

Histology of Muscle

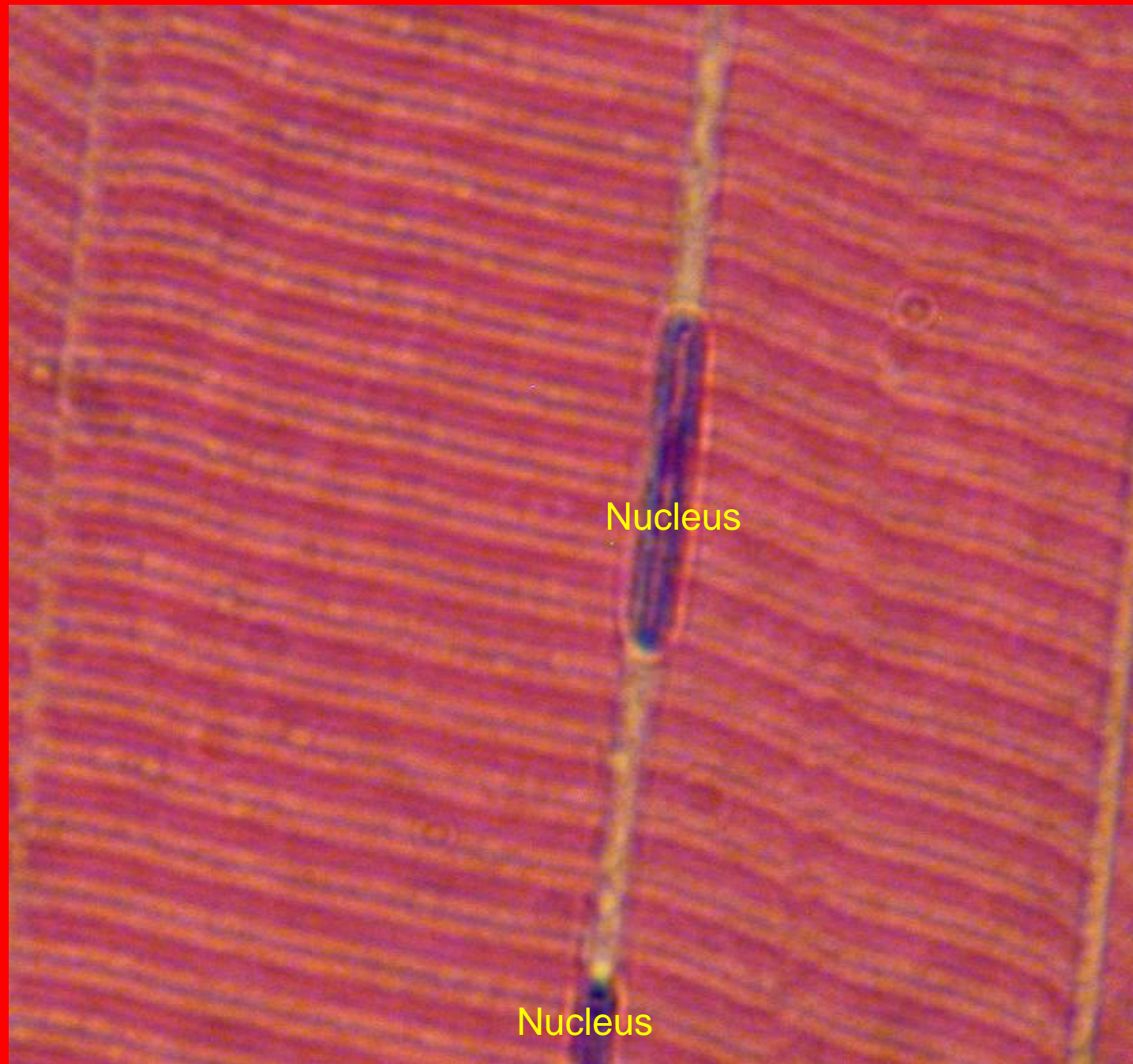
1. **Skeletal**, Striated, Voluntary Muscle:
Nucleus pushed to one side of cells
2. **Smooth**, Unstriated, Involuntary Muscle:
Nucleus in center of cell
3. **Cardiac**, Striated, Involuntary; Nucleus in center of branching & anastomosing cells and cells connected by intercalated discs(desmosomes and gaps) specialized cells conduct messages to contract (Purkinje cells)

Skeletal (Voluntary, Striated) Muscle

Skeletal, Striated, Voluntary Muscle:
Nucleus pushed to one side of cells

~2,000X

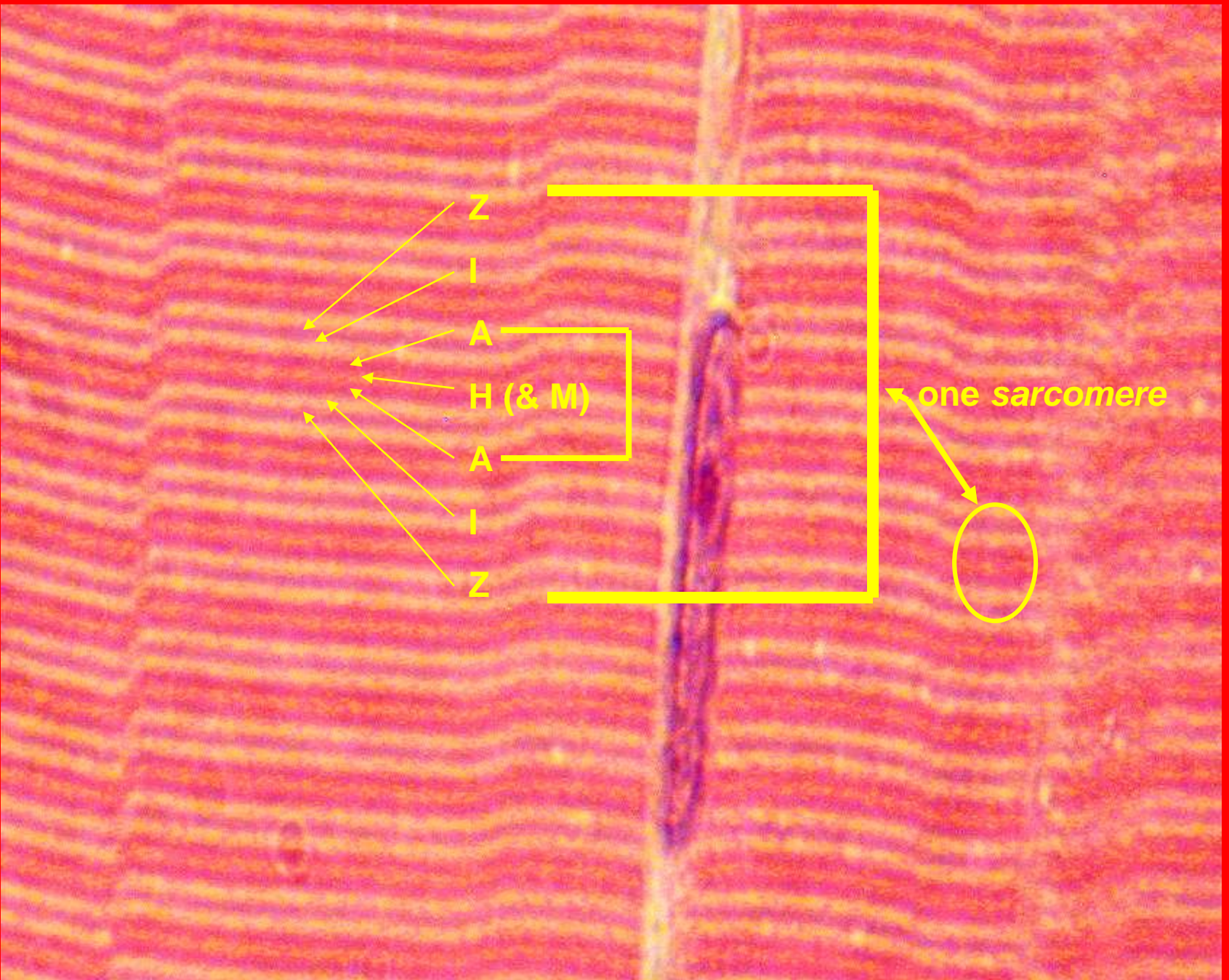
1.5um
plastic
section



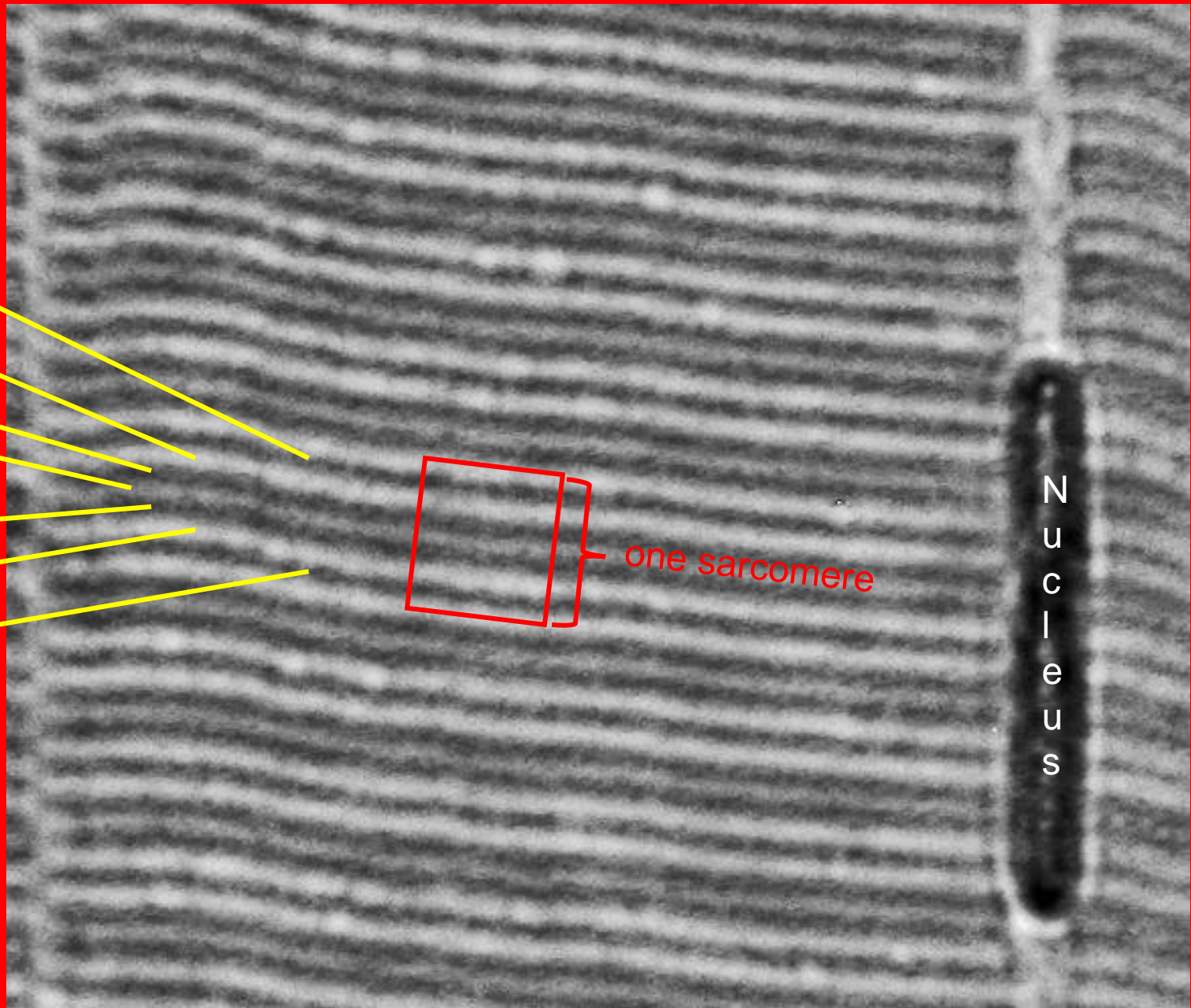
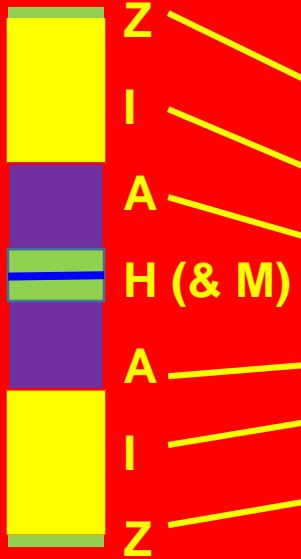
Nucleus

