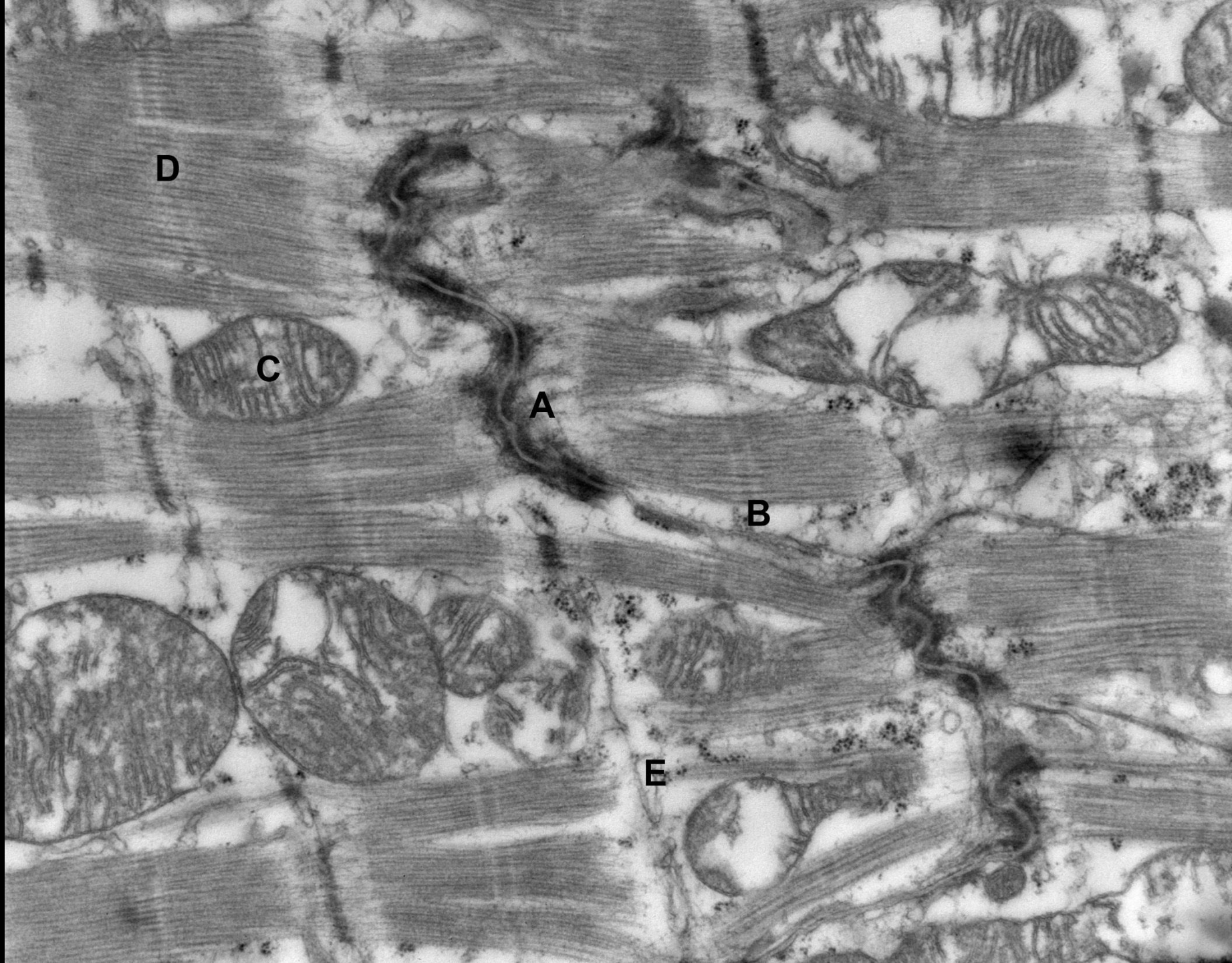
Macula adhaerens (nexus)

