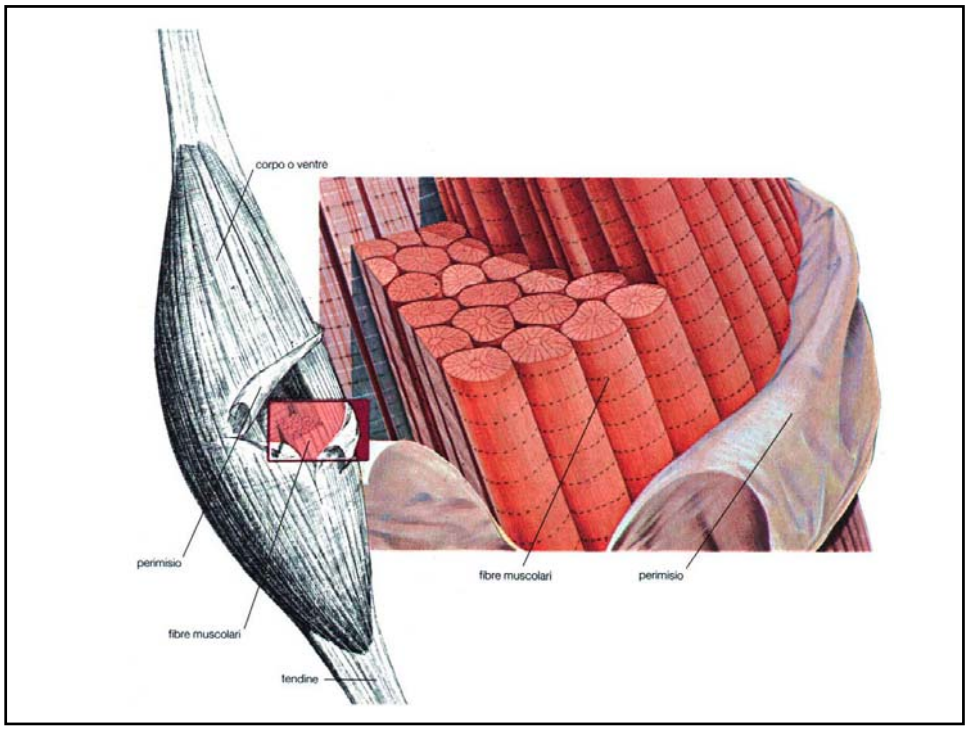
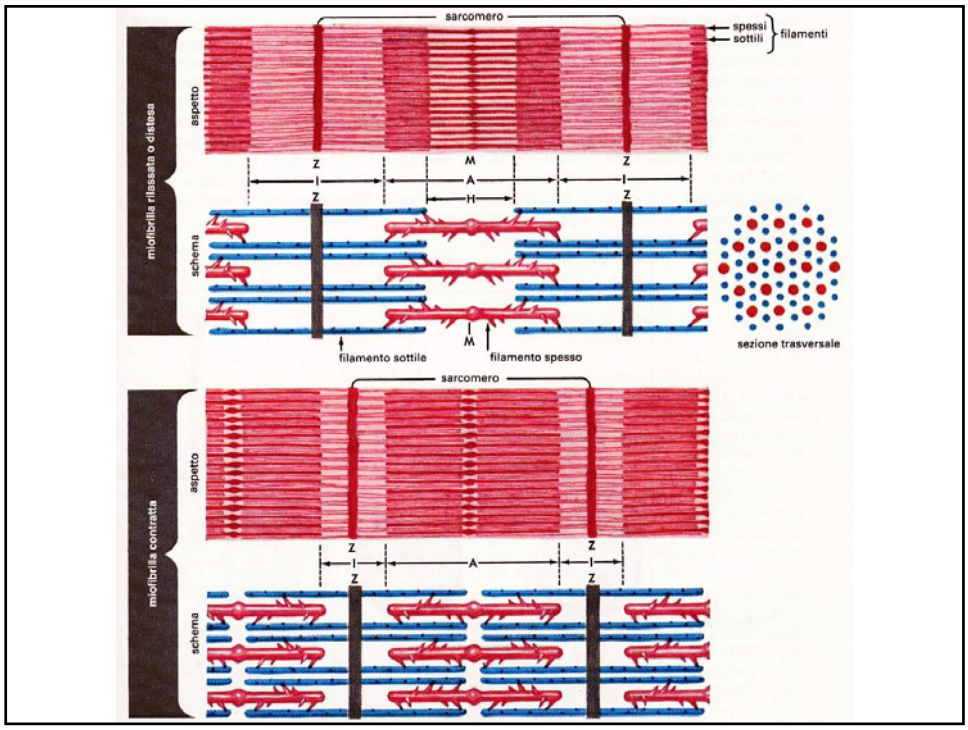
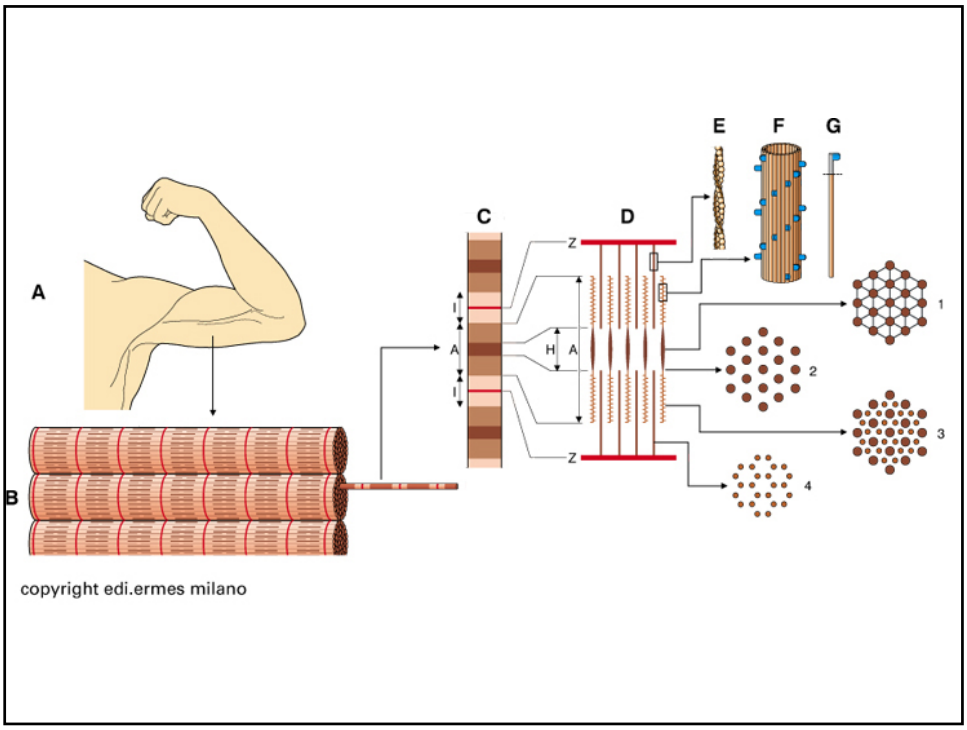
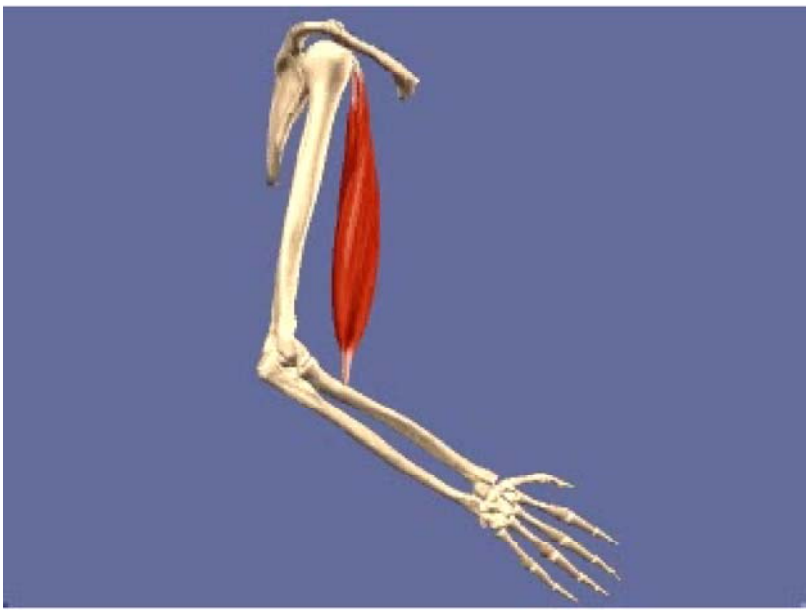
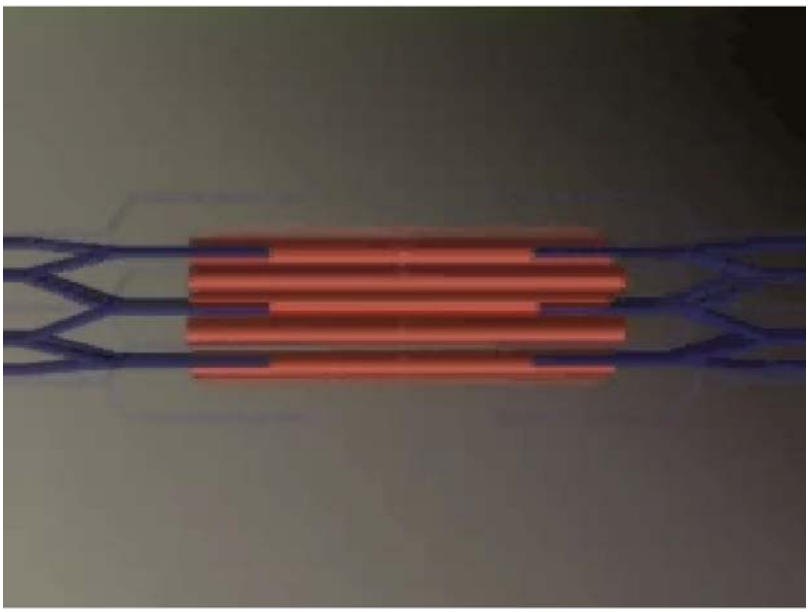