Nucleus

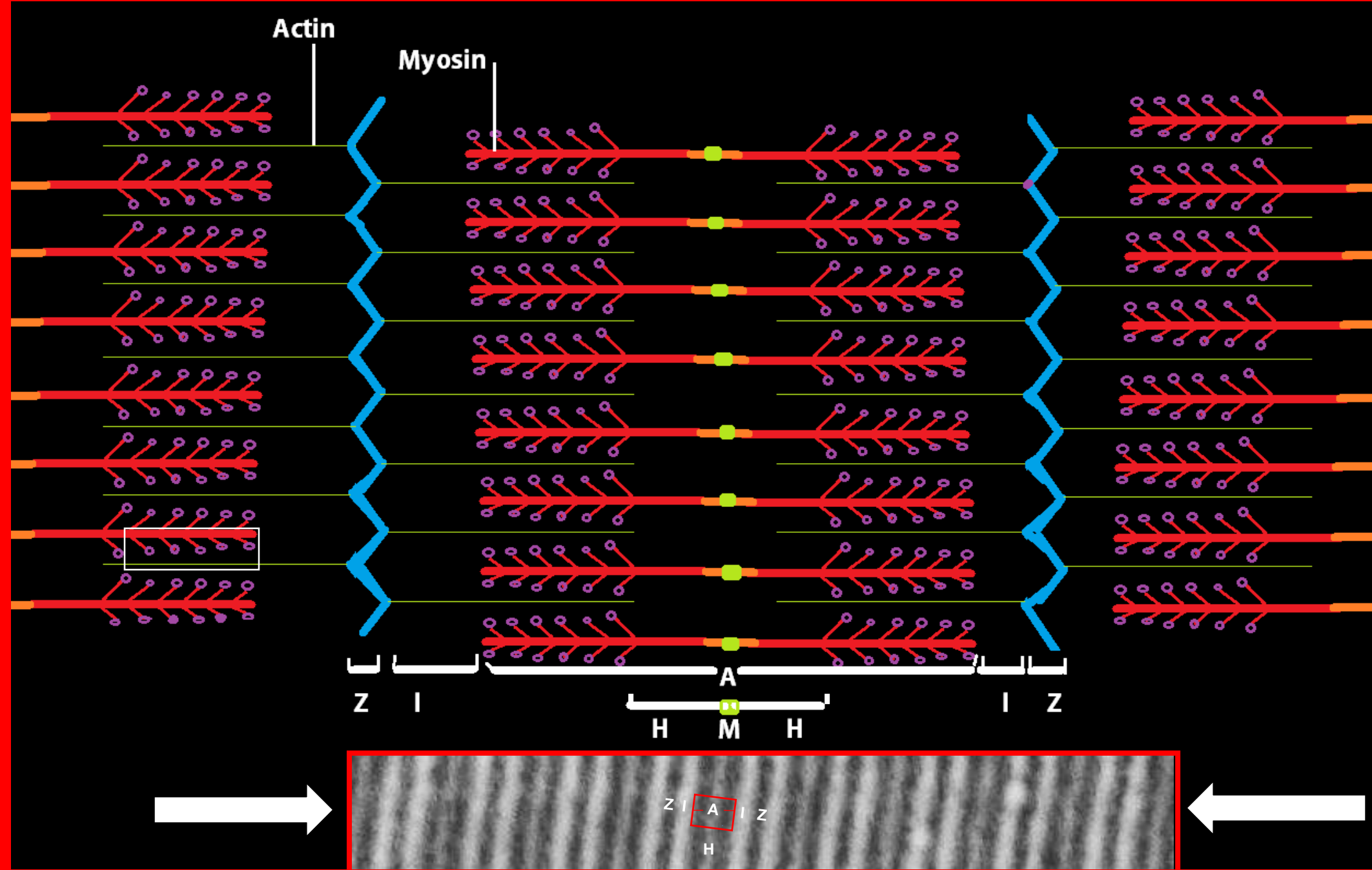
↑ contraction
↓
↑

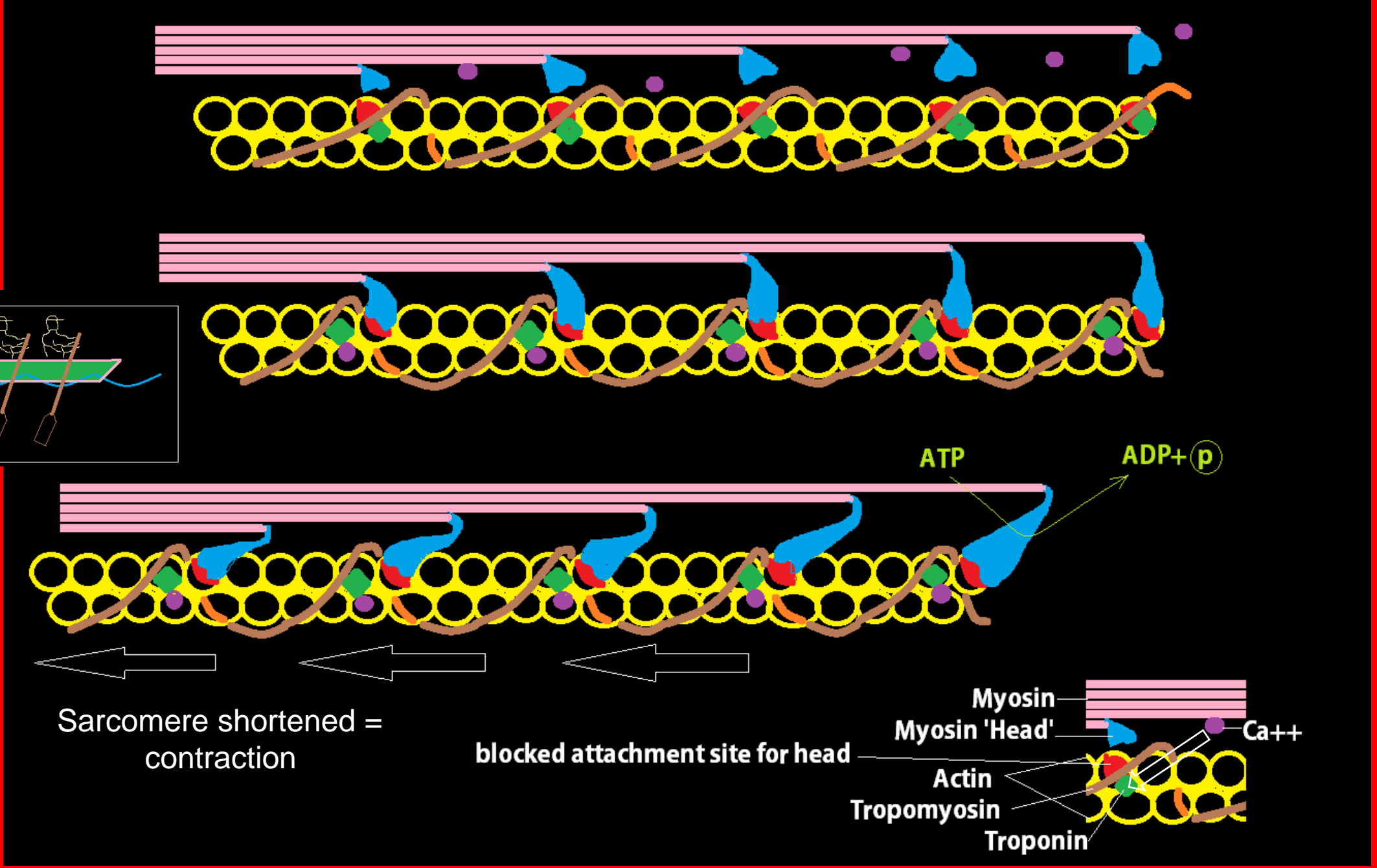
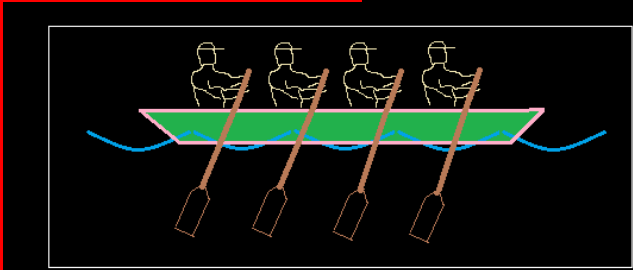