INTERKALÁRNÍ DISK



- A - fascia adherens
- B - macula adherens
- C - nexus





D

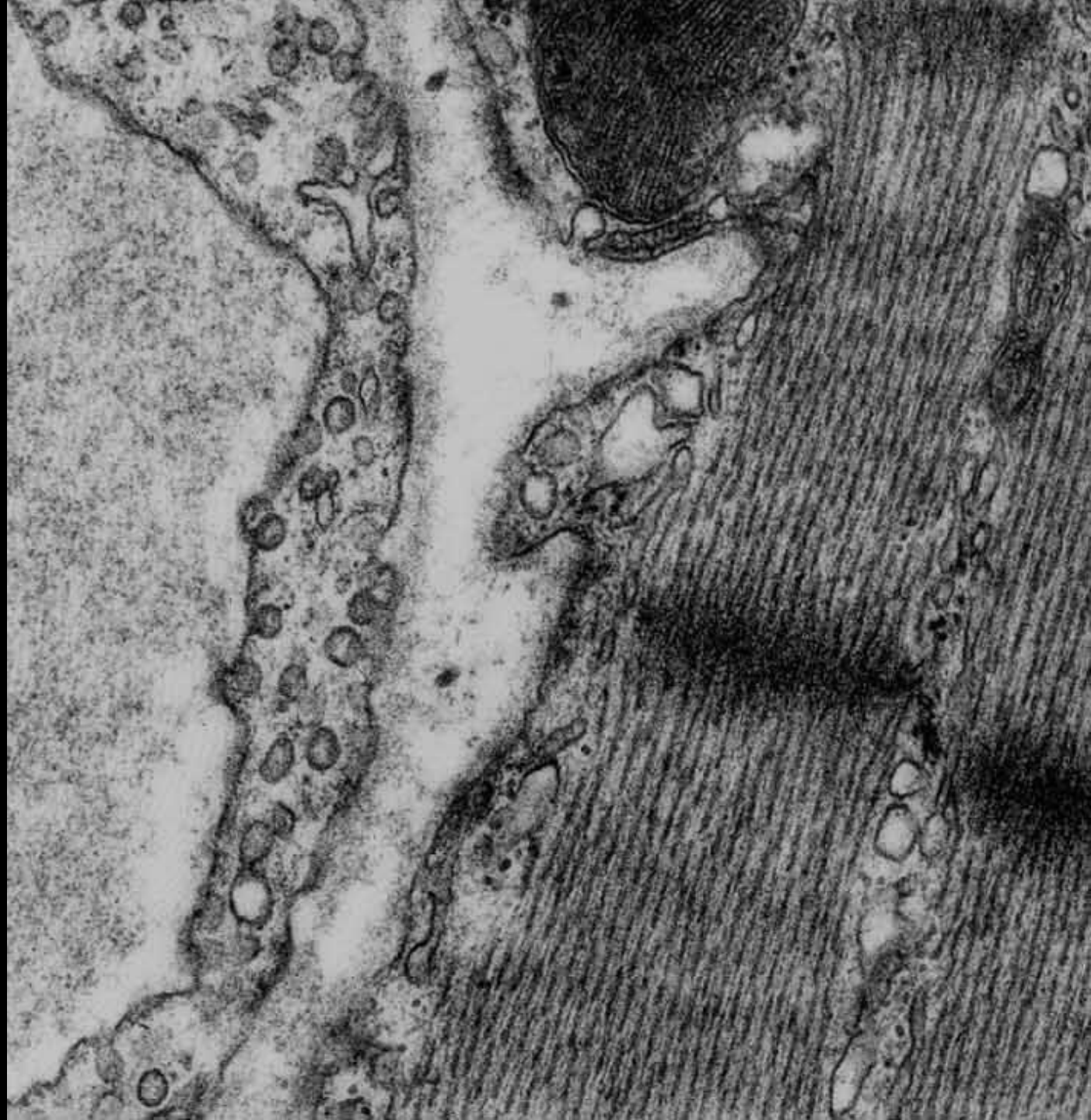
C

A

B

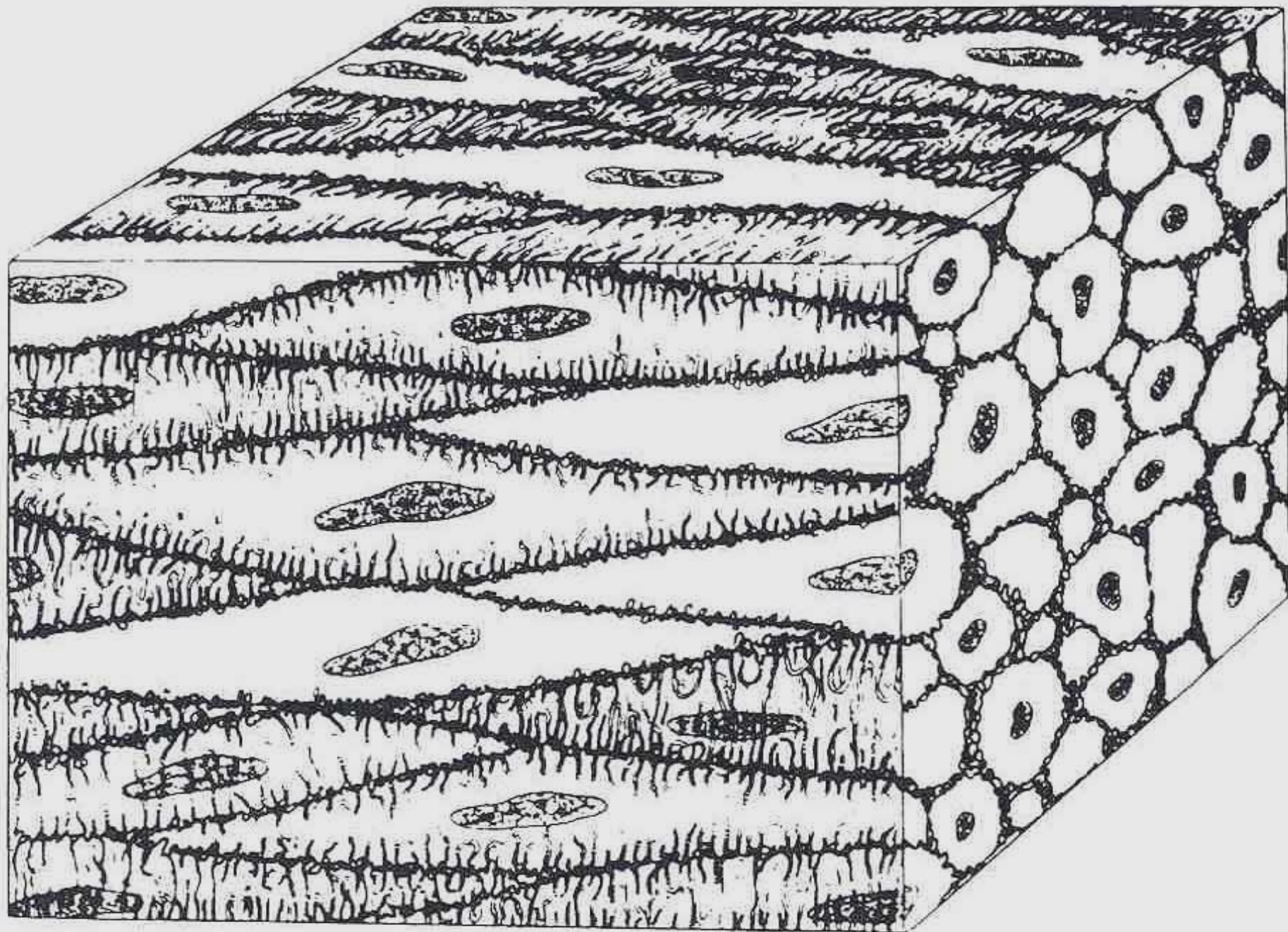