corpo o ventre
perimisio
fibre muscolari
tendine
fibre muscolari
perimisio

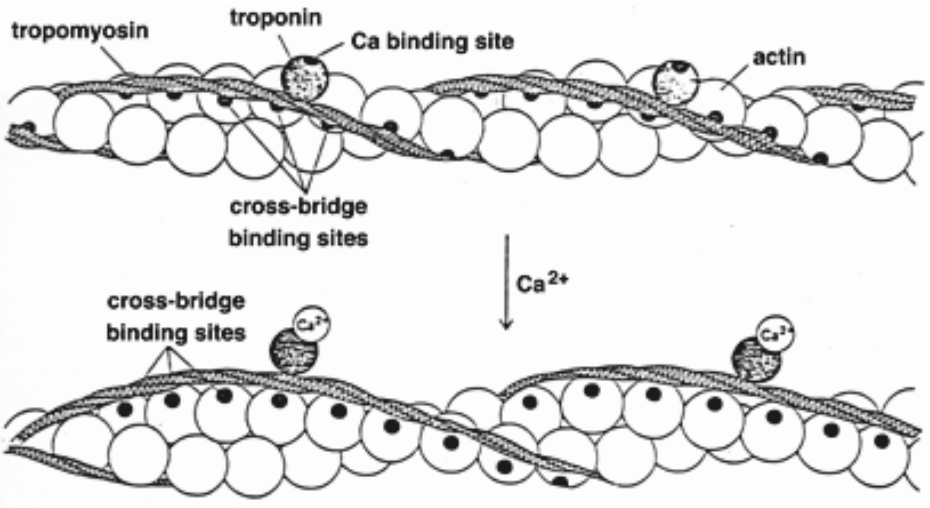

sarcomero
spessi
sottili
filamenti
miofibrilla rilassata o distesa
aspetto
schema
Z
I
M
A
H
filamento sottile
filamento spesso
sezione trasversale
sarcomero
miofibrilla contratta
aspetto
schema