↓
C
o
n
t
r
a
c
t
i
o
n
↑



one sarcomere





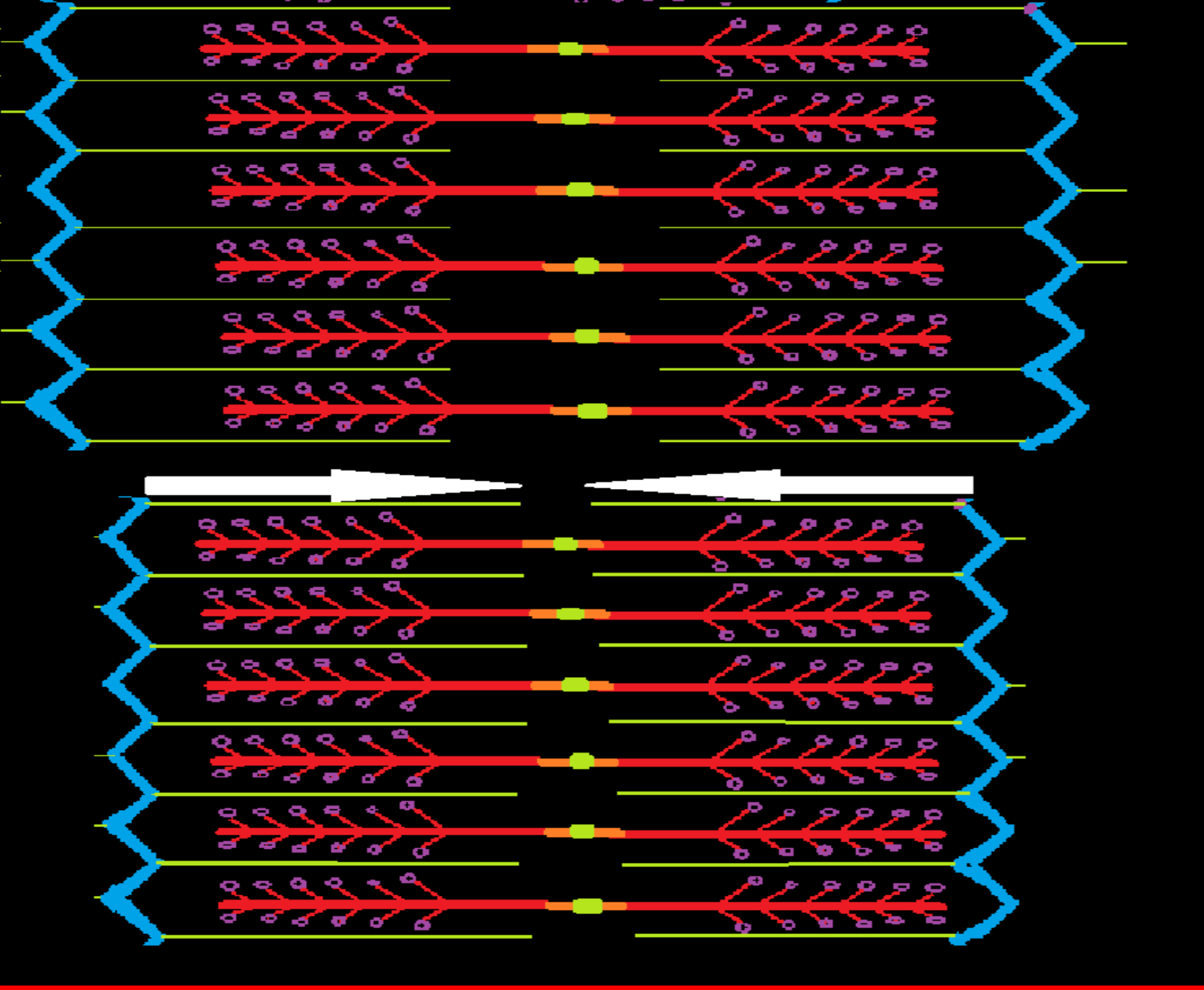
Sarcomere shortened = contraction

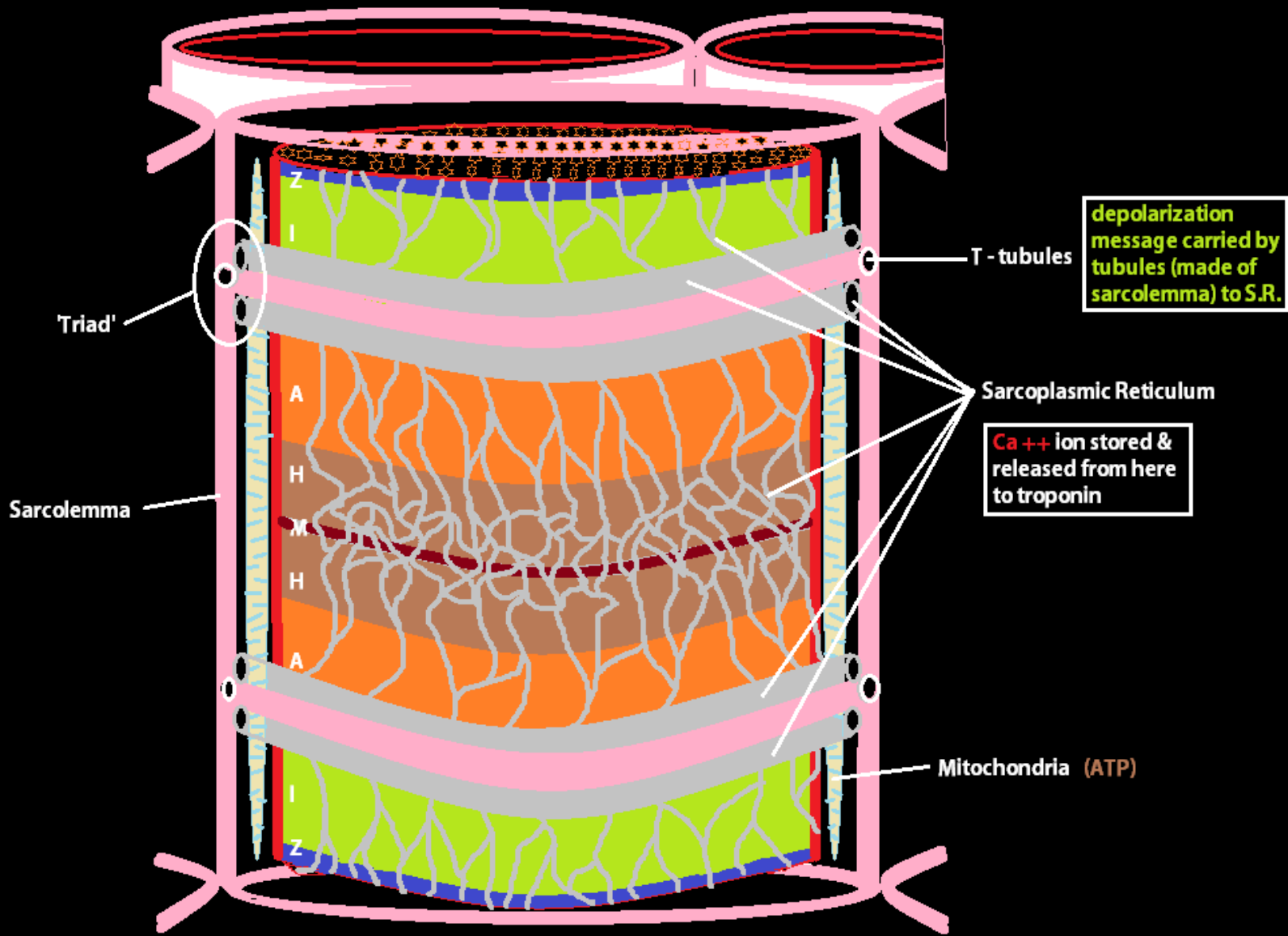
blocked attachment site for head

Myosin
Myosin 'Head'
Actin
Tropomyosin
Troponin
Ca⁺⁺

ATP

ADP + P





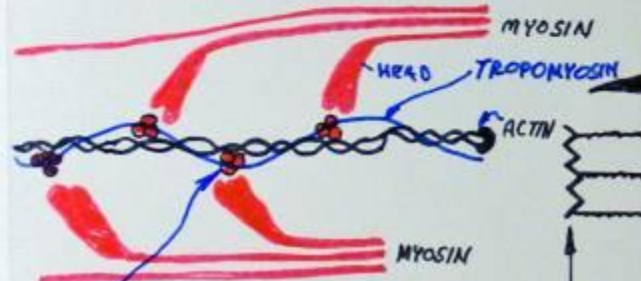


2,000x (L.M.)

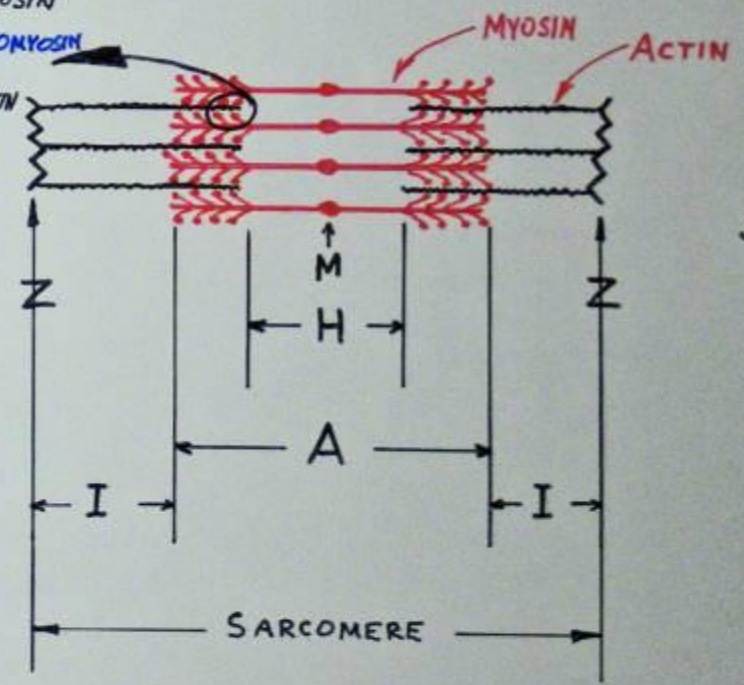
*T-TUBULES of ENDOPLASMIC RETICULUM
MITOCHONDRIA
ATP
Ca⁺



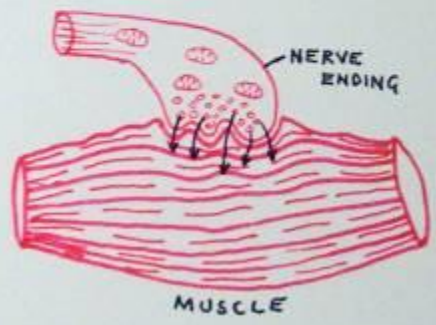
20,000x (TEM)



500,000x
TROPONIN w/ Ca⁺

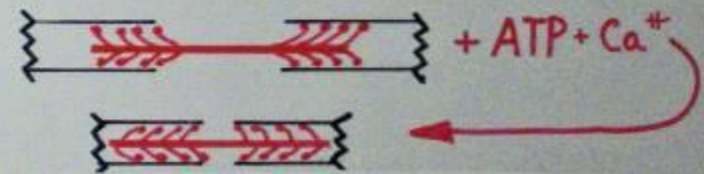


50,000x (TEM)