E

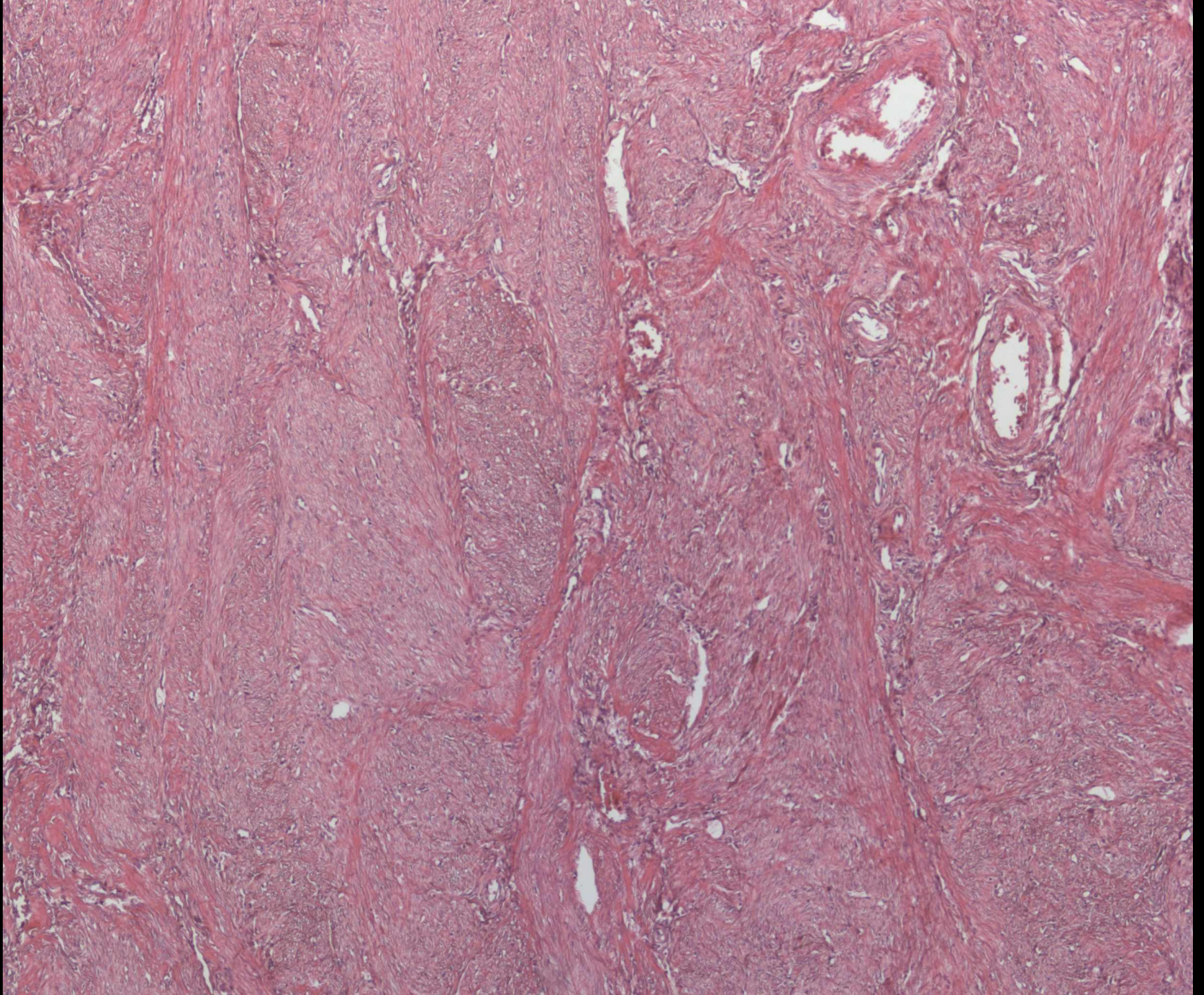


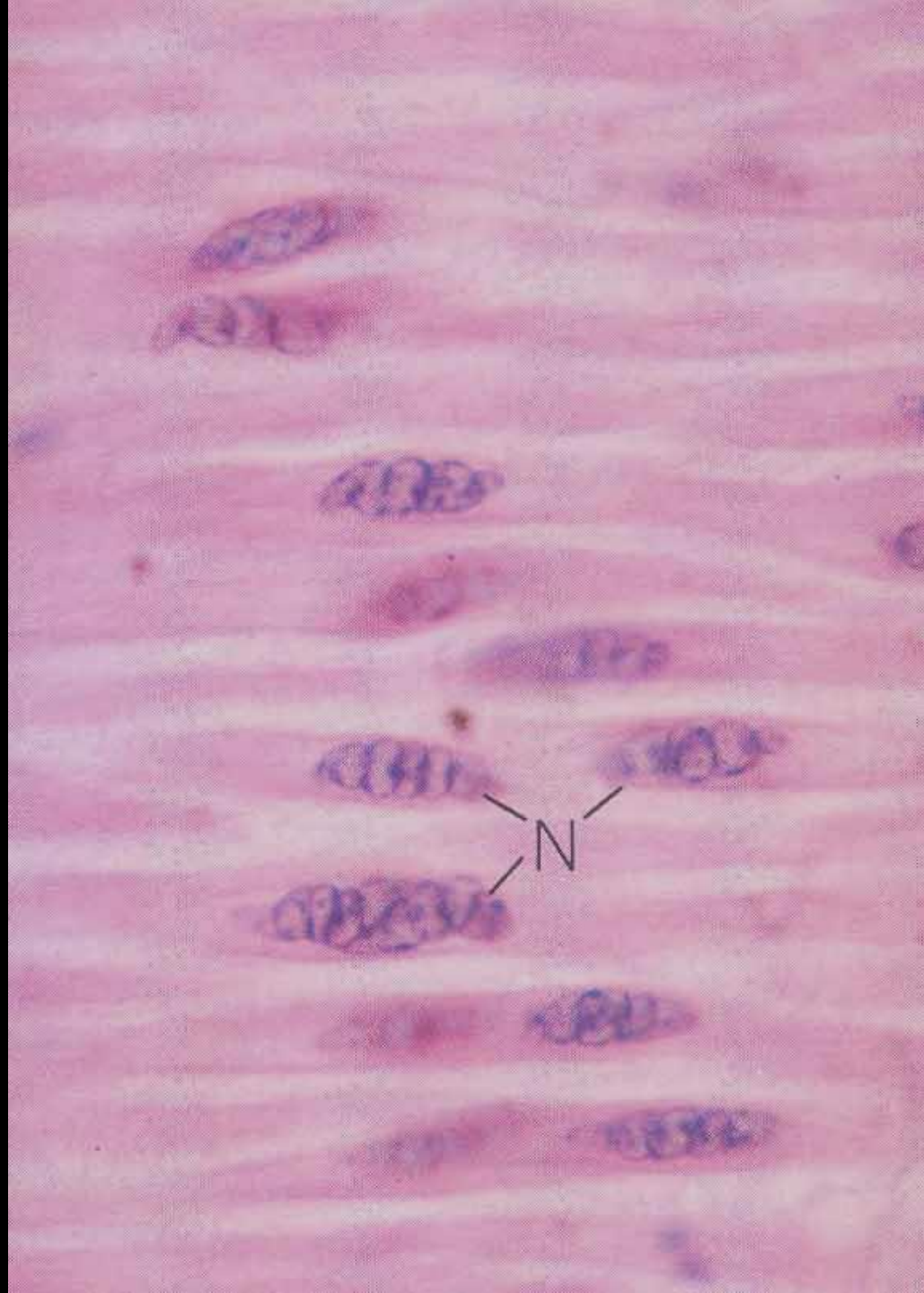


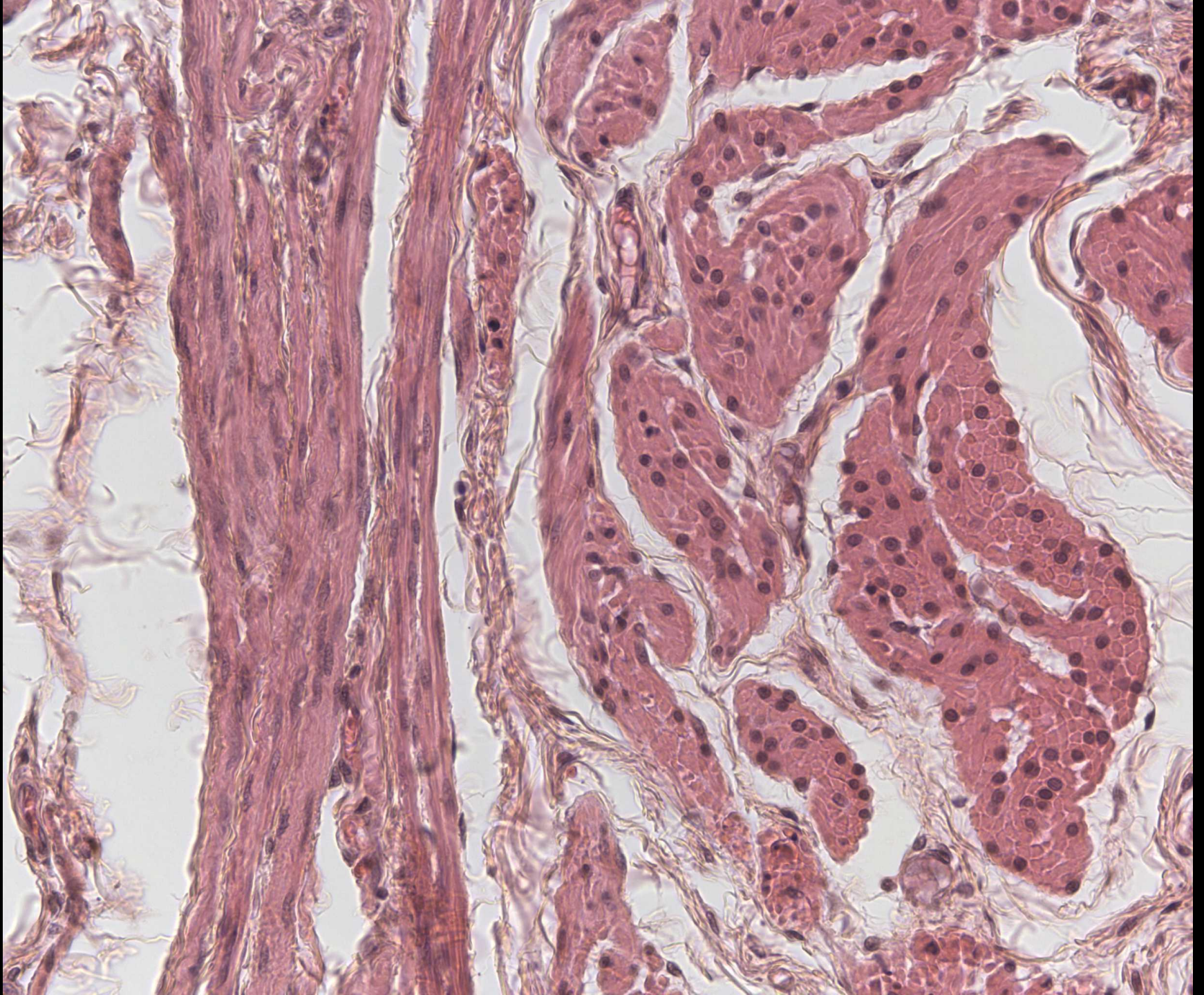
Hladká svalová tkáň