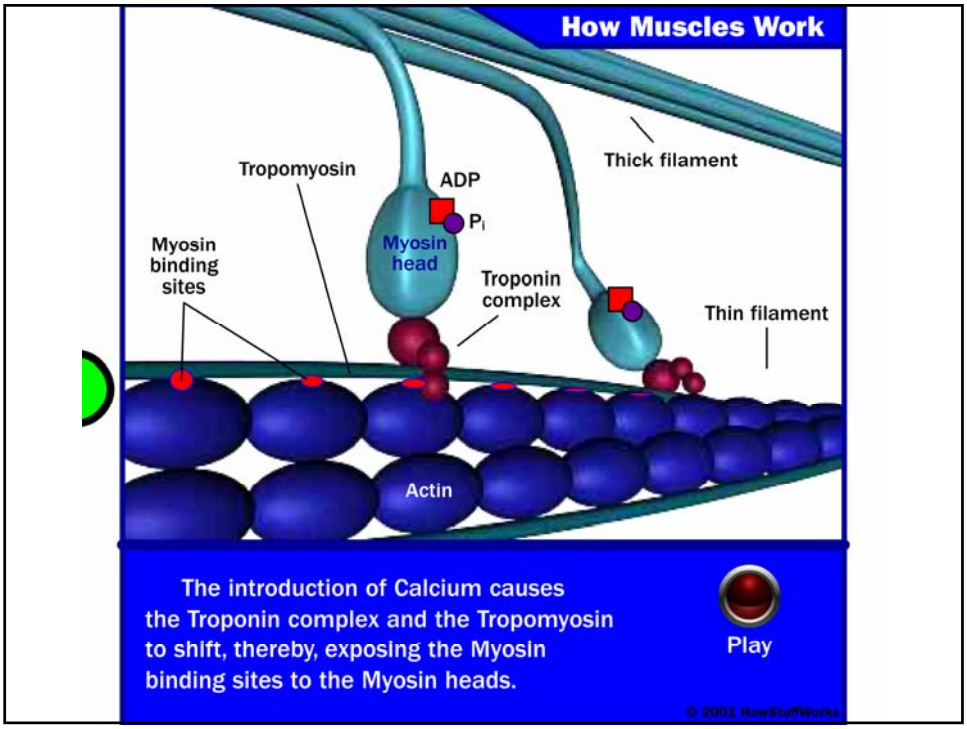


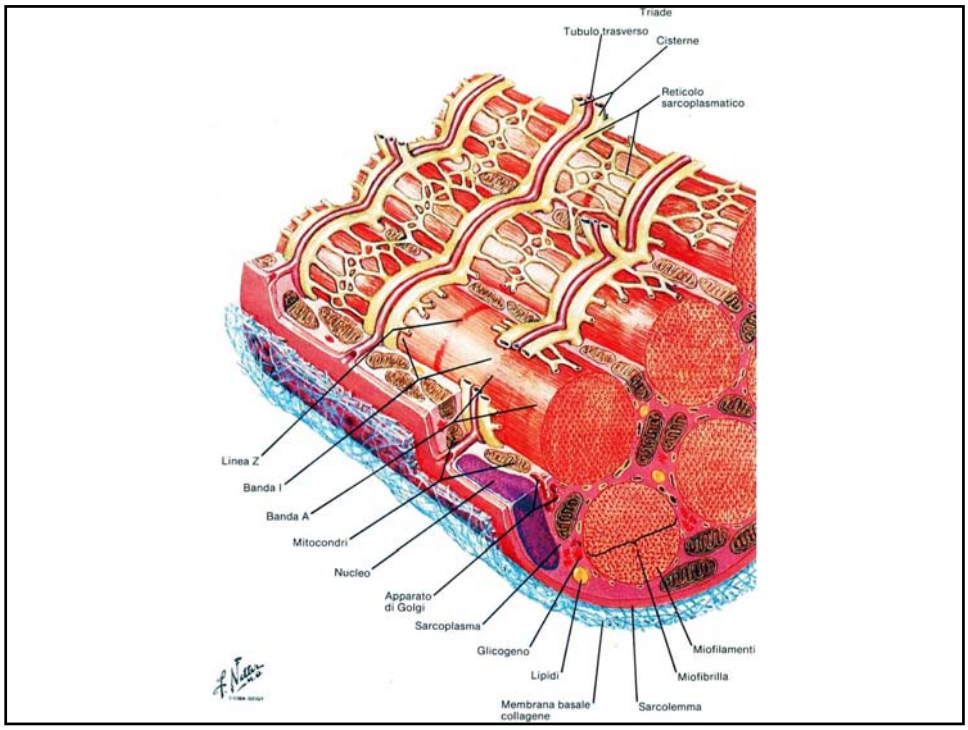


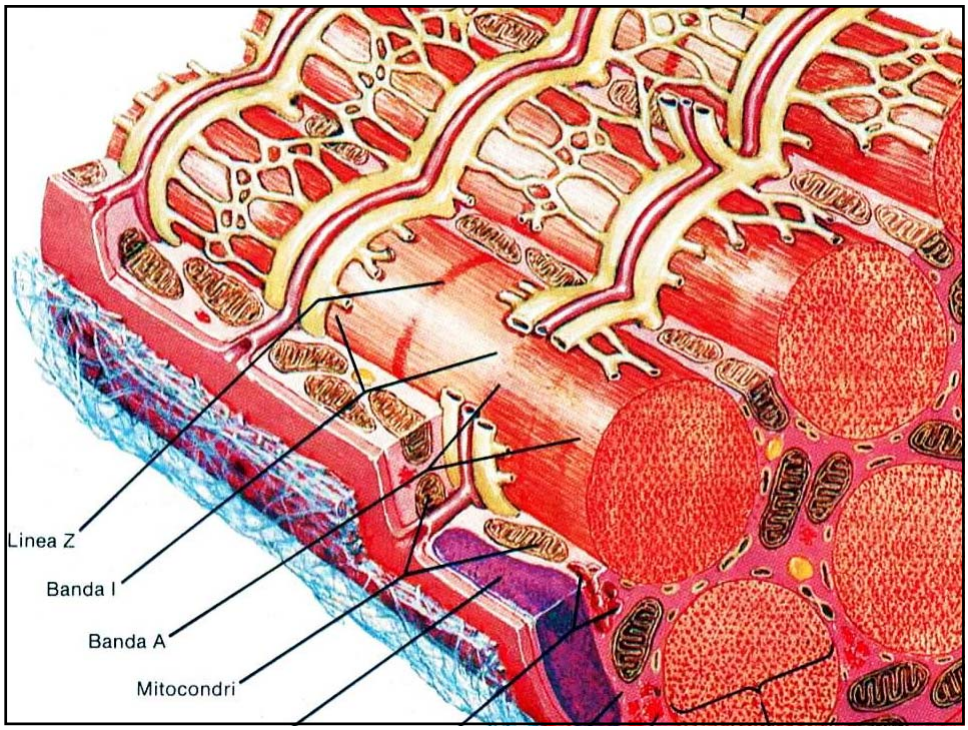


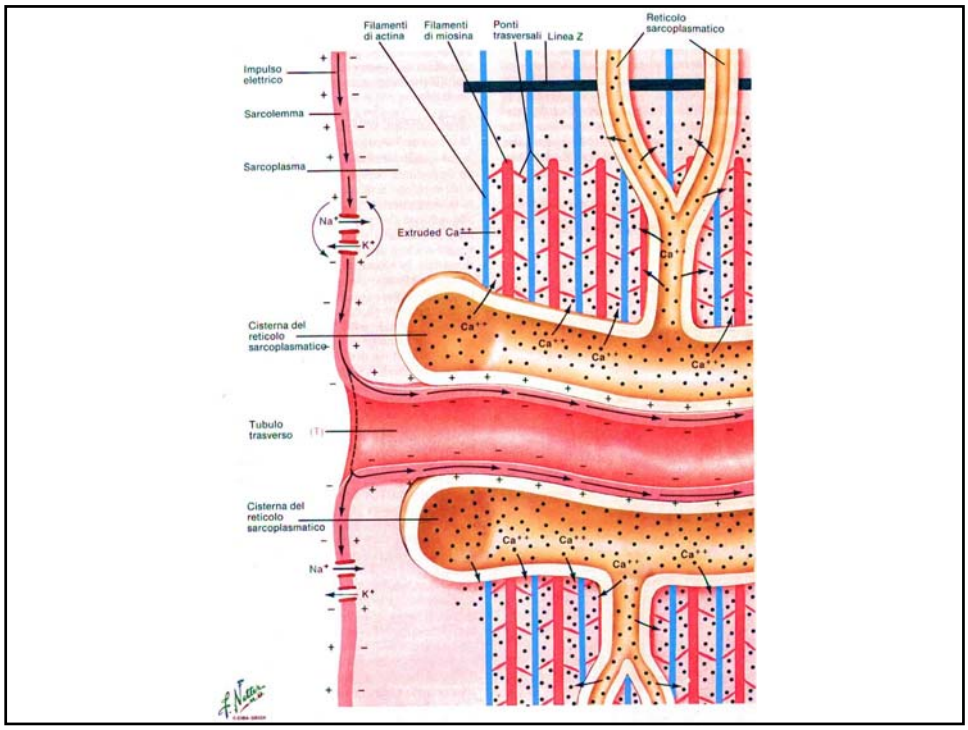

Myosin complex
with
ATPase
activation
Actin Helix
Tropomyosin
ATP
Troponin
ADP
Pi
Ca2+
Mg2+

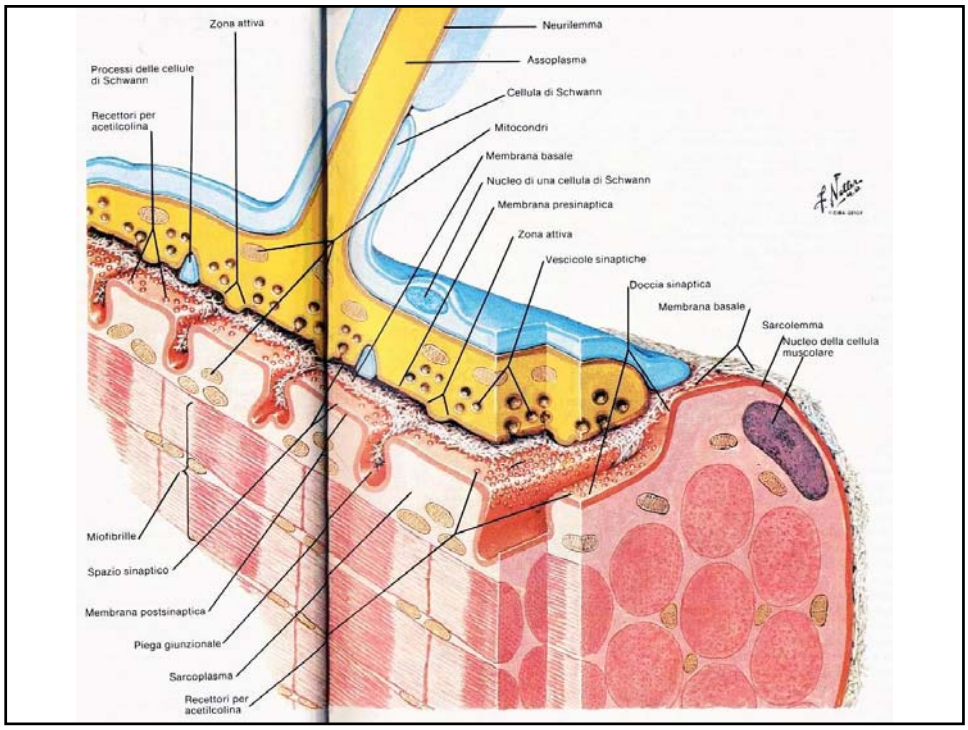

tropomyosin
troponin
Ca binding site
actin
cross-bridge
binding sites
Ca 2+
cross-bridge
binding sites

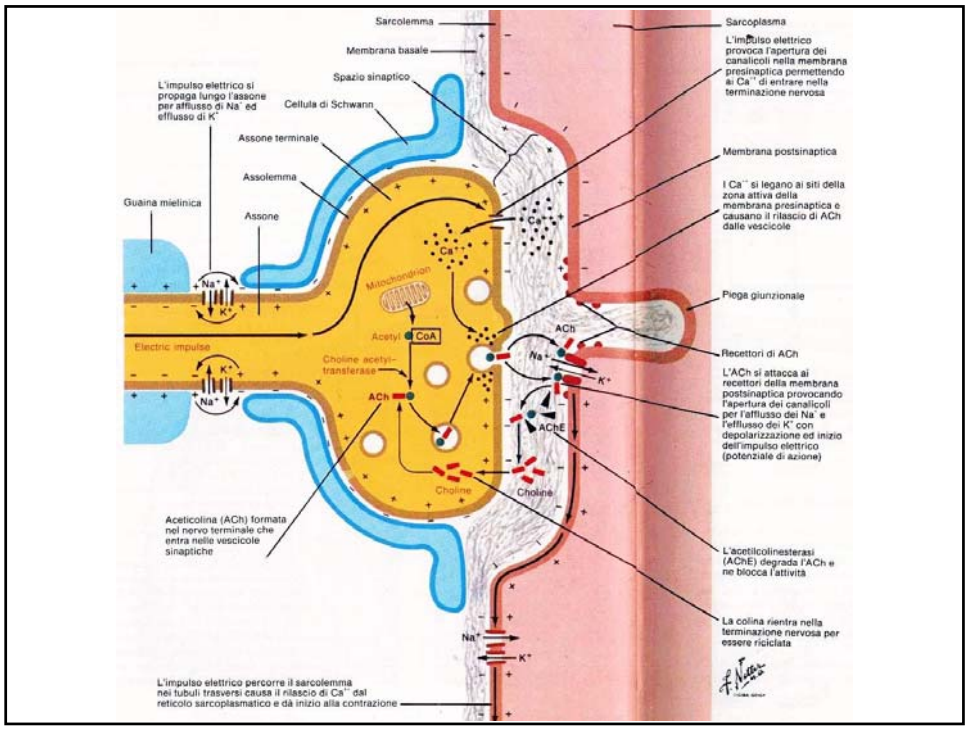

How Muscles Work
Tropomyosin
ADP
Pi
Thick filament
Myosin
binding
sites
Myosin
head
Troponin
complex
Thin filament
Actin
The introduction of Calcium causes the Troponin complex and the Tropomyosin to shift, thereby, exposing the Myosin binding sites to the Myosin heads.
Play

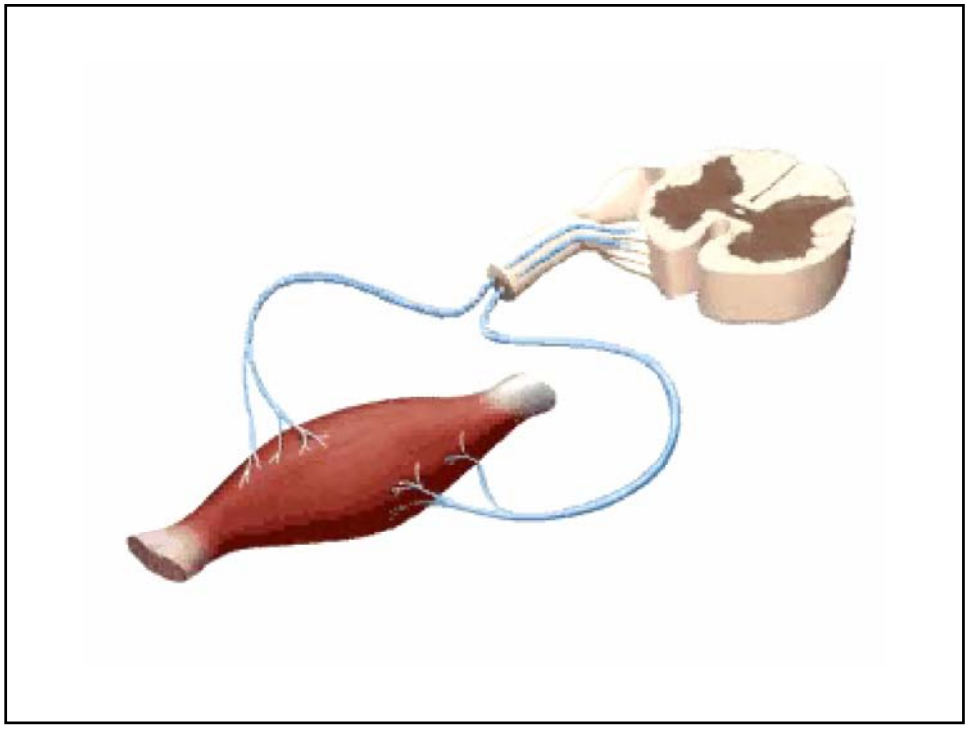

Triade
Tubulo trasverso
Cisterne
Reticolo sarcoplasmatico
Linea Z
Banda I
Banda A
Mitocondri
Nucleo
Apparato di Golgi
Sarcoplasma
Glicogeno
Lipidi
Membrana basale collagene
Sarcolemma
Miofilamenti
Miofibrilla