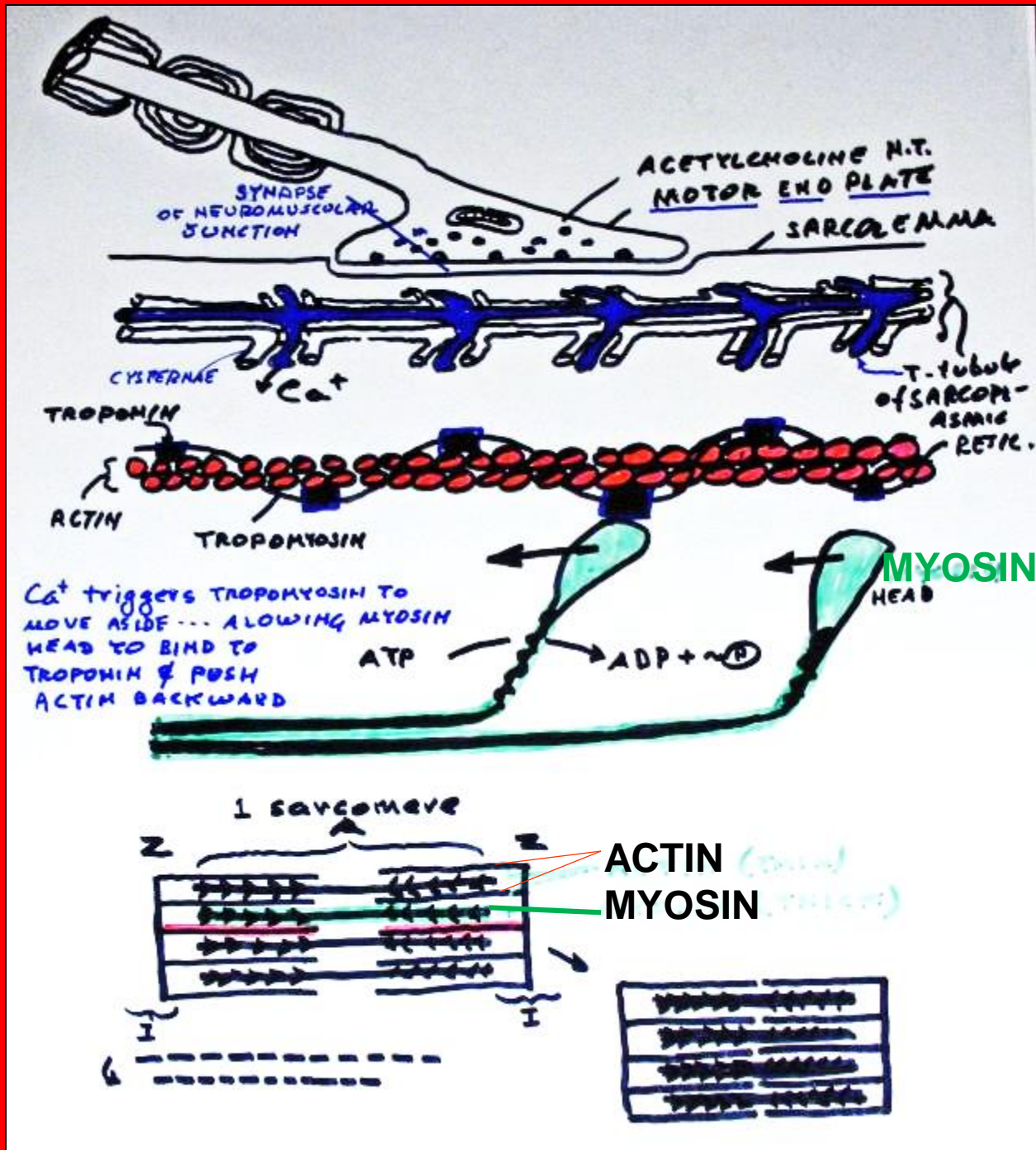


NERVE ENDING

MUSCLE



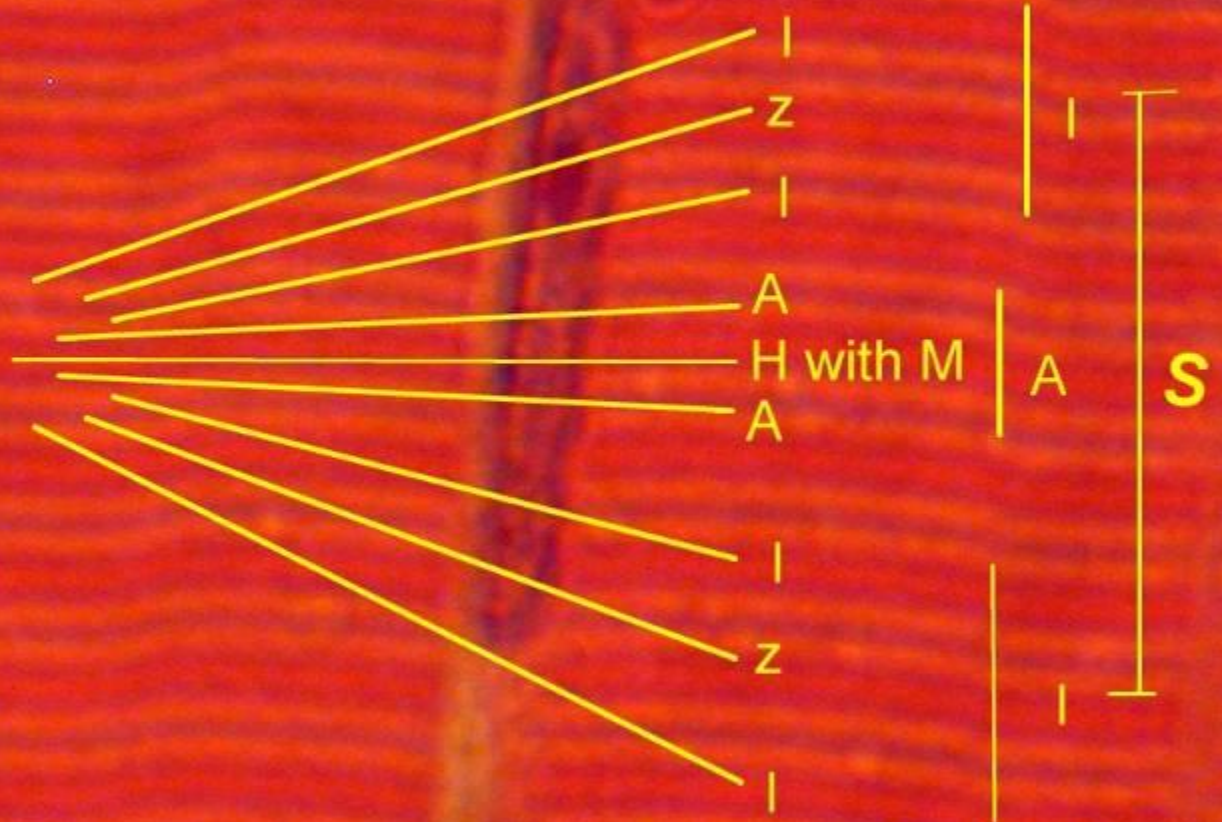
+ ATP + Ca⁺

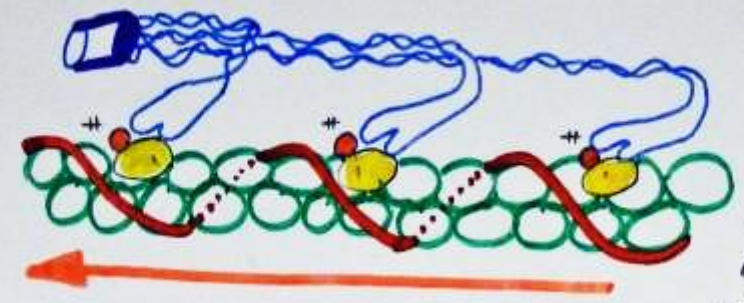
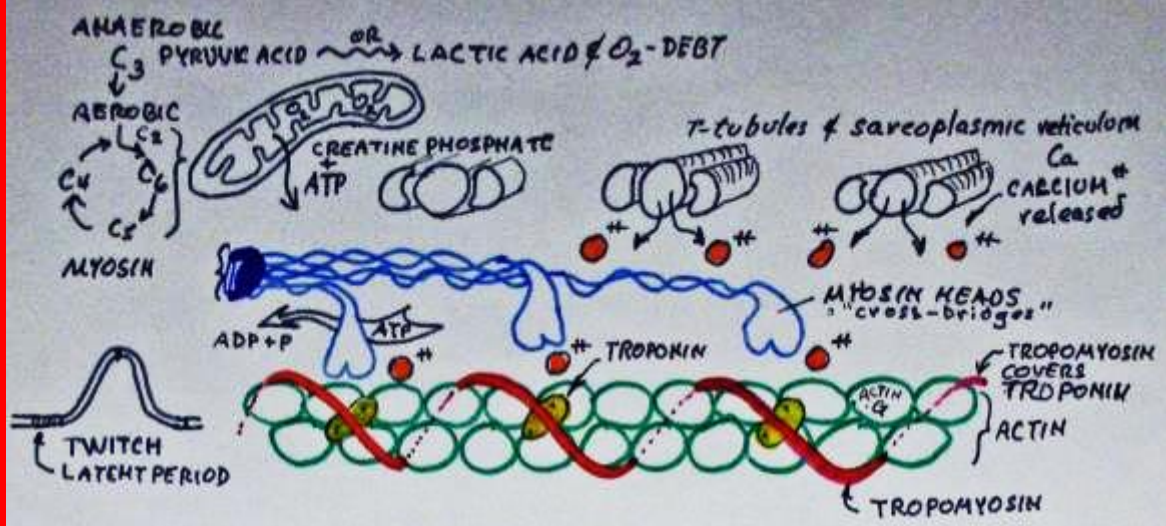




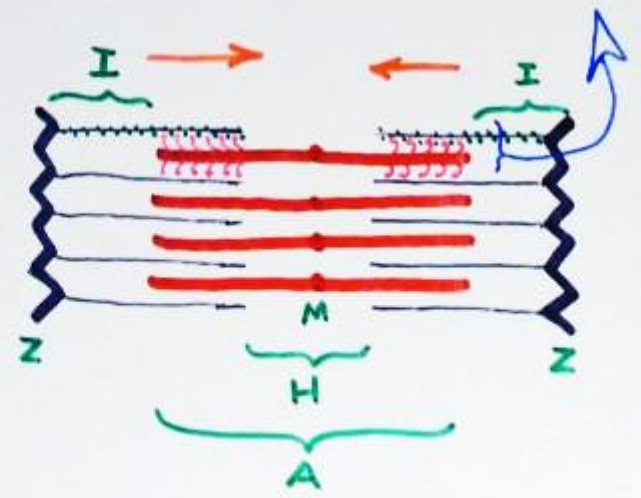
Nerve fibers

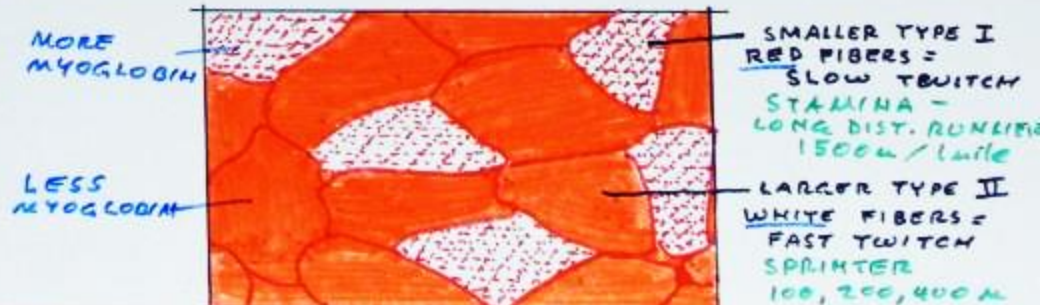
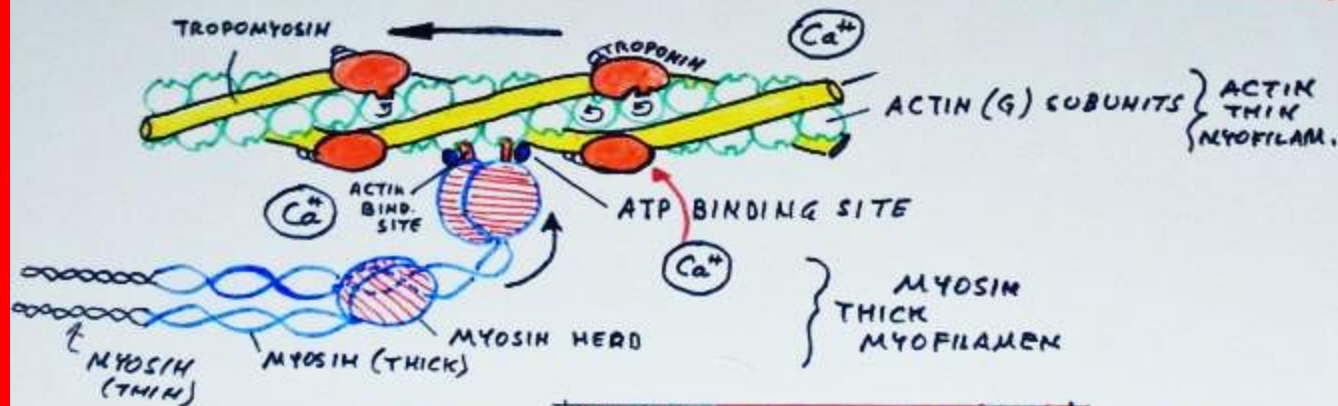
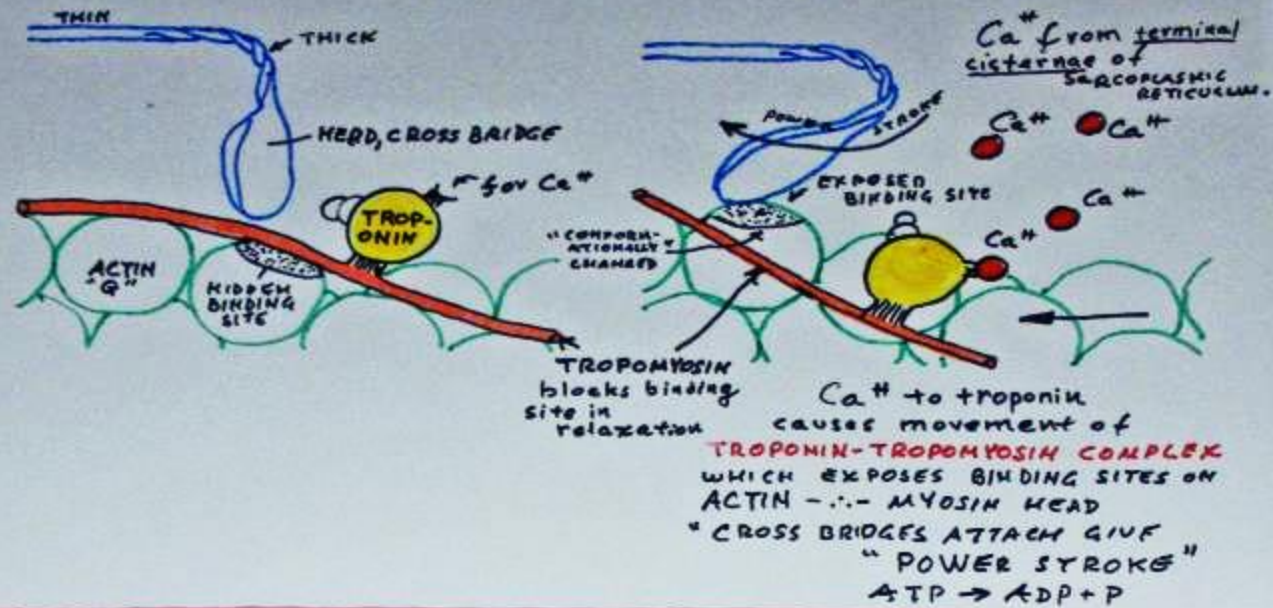
Motor end plates *terminating on muscle fibers*

