

Muscle Function During *Acute* Exercise

**Chapters 8 & 19
(pp. 393-397)**

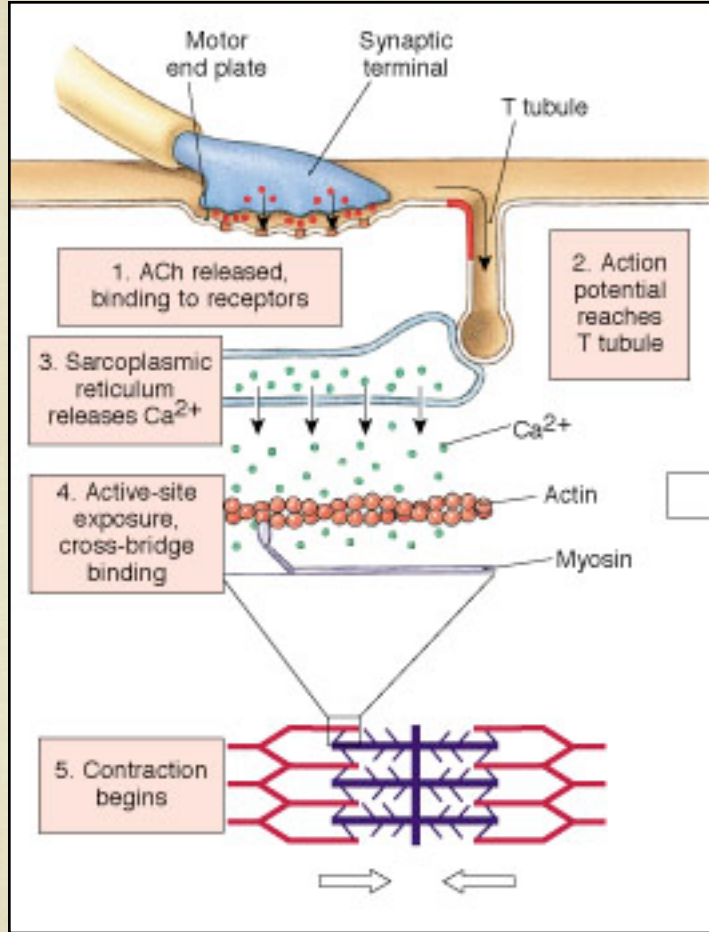
ACUTE FORCE PRODUCTION

JUST RIGHT

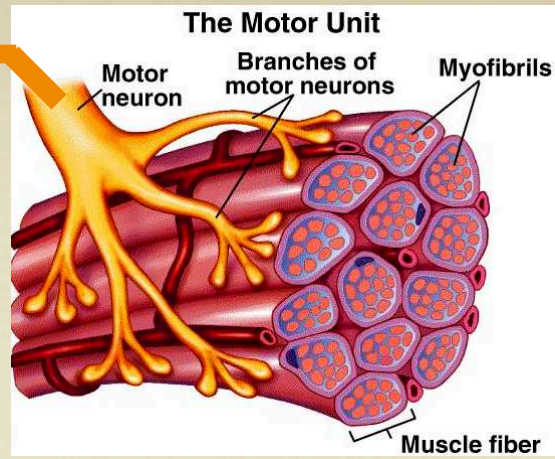


TOO MUCH

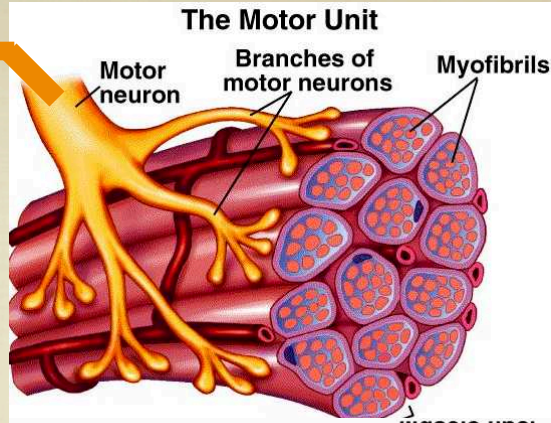
■ WITHOUT MAKING ANY PERMEANT CHANGES TO THE NEUROMUSCULAR SYSTEM, WHAT COULD CAUSE THE MUSCLE TO GENERATOR MORE OF LESS FORCE?