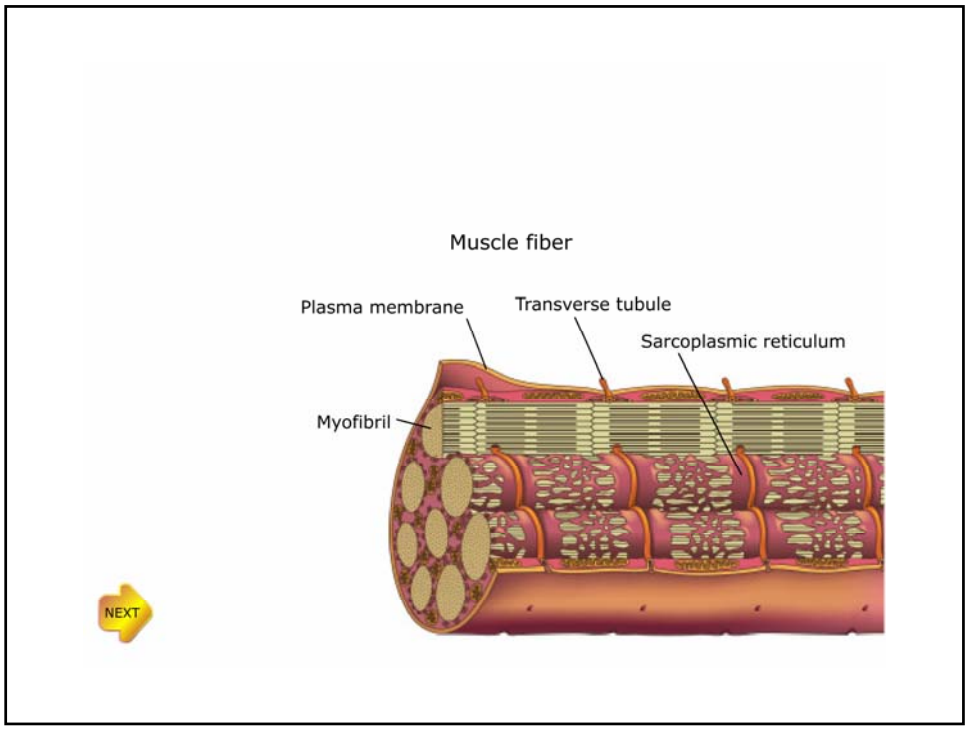

Linea Z
Banda I
Banda A
Mitocondri


Filamenti di actina
Filamenti di miosina
Ponti trasversali
Linea Z
Reticolo sarcoplasmatico
Impulso elettrico
Sarcolemma
Sarcoplasma
Na+
K+
Extruded Ca++
Ca++
Cisterna del reticolo sarcoplasmatico
Tubulo trasverso (T)
Cisterna del reticolo sarcoplasmatico
Na+
K+


Zona attiva
Processi delle cellule di Schwann
Recettori per acetilcolina
Neurilemma
Assoplasma
Cellula di Schwann
Mitocondri
Membrana basale
Nucleo di una cellula di Schwann
Membrana presinaptica
Zona attiva
Vescicole sinaptiche
Doccia sinaptica
Membrana basale
Sarcolemma
Nucleo della cellula muscolare
Miofibrille
Spazio sinaptico
Membrana postsinaptica
Piega giunzionale
Sarcoplasma
Recettori per acetilcolina


Sarcolemma
Sarcoplasma
Membrana basale
L'impulso elettrico provoca l'apertura dei canalicoli nella membrana presinaptica permettendo ai Ca++ di entrare nella terminazione nervosa
Spazio sinaptico
L'impulso elettrico si propaga lungo l'assone per afflusso di Na+ ed efflusso di K+
Cellula di Schwann
Assone terminale
Membrana postsinaptica
Assolemma
I Ca++ si legano ai siti della zona attiva della membrana presinaptica e causano il rilascio di ACh dalle vescicole
Guaina mielinica
Assone
Mitochondrion
Piega giunzionale
Acetyl CoA
ACh
Recettori di ACh
Electric impulse
Choline acetyl-transferase
L'ACh si attacca ai recettori della membrana postsinaptica provocando l'apertura dei canalicoli per l'afflusso dei Na+ e l'efflusso dei K+ con depolarizzazione ed inizio dell'impulso elettrico (potenziale di azione)
AChE
Choline
Aceticolina (ACh) formata nel nervo terminale che entra nelle vescicole sinaptiche
L'acetilcolinesterasi (AChE) degrada l'ACh e ne blocca l'attività
La colina rientra nella terminazione nervosa per essere riciclata
L'impulso elettrico percorre il sarcolemma nei tubuli trasversi causa il rilascio di Ca++ dal reticolo sarcoplasmatico e dà inizio alla contrazione