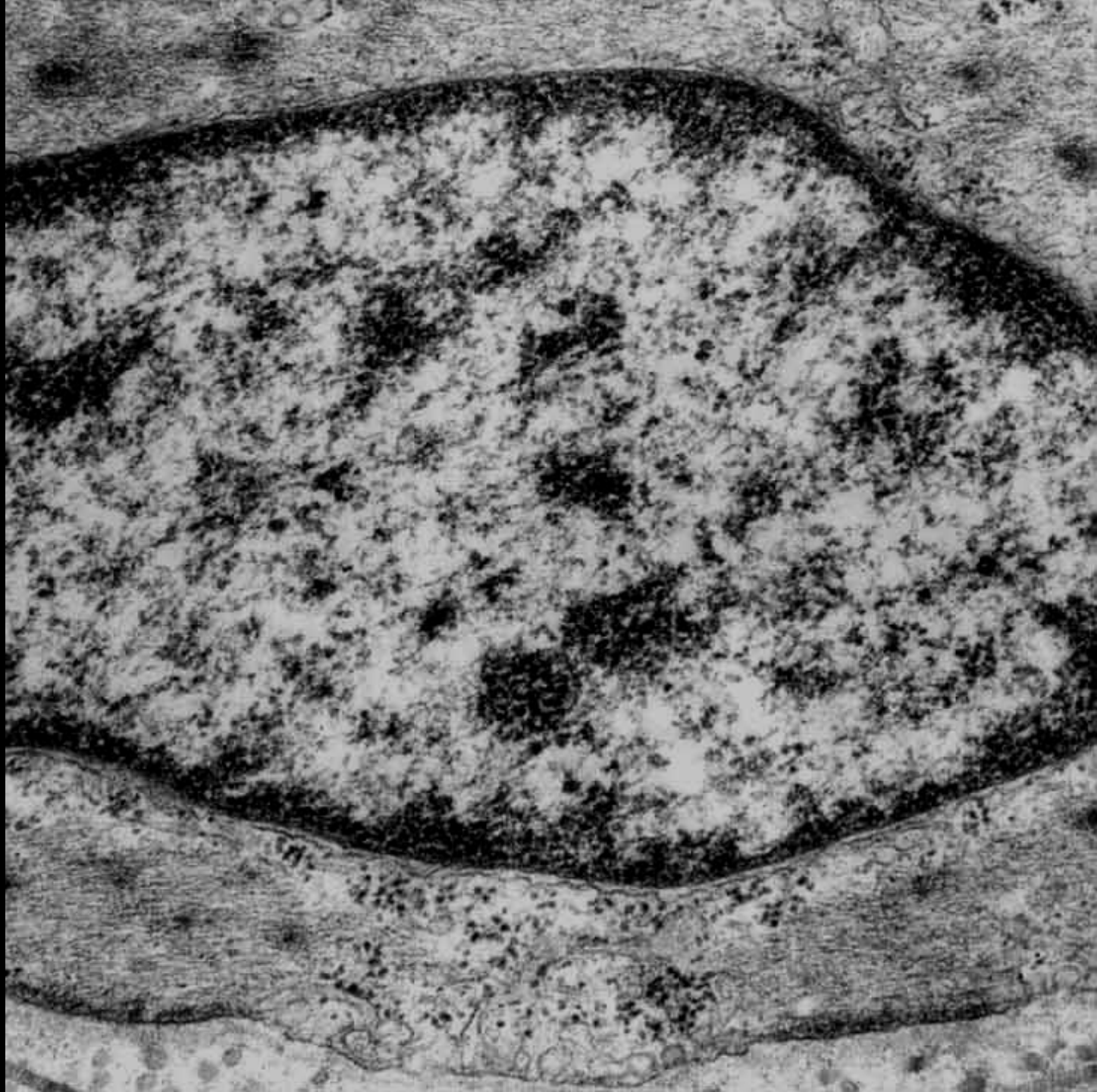
základní jednotka: HLADKÁ SVALOVÁ BUŇKA
vřetenovitý element s jedním jádrem - buňka
pomalá kontrakce bez volní kontroly
délka: od 15 do 500 mikrometrů
průměr: kolem 6 mikrometrů
jádro umístěné ve středu buňky
myofilamenta nepravidelně uspořádaná
(ŽÁDNÉ MYOFIBRILY)