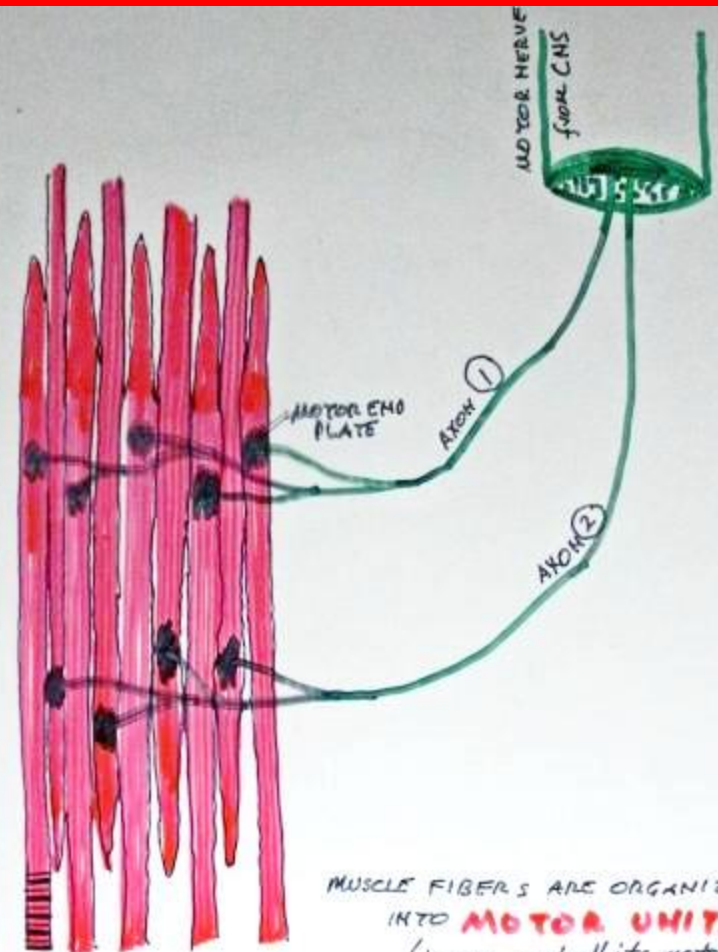




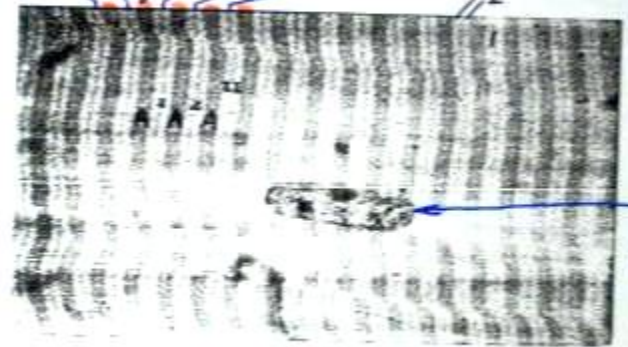
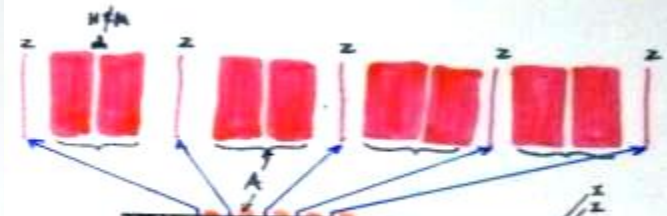
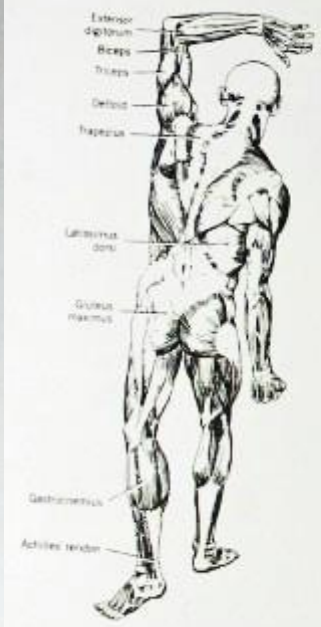
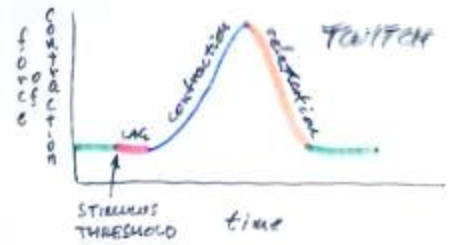
Ca⁺⁺ attach to troponin & tropomyosin moves away so head can attach & push ACTIN to LEFT, closing "H"-band.





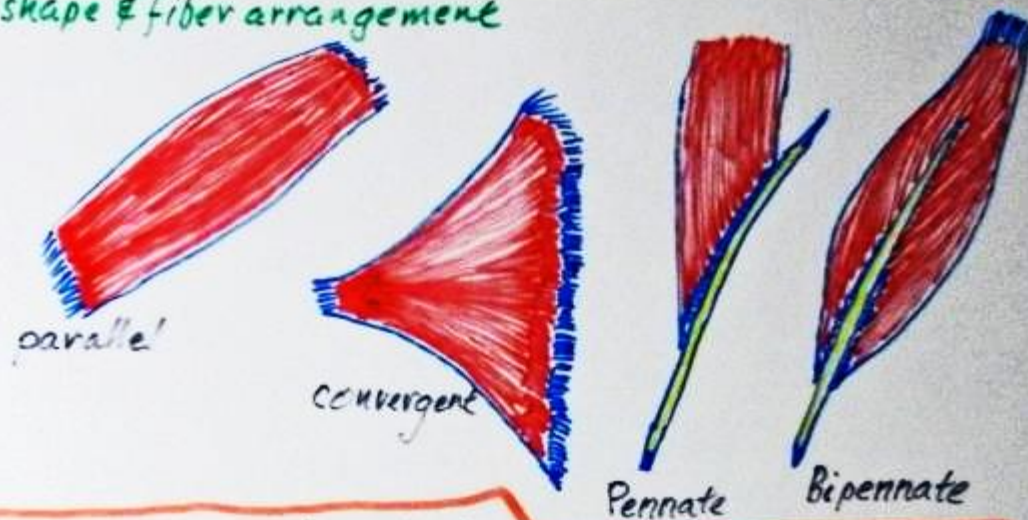


MUSCLE FIBERS ARE ORGANIZED INTO **MOTOR UNITS** (1 axon and all its motor end plates on its fibers) WHICH RESPOND IN ALL-OR-NONE fashion BY HAVING ONE THRESHOLD



NUCLEUS is located UNDER SARCOLEMMMA

shape & fiber arrangement



prime mover (agonist)

↑
↓ muscle or group that perform specific task (its 'action')

antagonist

oppose prime mover and provide control & precision (= "cooperate")

synergists

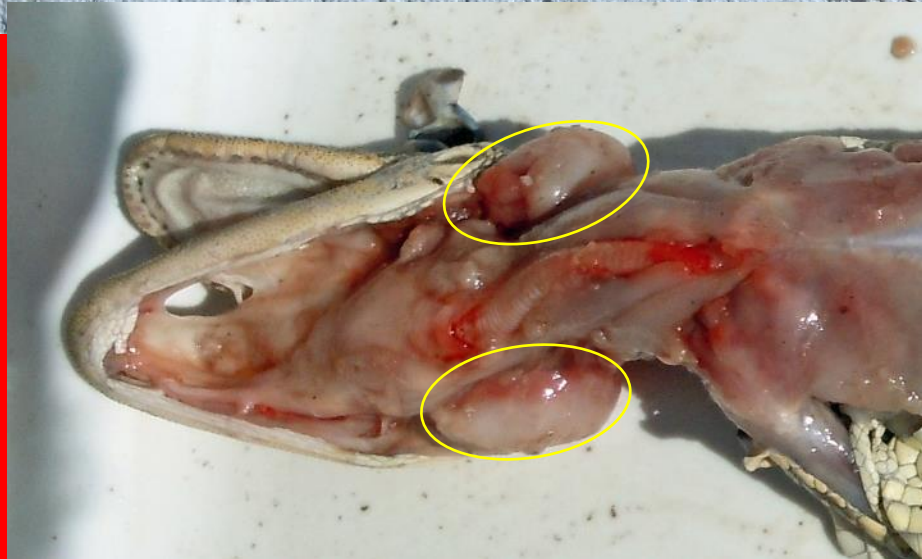
muscles that contract @ same time as prime mover

fixators

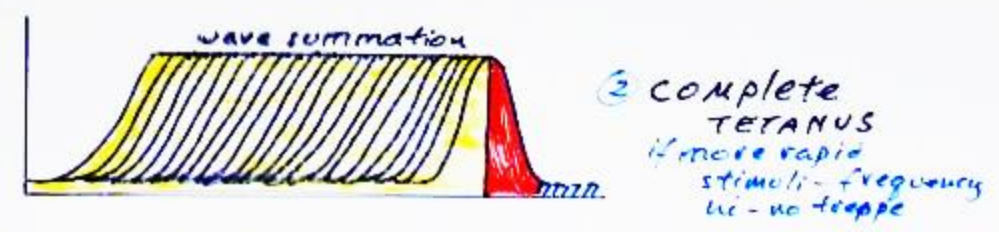
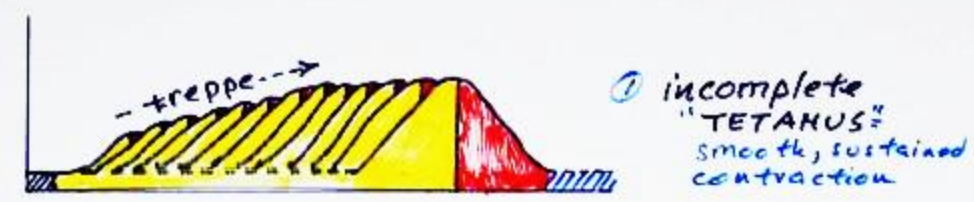
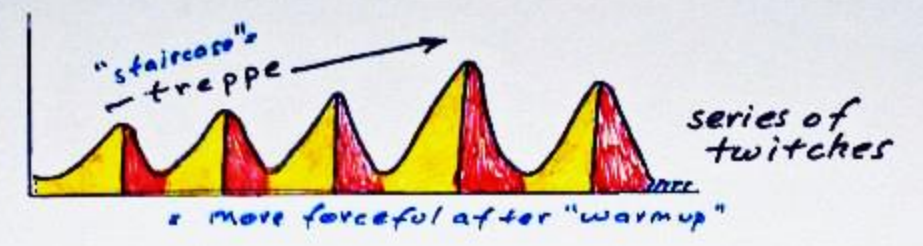
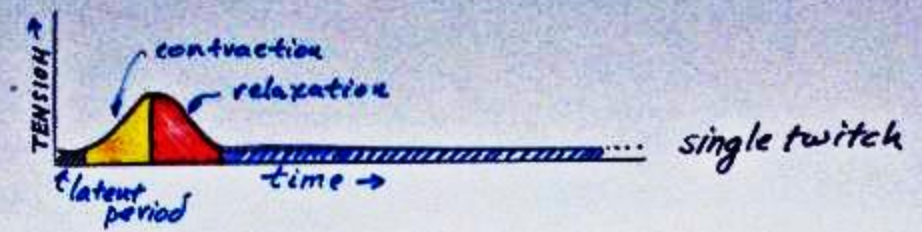
joint stabilizers

* most muscles can do all four jobs.