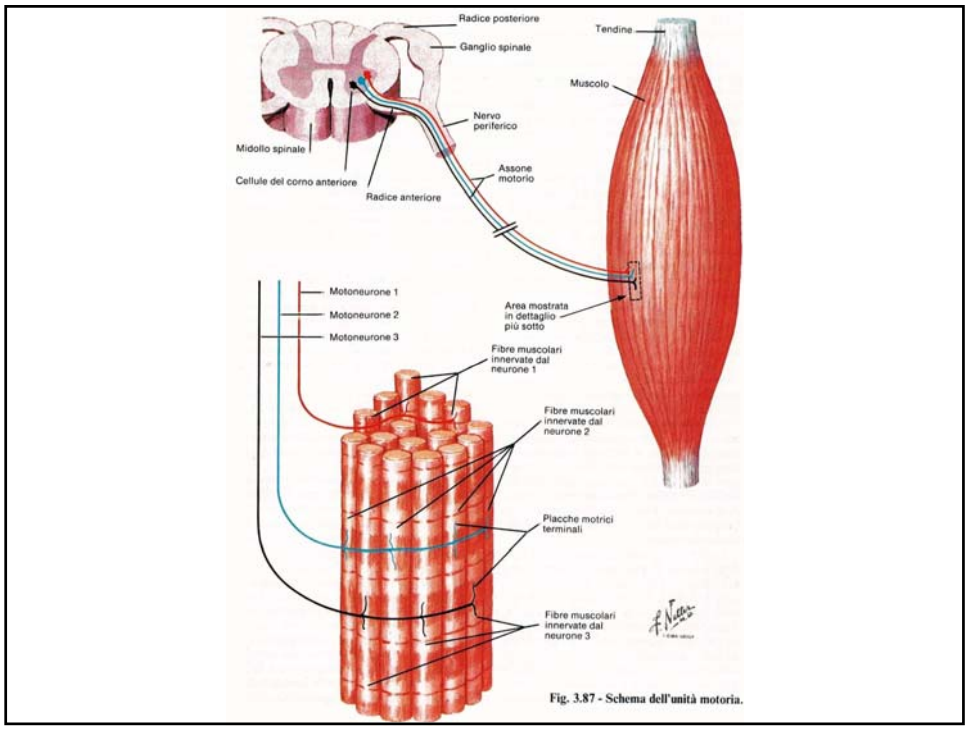
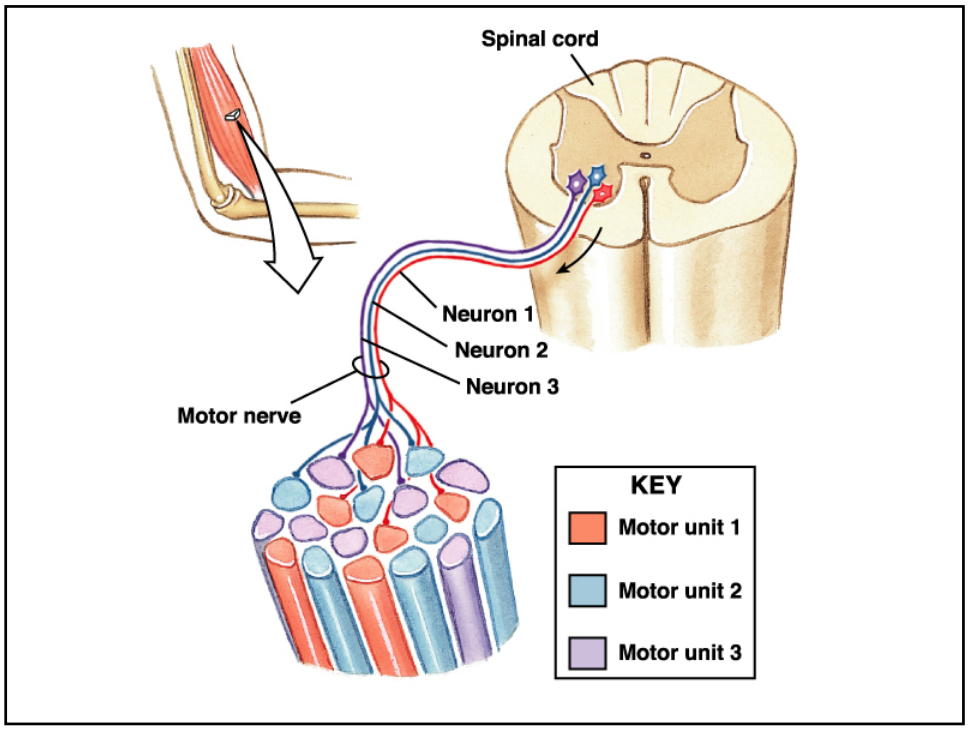
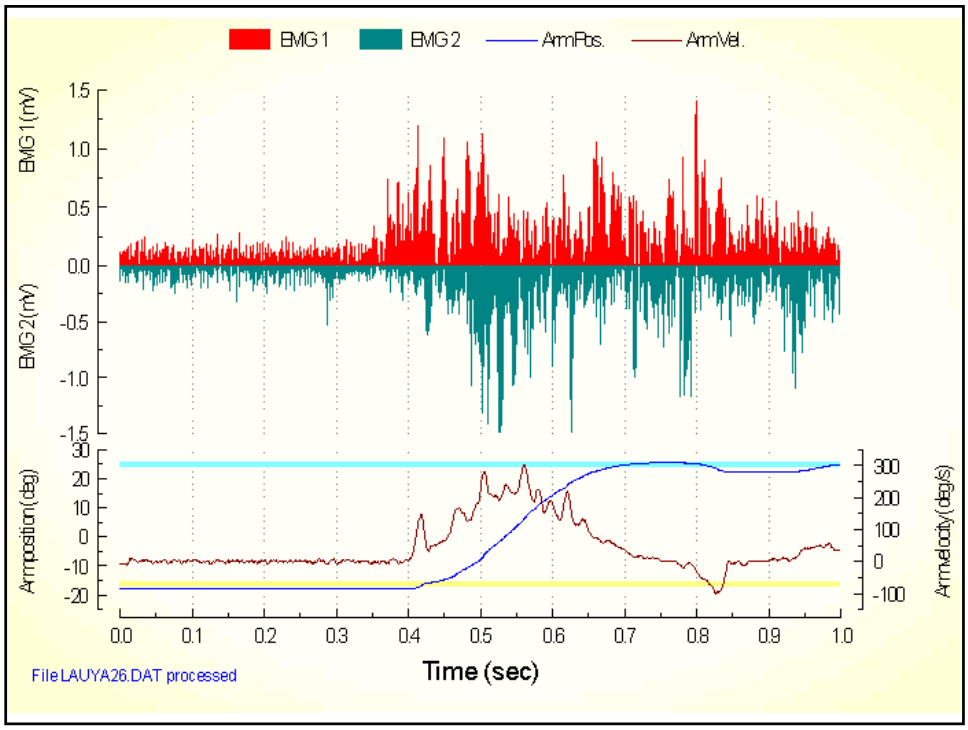
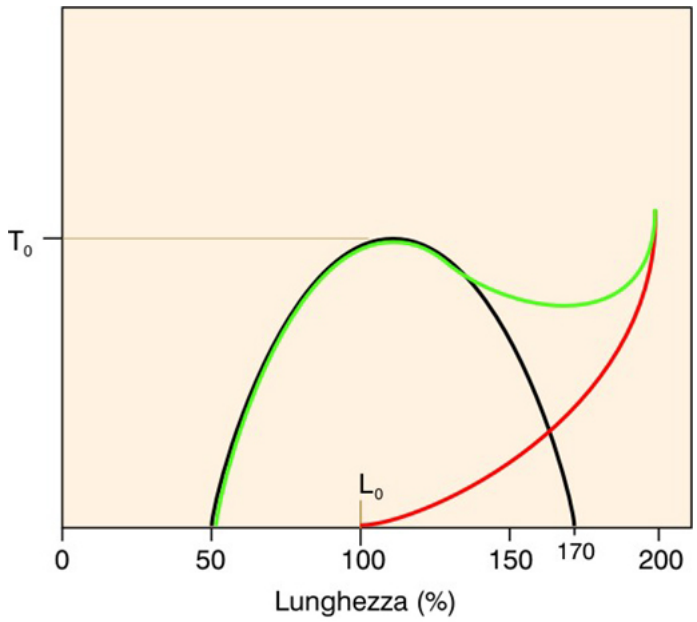
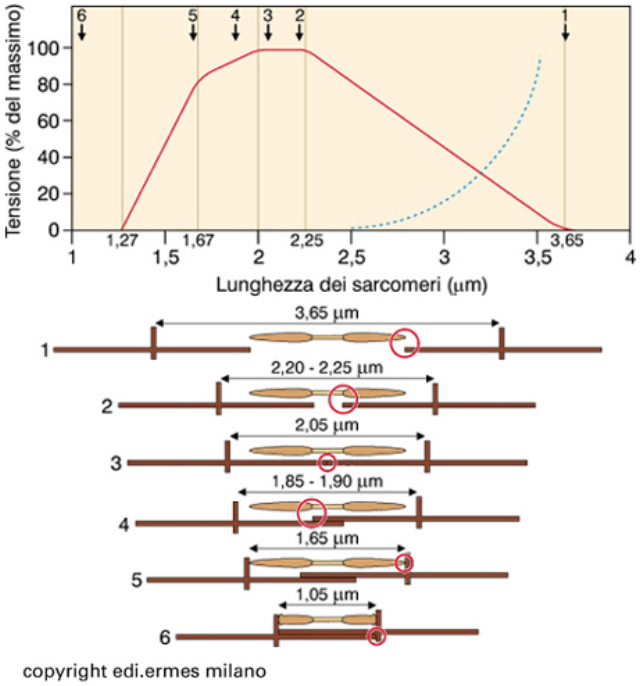


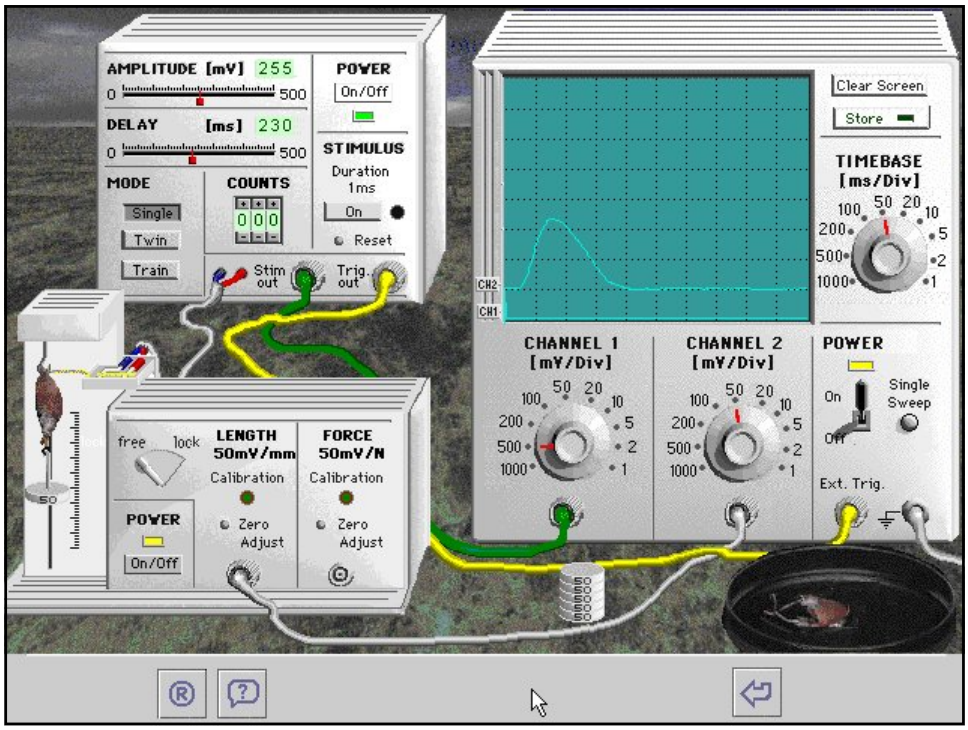
Fig. 3.87 - Schema dell'unità motoria.