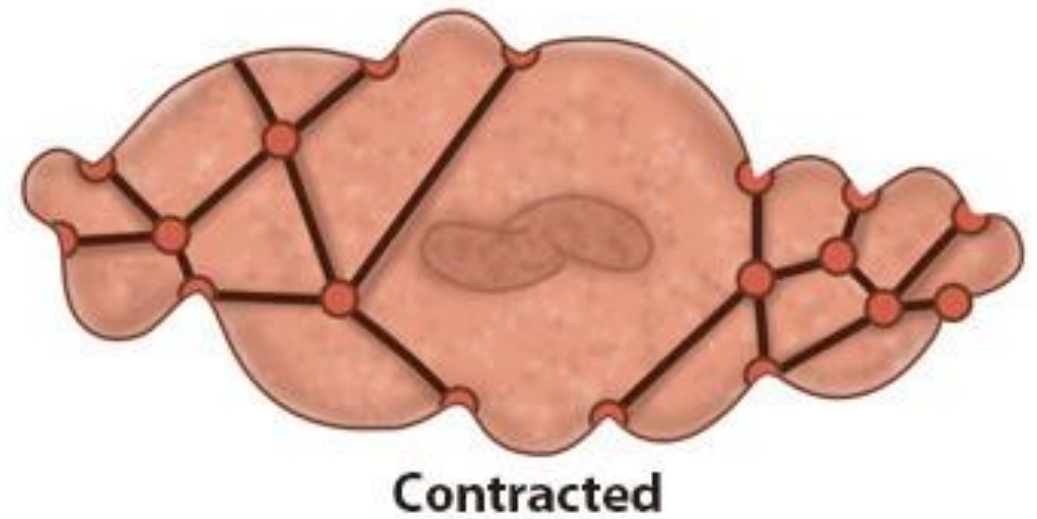
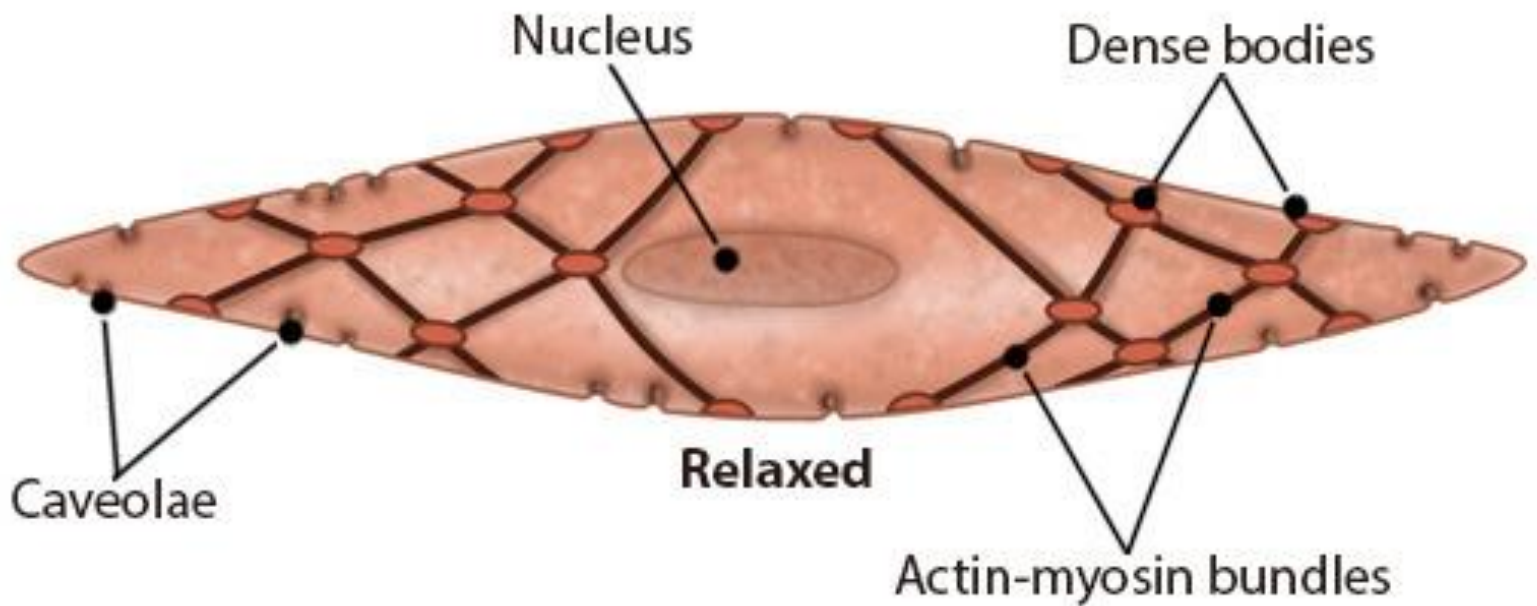