**External alligator
musculature (Skeletal)**



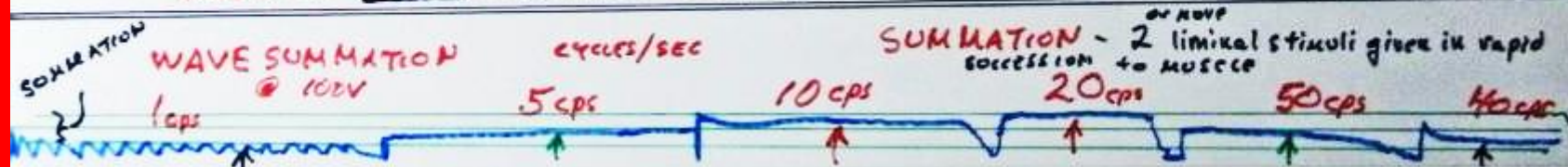
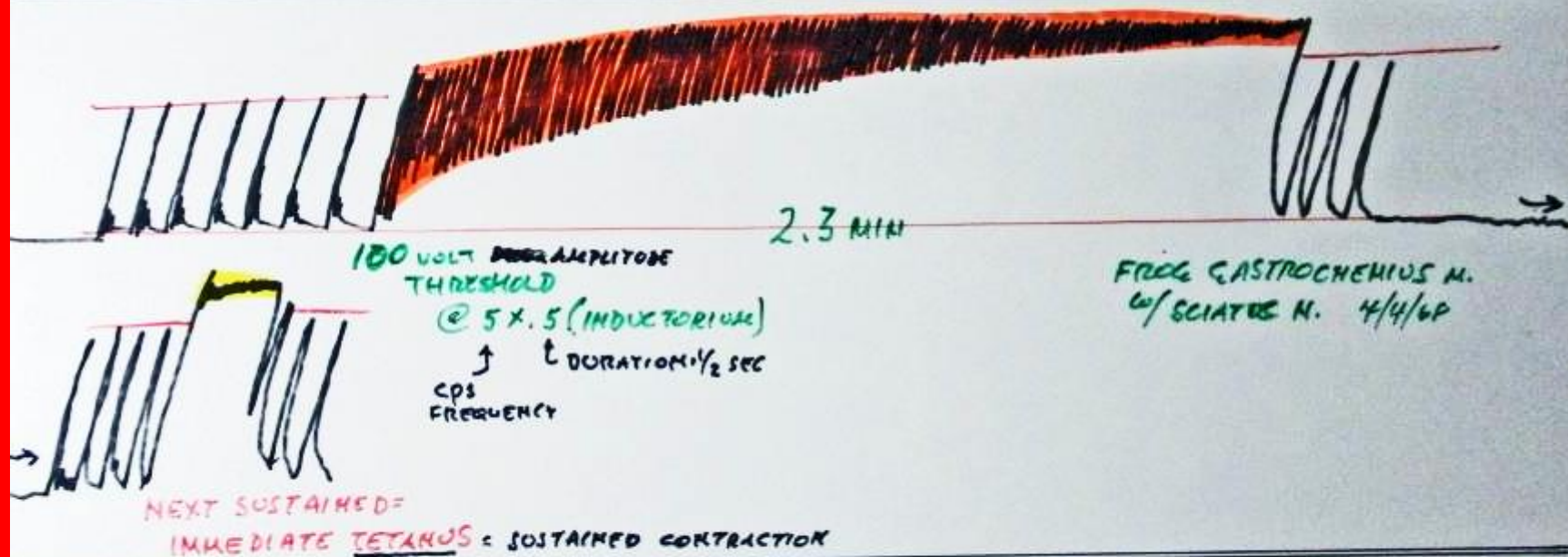
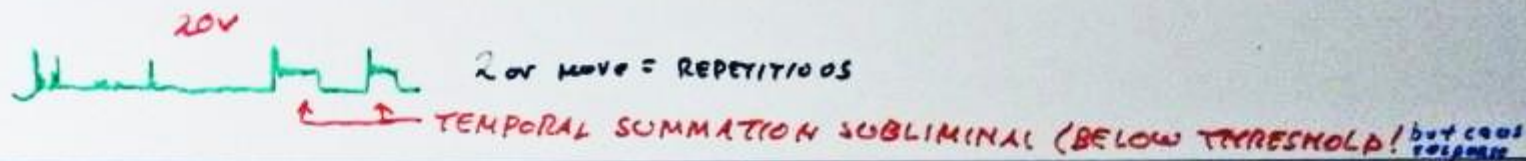
**Massive
Pterygoideus m.**



muscle tone - continuous but partial contraction - some fibers always in contraction:
 ↳ too many = SPASTIC
 ↳ too few = FLACCID

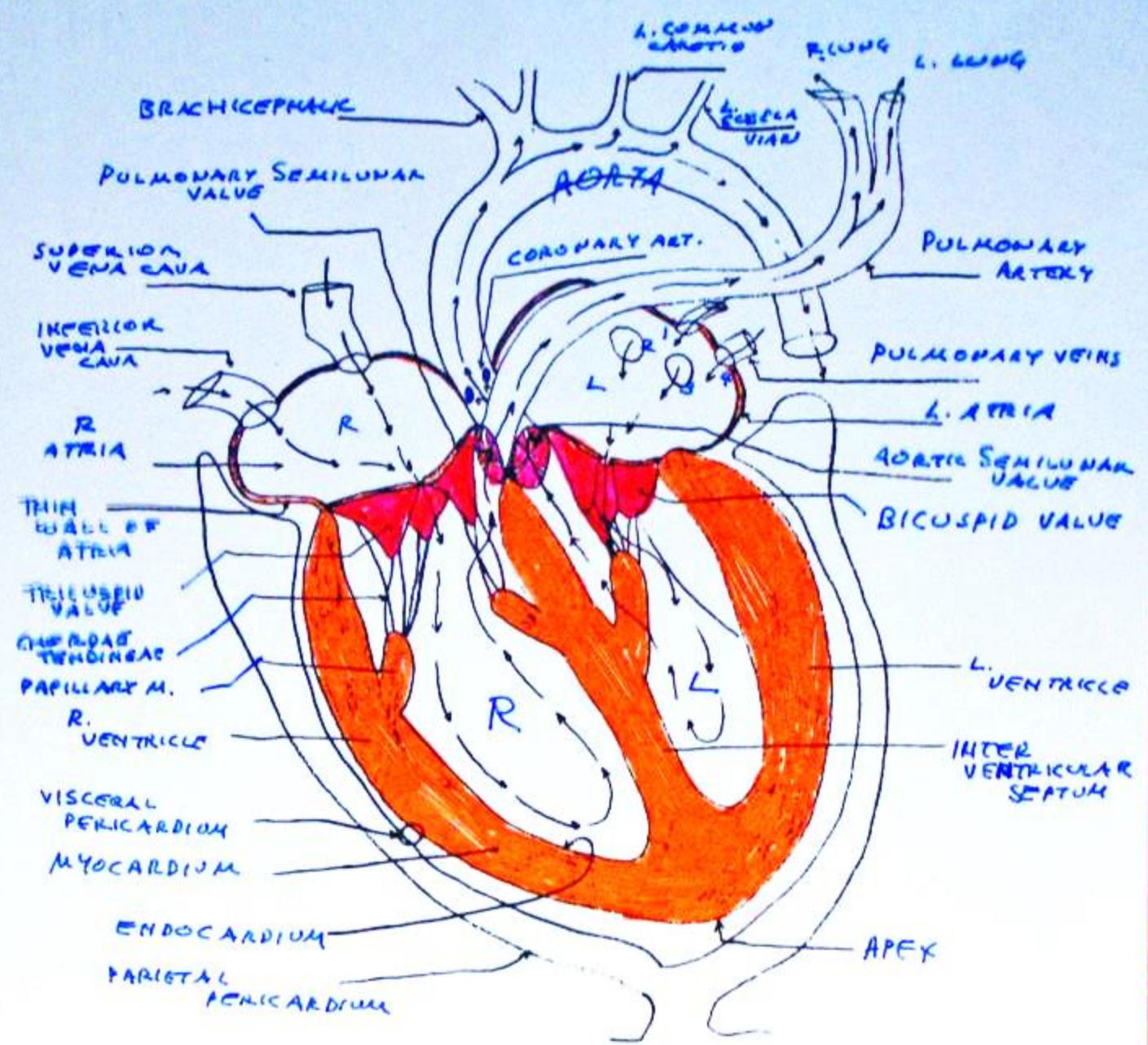
isotonic contraction = tension same but length of muscle changes, no load (wt.) on muscle - myofibrils are shorter (myosin "wins")
 isometric contraction = muscle length same - tension increases

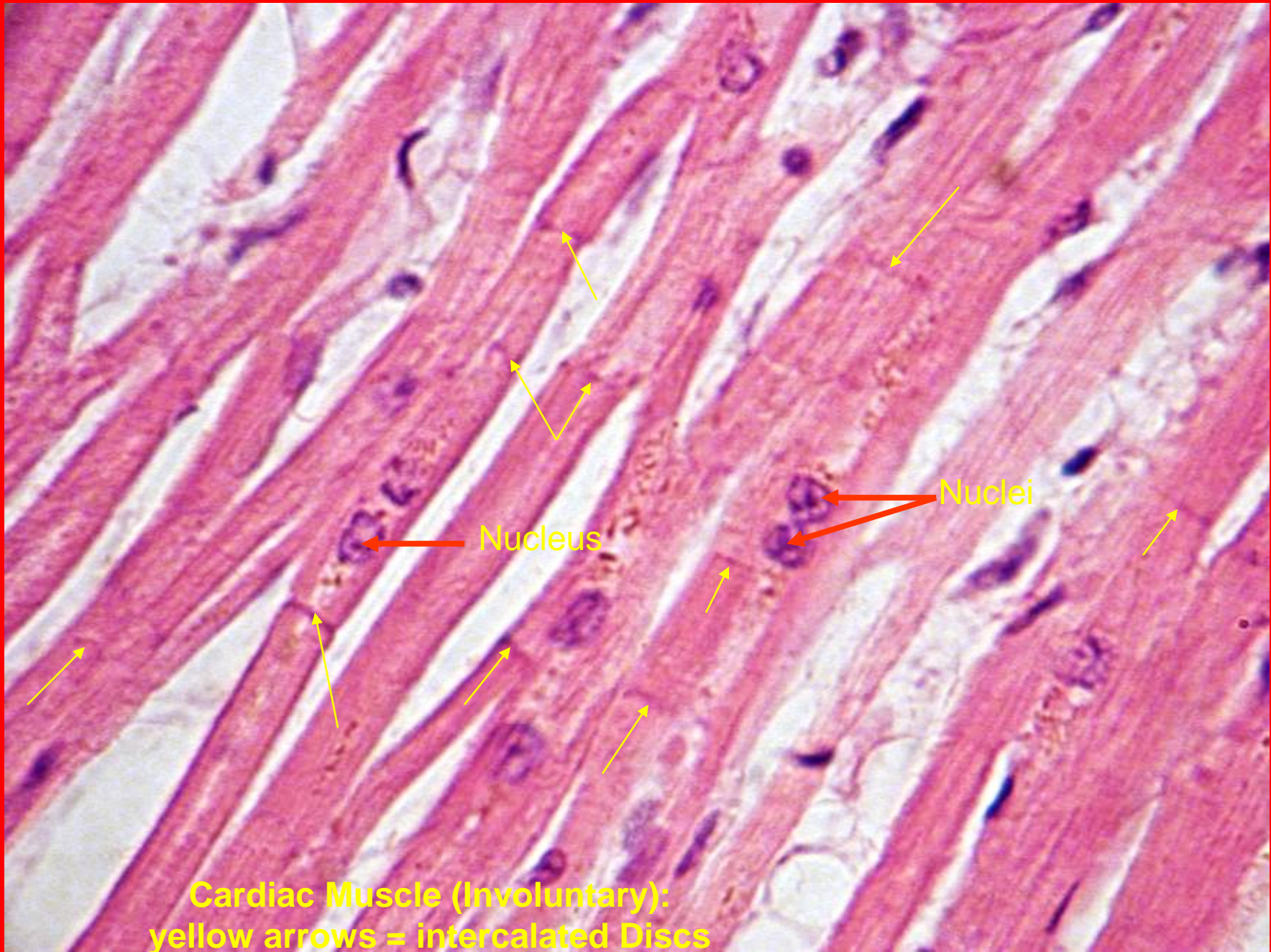
TREPPE STAIRCASE (contractions increase @ first - then FATIGUE)