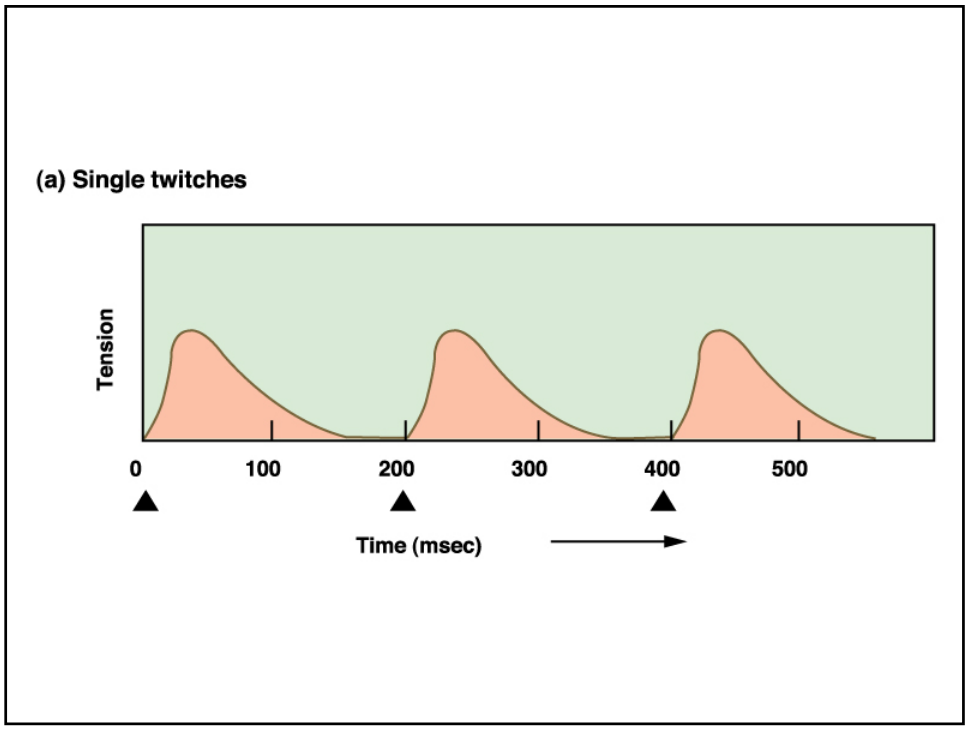

Spinal cord
Neuron 1
Neuron 2
Neuron 3
Motor nerve
KEY
Motor unit 1
Motor unit 2
Motor unit 3

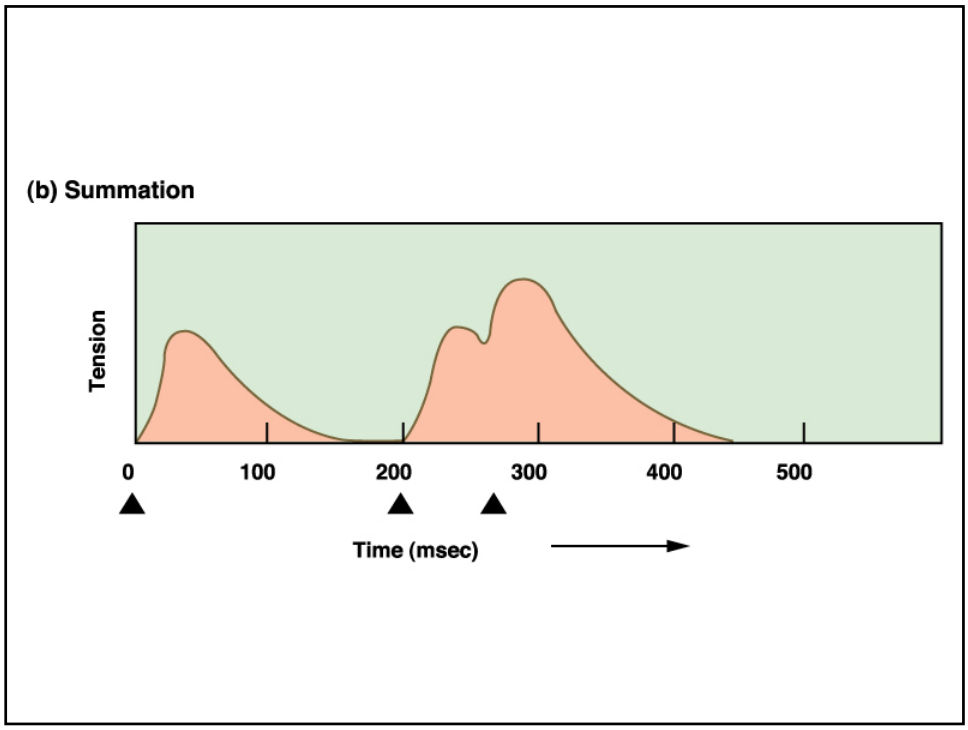

EMG 1
EMG 2
ArmPos.
ArmVel.
EMG 1 (mV)
EMG 2 (mV)
Armposition (deg)
Armvelocity (deg/s)
Time (sec)
File LAUYA26.DAT processed