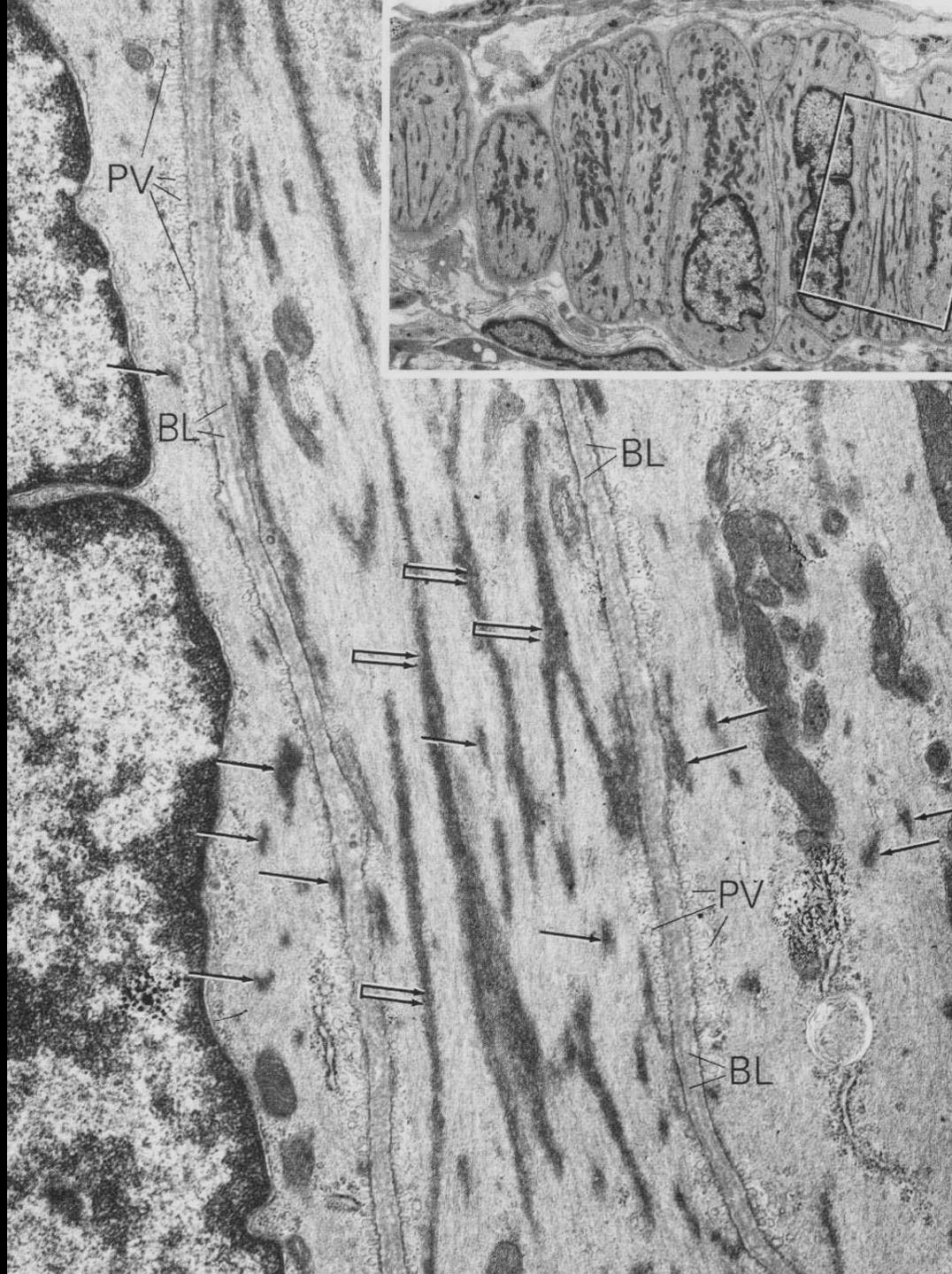




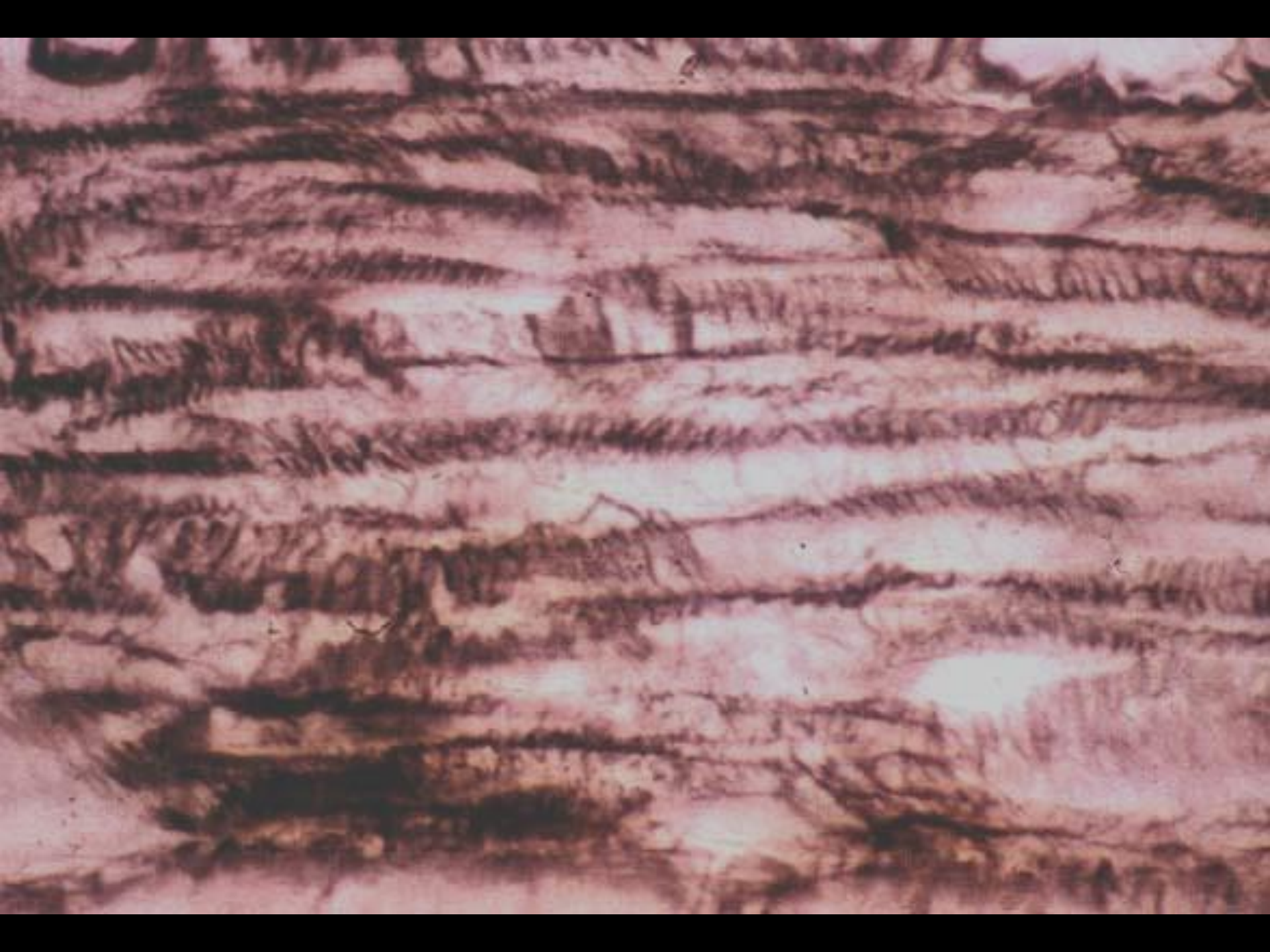




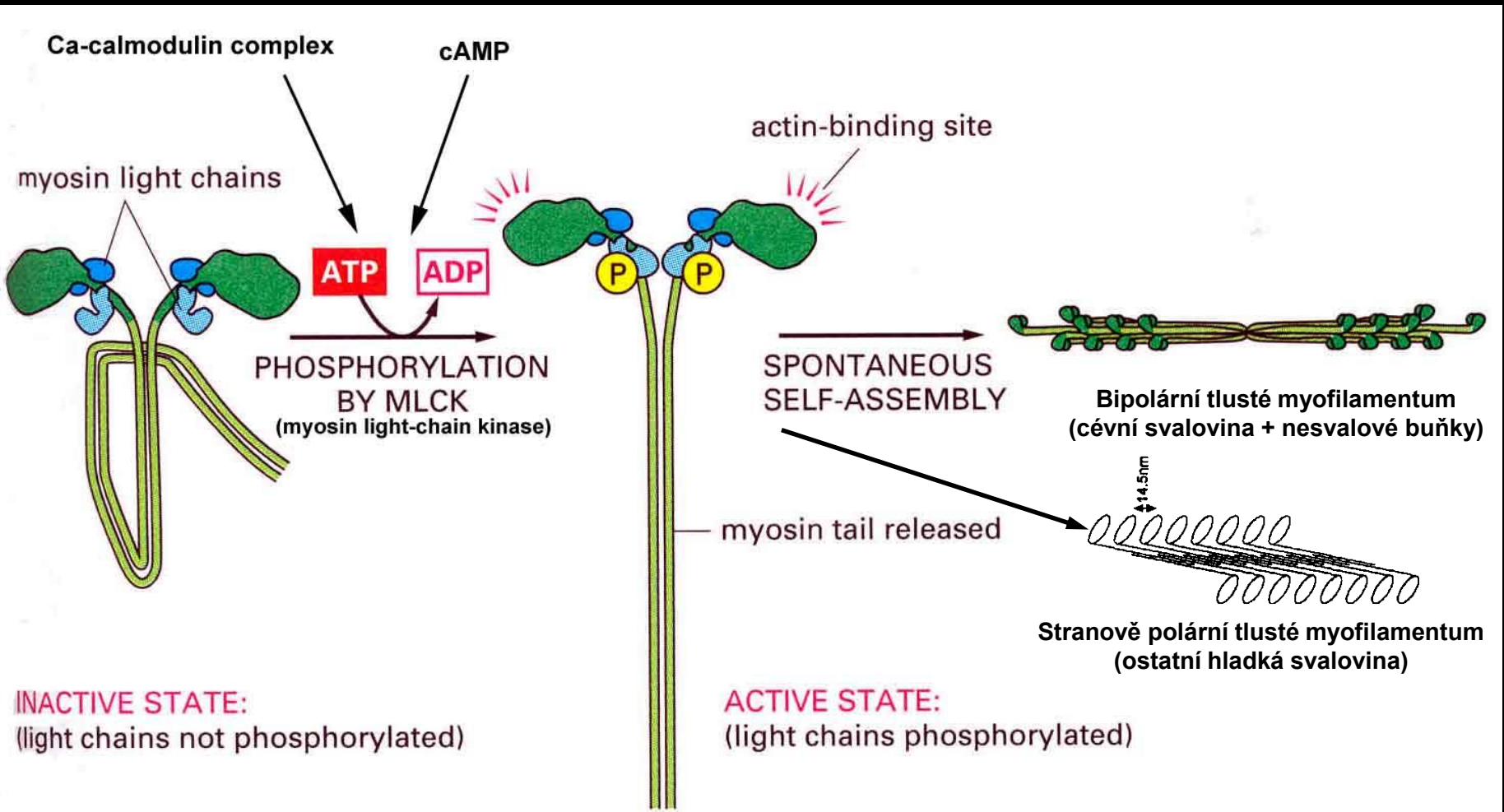








Kontrakce hladké svaloviny



interakce aktinu a myosinu pak probíhá stejně jako u příčně pruhované svaloviny

Hladká svalovina