Cardiac (Involuntary) Muscle: only in HEART

Cardiac, Striated, Involuntary; Nucleus in center of branching & anastomosing cells and cells connected by intercalated discs(desmosomes and gaps) specialized cells conduct messages to contract (Purkinje cells)

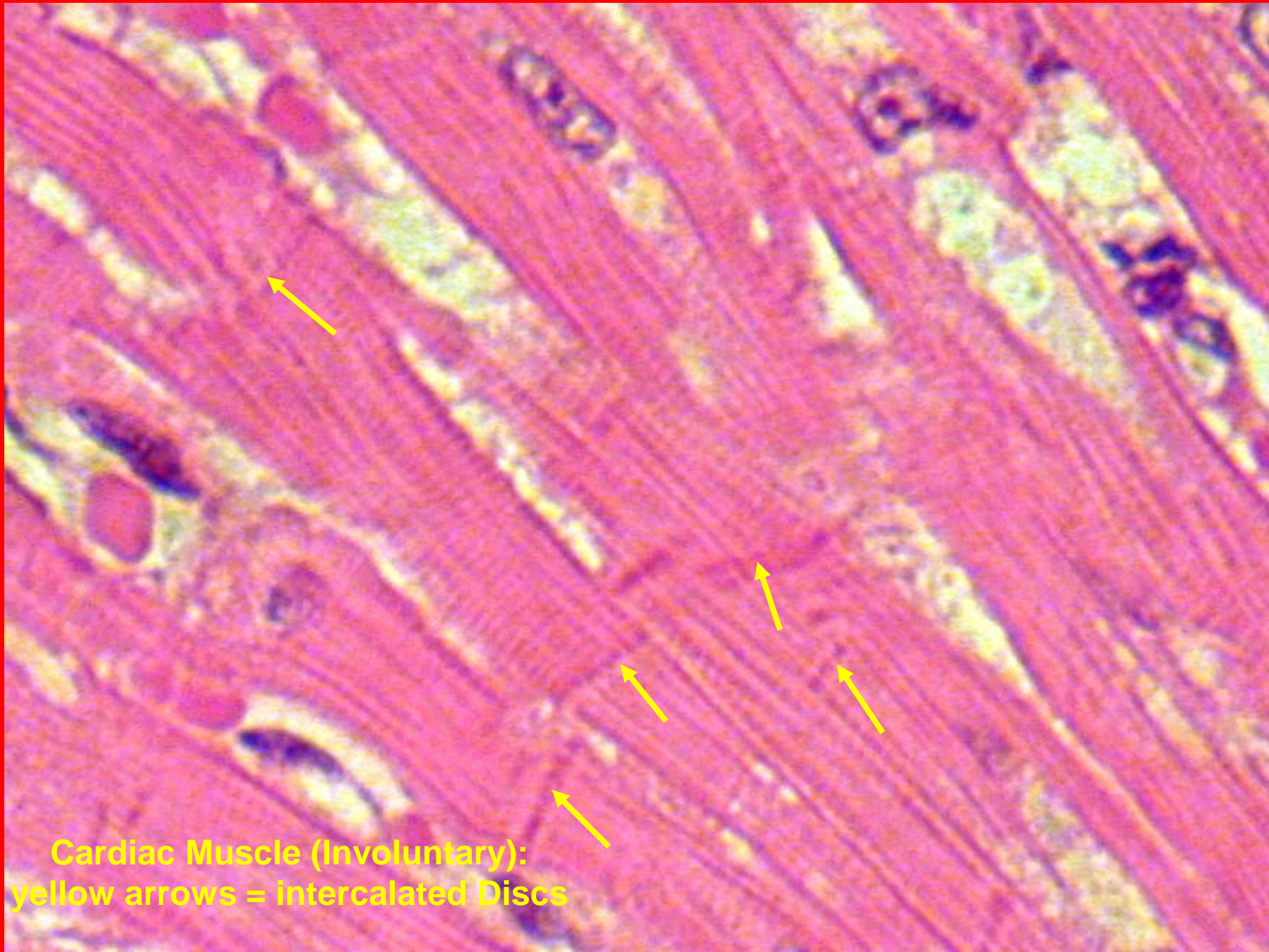




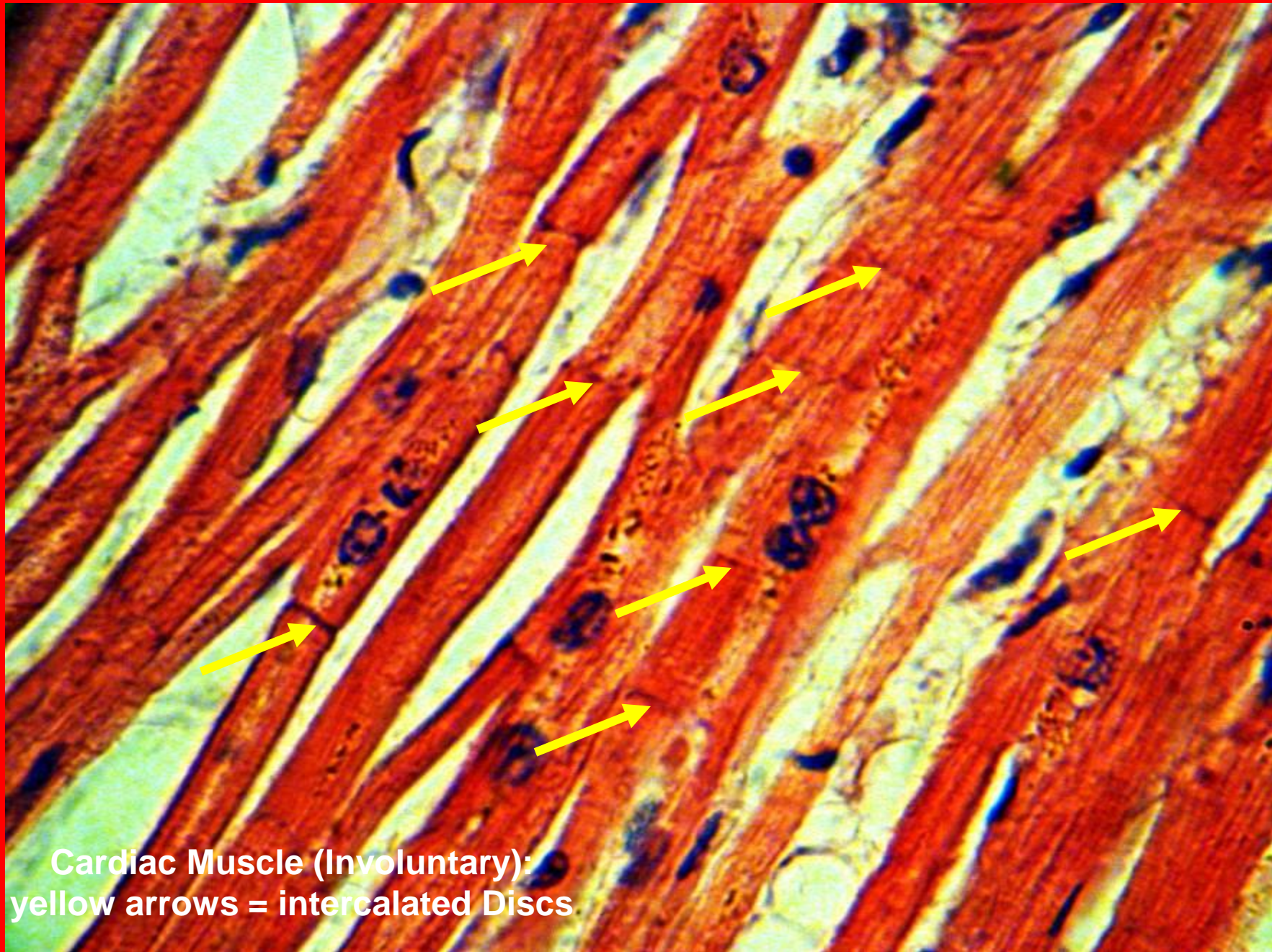
Nucleus

Nuclei

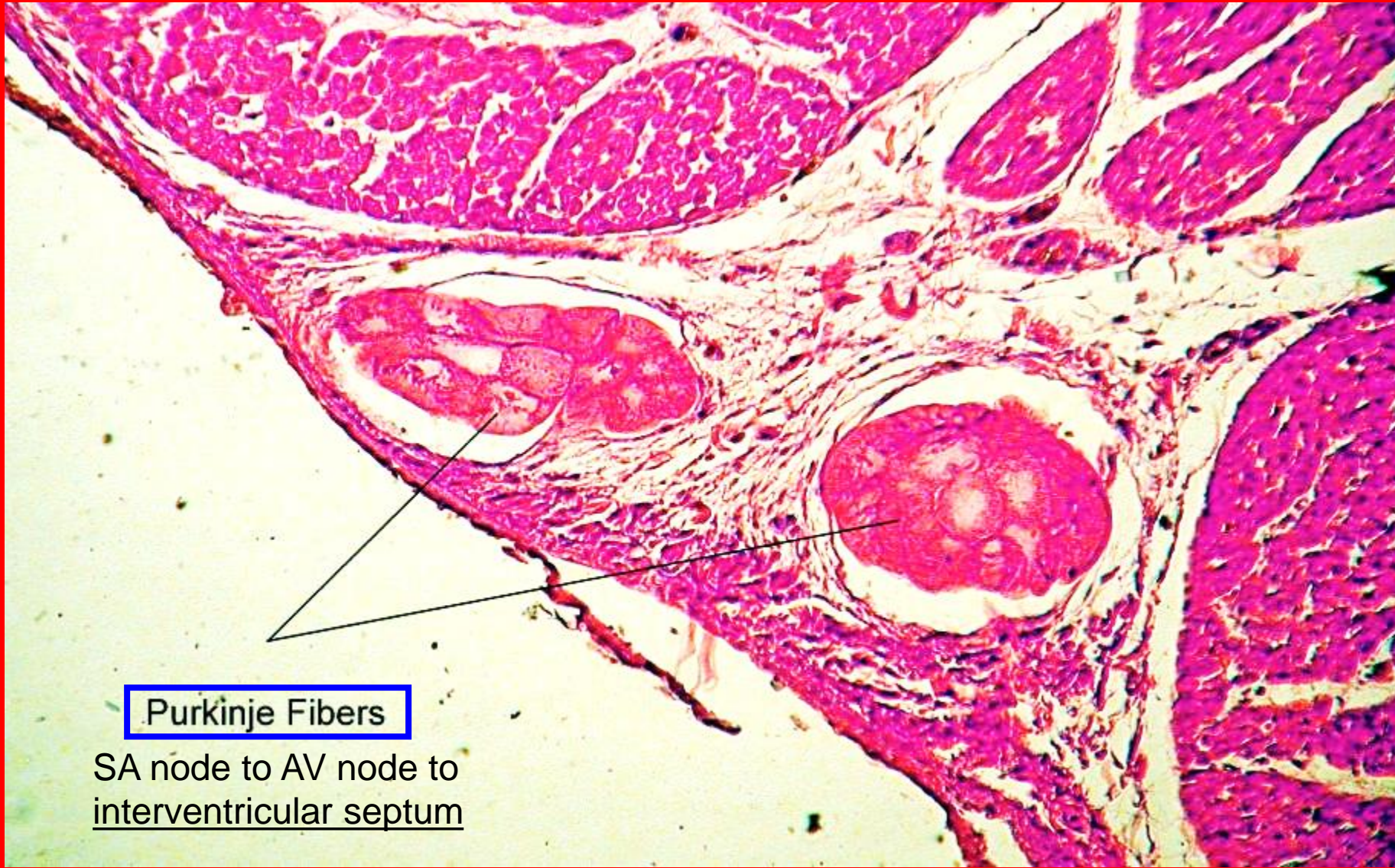
Cardiac Muscle (Involuntary):
yellow arrows = intercalated Discs



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yellow arrows = intercalated Discs