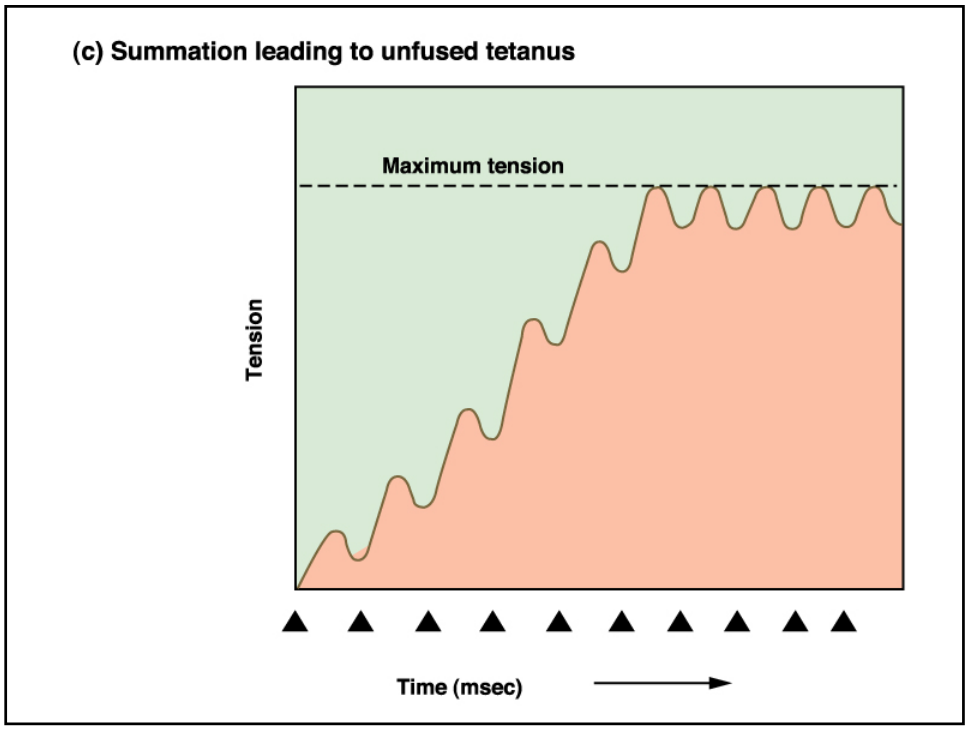


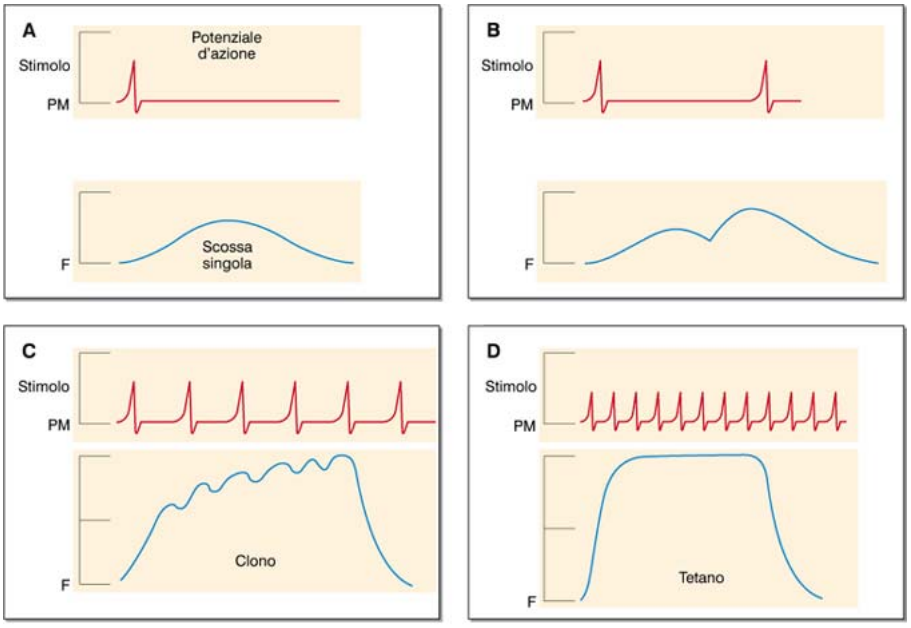


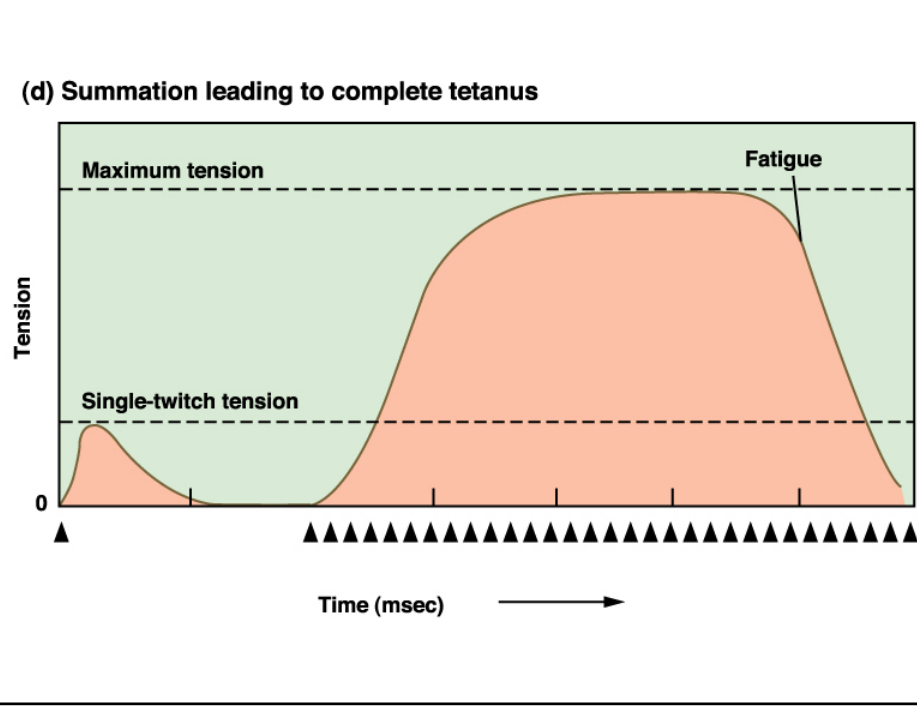

AMPLITUDE [mV] 255
0
500
DELAY [ms] 230
0
500
MODE
Single
Twin
Train
COUNTS
0 0 0
POWER
On/Off
STIMULUS
Duration
1ms
On
Reset
Stim out
Trig. out
Clear Screen
Store
TIMEBASE
[ms/Div]
100 50 20 10
200 5
500 2
1000 1
CH2
CH1
CHANNEL 1
[mV/Div]
CHANNEL 2
[mV/Div]
100 50 20 10
200 5
500 2
1000 1
POWER
On
Off
Single
Sweep
Ext. Trig.
free
lock
LENGTH
50mV/mm
Calibration
Zero
Adjust
FORCE
50mV/N
Calibration
Zero
Adjust
POWER
On/Off

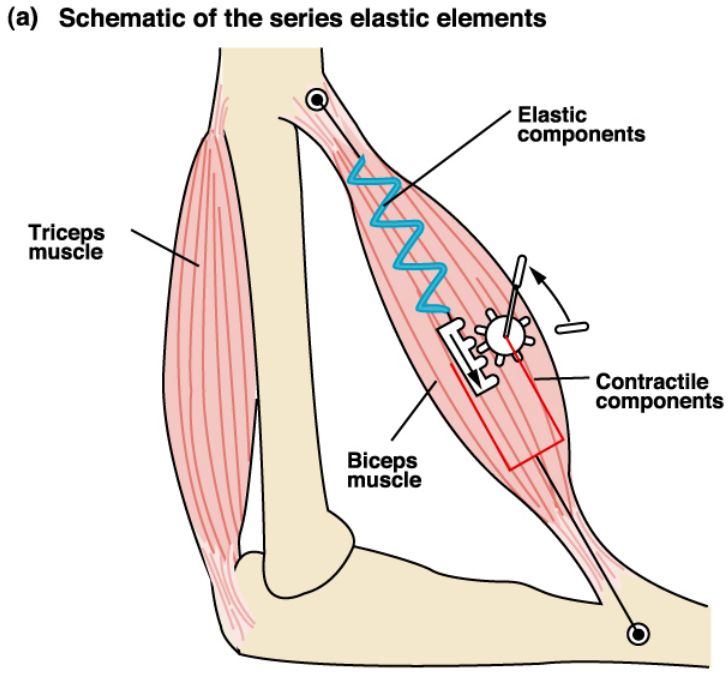

(a) Single twitches
Tension
0
100
200
300
400
500
Time (msec)


(b) Summation
Tension
0
100
200
300
400
500
Time (msec)


(c) Summation leading to unfused tetanus
Maximum tension
Tension
Time (msec)



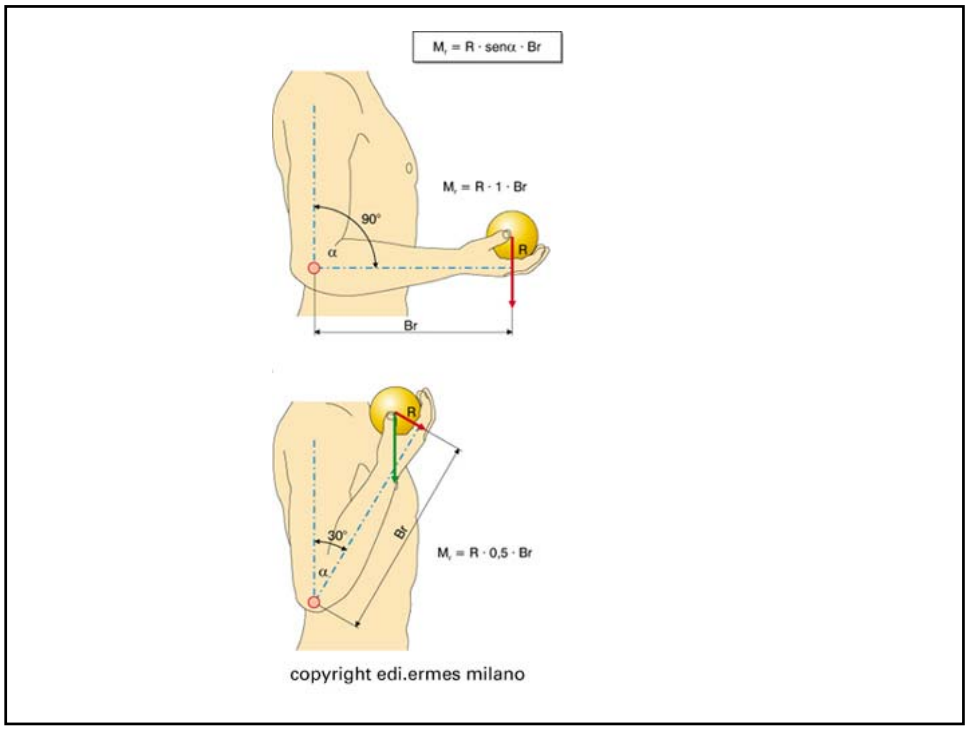


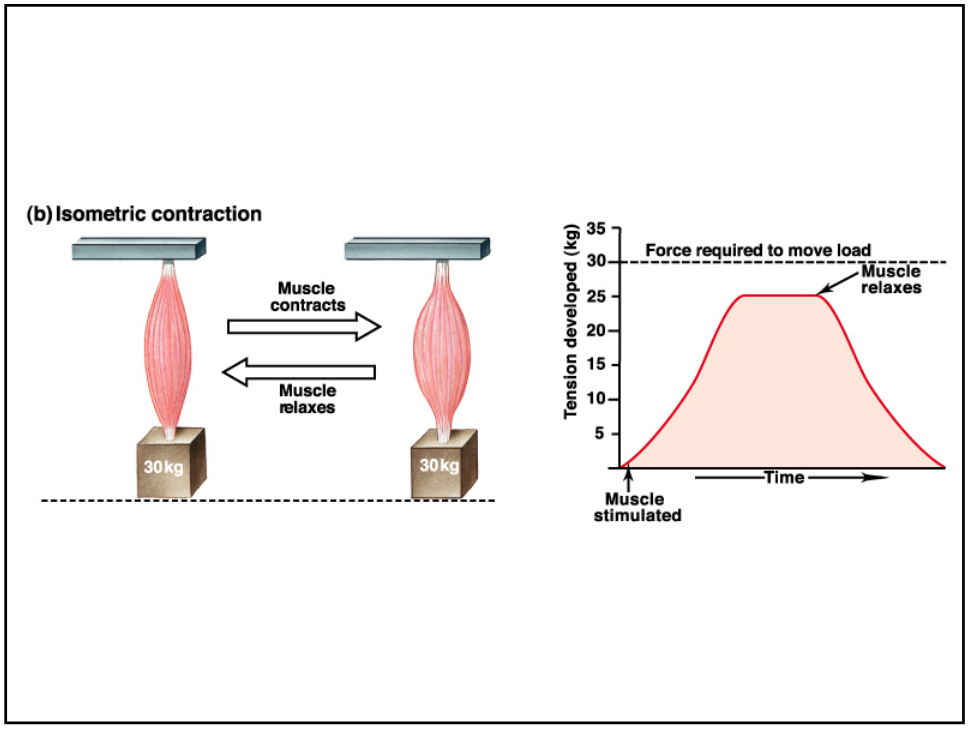


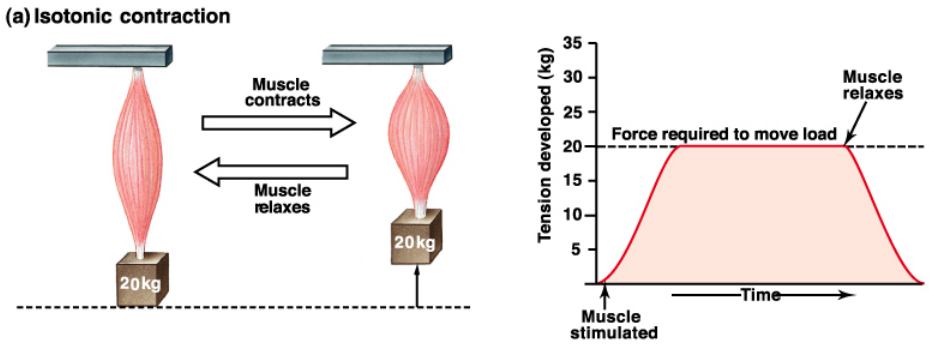
Contrazione isometrica: durante la contrazione non varia la lunghezza totale del muscolo - la forza, invece, può variare.