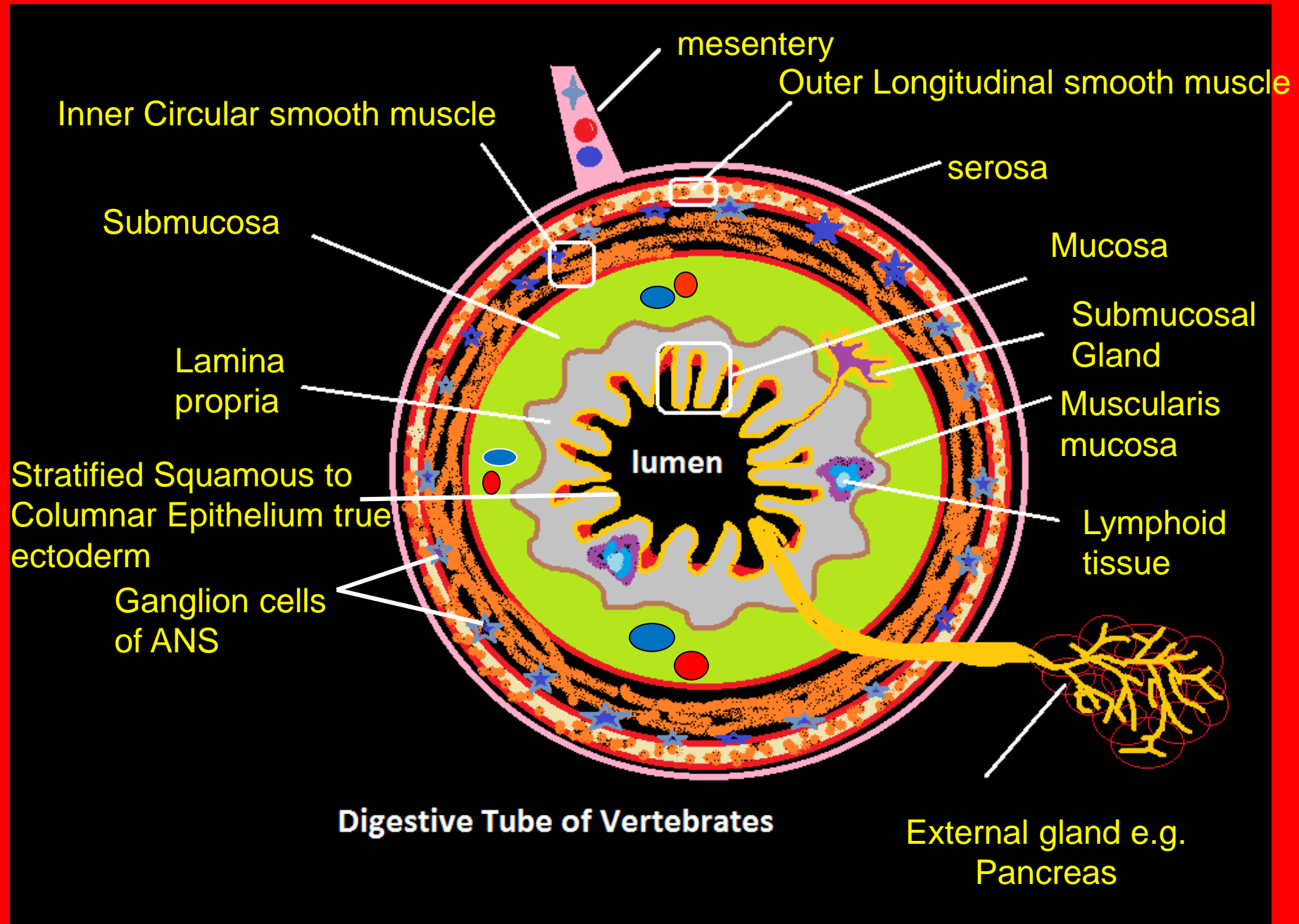


Purkinje Fibers

SA node to AV node to
interventricular septum

Smooth (Involuntary) Muscle – Digestive Tube, Urinary and Reproductive system and Arteries, etc..

Smooth, Unstriated, Involuntary Muscle:
Nucleus in center of cell





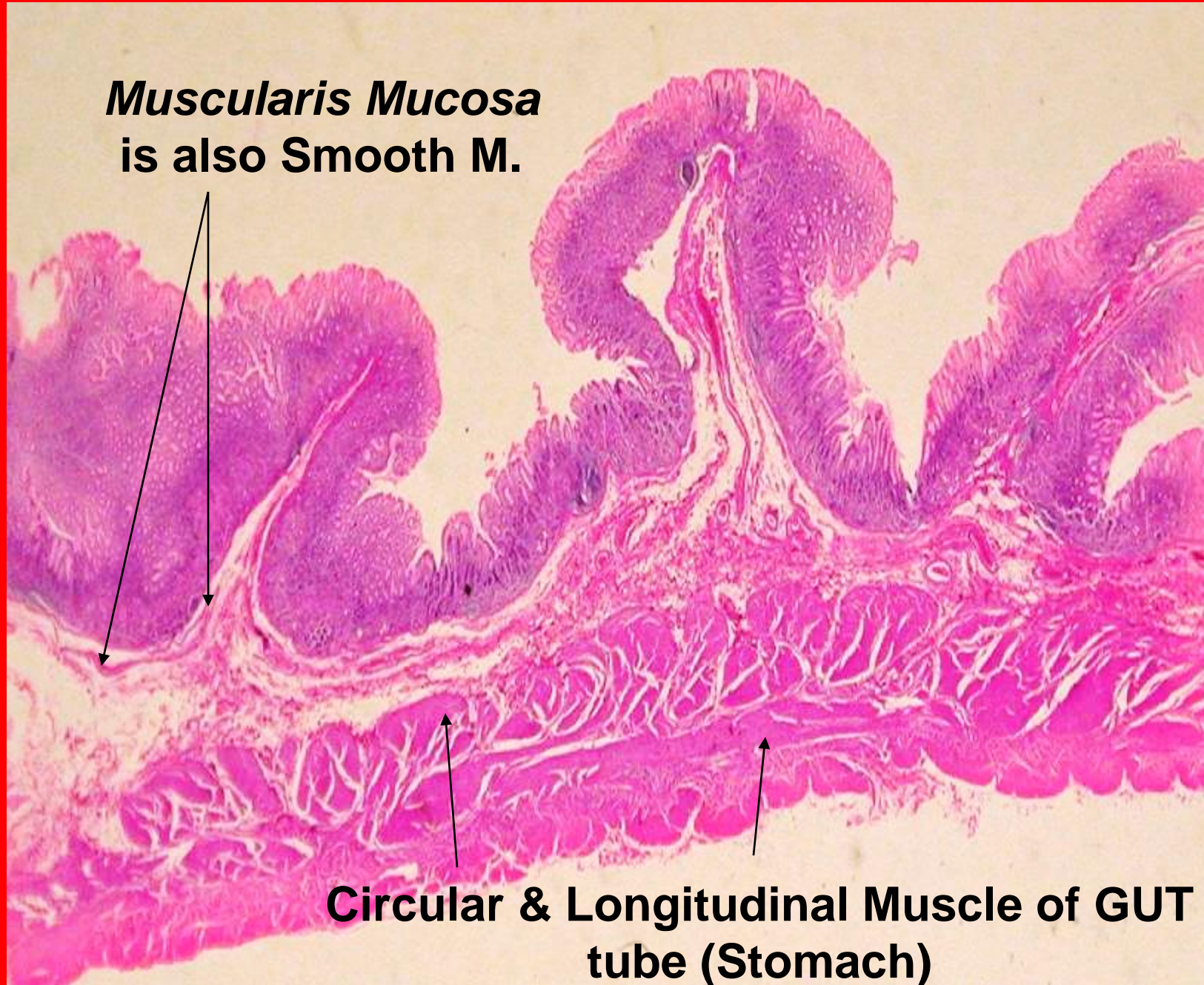
cilia

Smooth muscle
in uterine tube

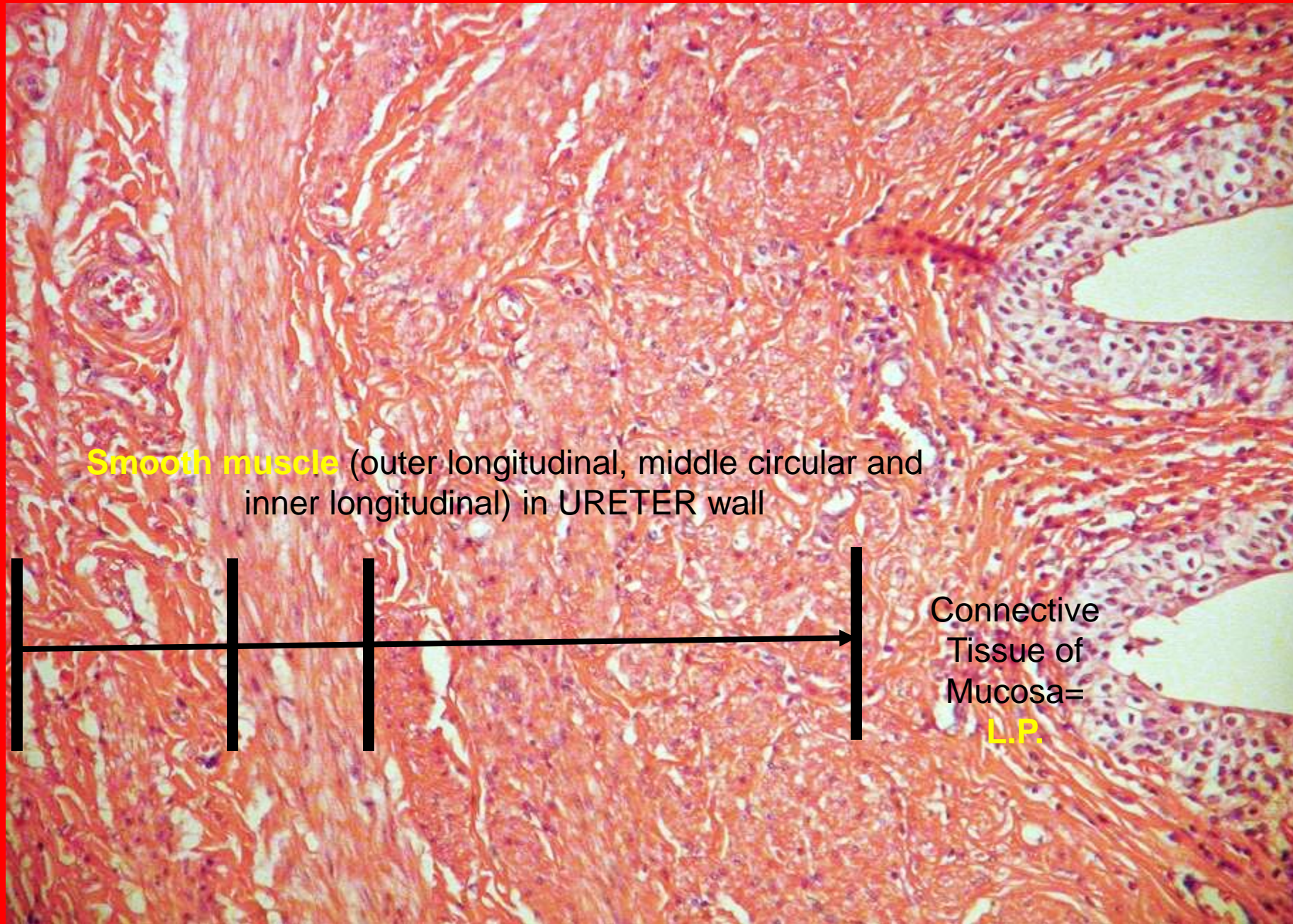
Note elongate, spindle-shape cells & elongate, centrally located nuclei



Muscularis Mucosa
is also Smooth M.



**Circular & Longitudinal Muscle of GUT
tube (Stomach)**



Smooth muscle (outer longitudinal, middle circular and inner longitudinal) in URETER wall

Connective
Tissue of
Mucosa=
L.P.