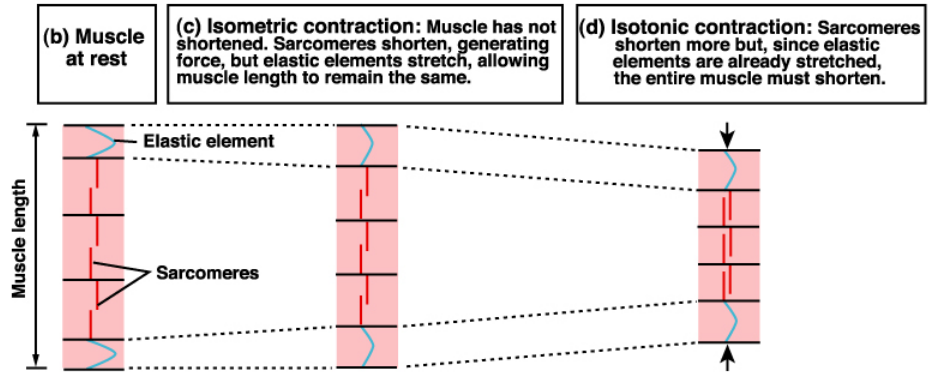
Contrazione isotonica: durante la contrazione il muscolo sviluppa sempre la stessa forza - la lunghezza, invece, può variare.

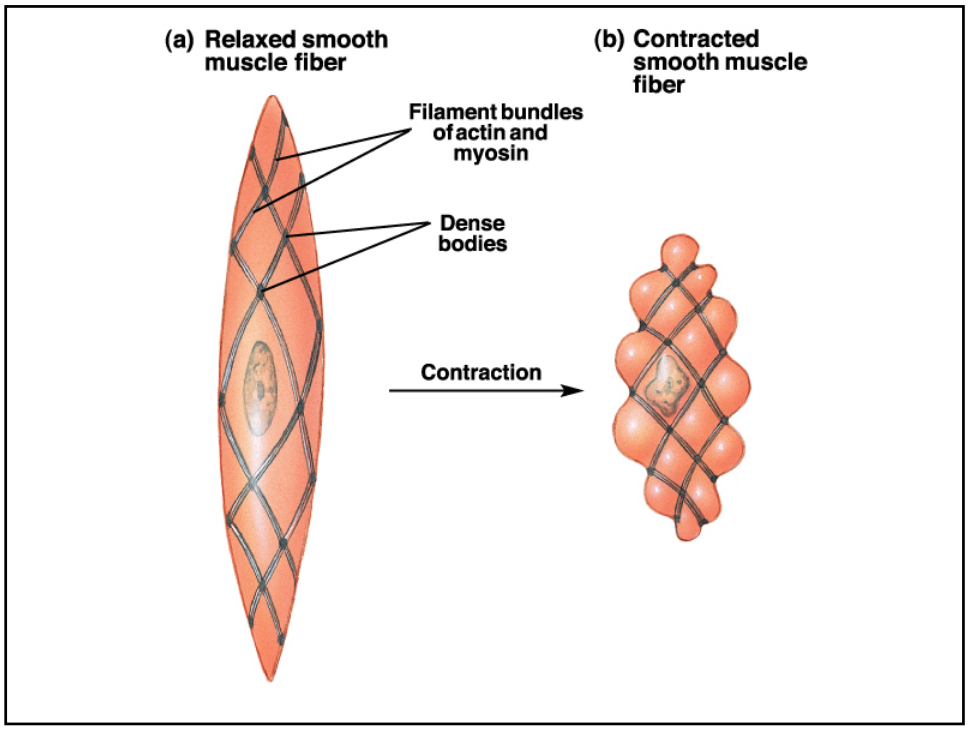
Il più delle volte la contrazione di un muscolo è isometrica nella prima fase, per poi diventare isotonica.

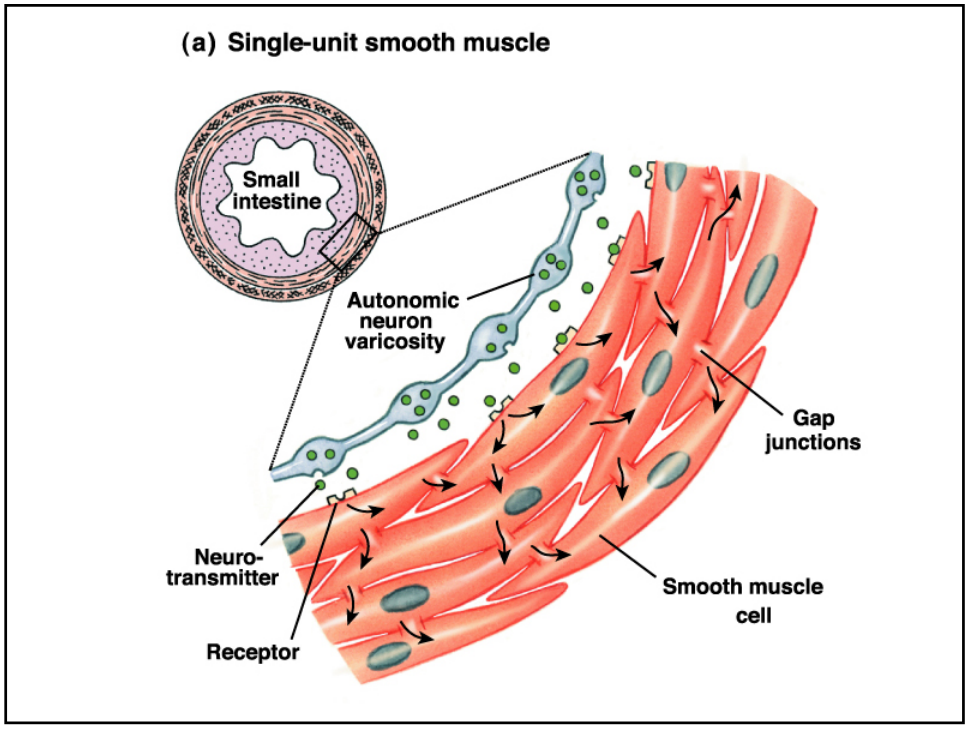


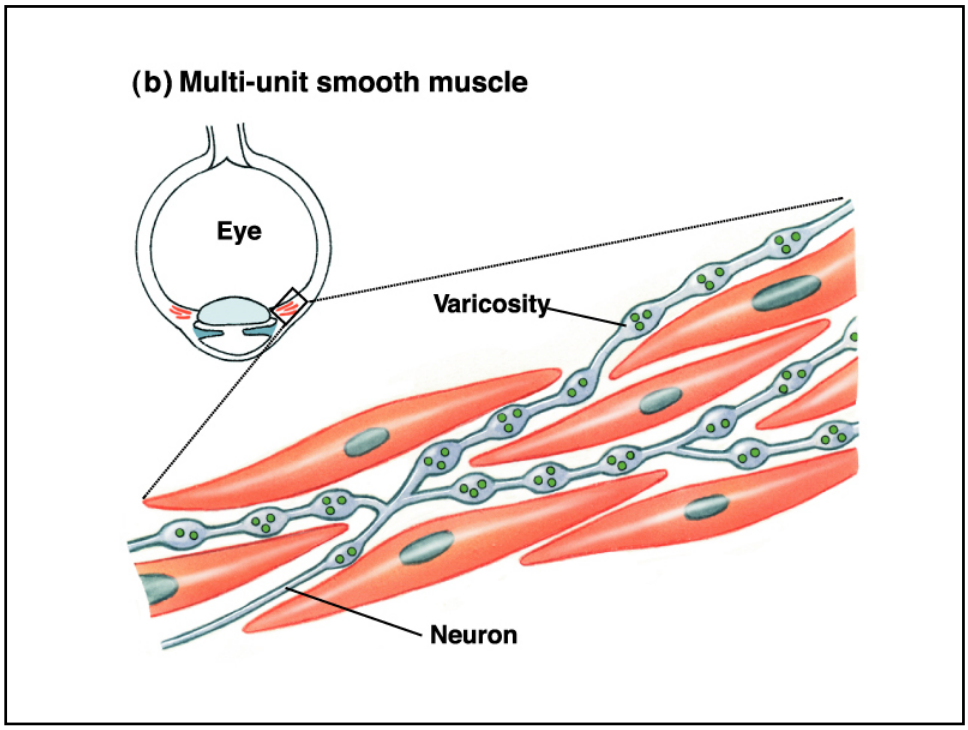



(a) Isotonic contraction
Muscle contracts
Muscle relaxes
20 kg
20 kg
Tension developed (kg)
35
30
25
20
15
10
5
Force required to move load
Muscle relaxes
Time
Muscle stimulated


(b) Muscle at rest
(c) Isometric contraction: Muscle has not shortened. Sarcomeres shorten, generating force, but elastic elements stretch, allowing muscle length to remain the same.
(d) Isotonic contraction: Sarcomeres shorten more but, since elastic elements are already stretched, the entire muscle must shorten.
Elastic element
Muscle length
Sarcomeres


(a) Relaxed smooth muscle fiber
(b) Contracted smooth muscle fiber
Filament bundles of actin and myosin
Dense bodies
Contraction


(a) Single-unit smooth muscle
Small intestine
Autonomic neuron varicosity
Gap junctions
Neuro-transmitter
Receptor
Smooth muscle cell


(b) Multi-unit smooth muscle
Eye
Varicosity
Neuron