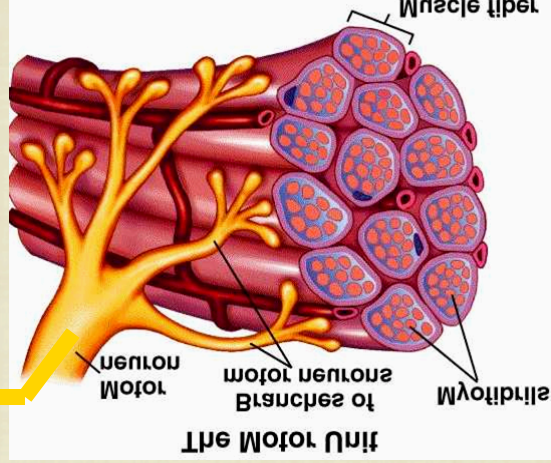
IIB



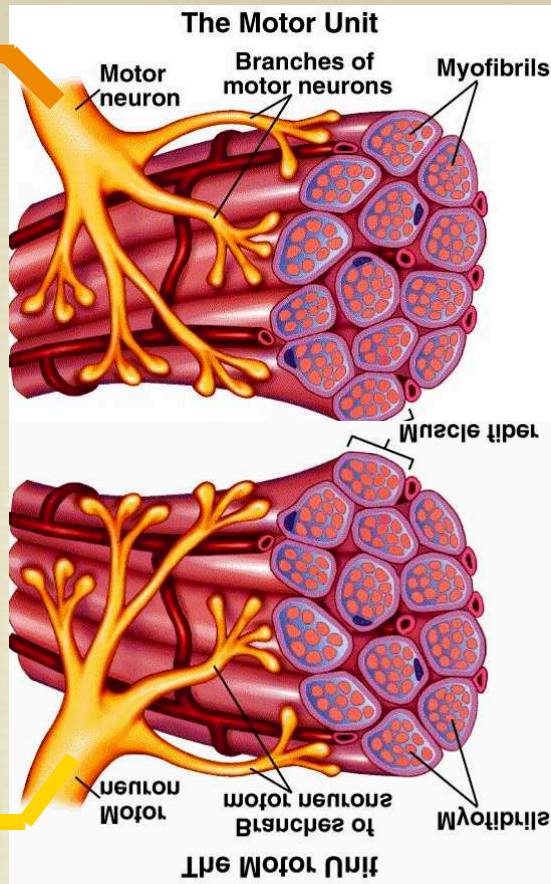
IIB



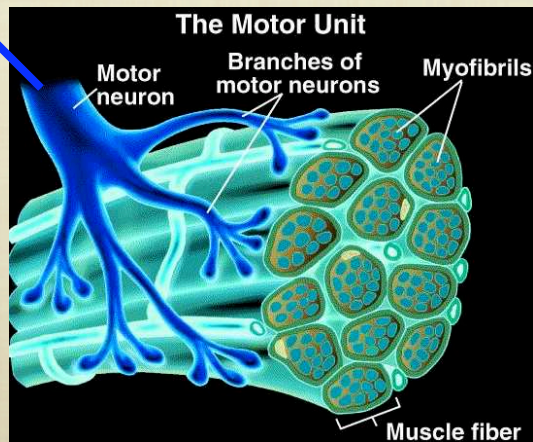
IIA



IIB

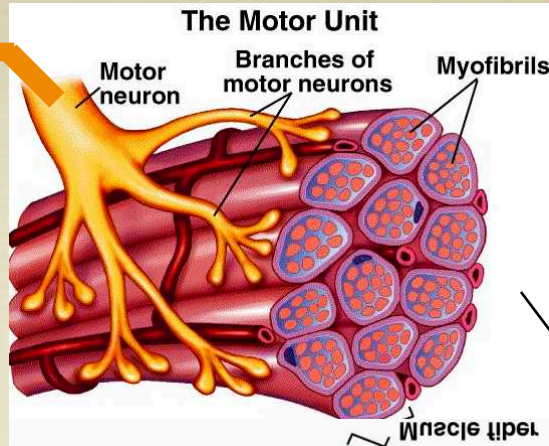


IIA

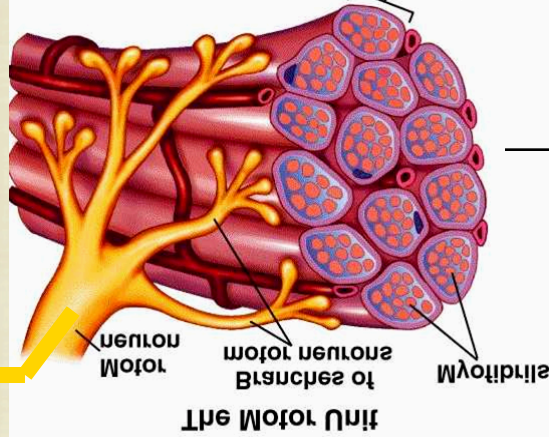


I

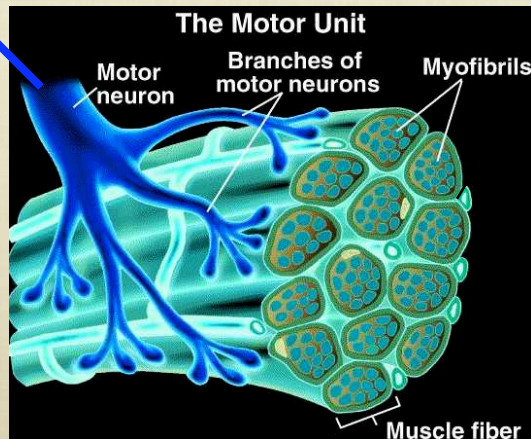
IIB



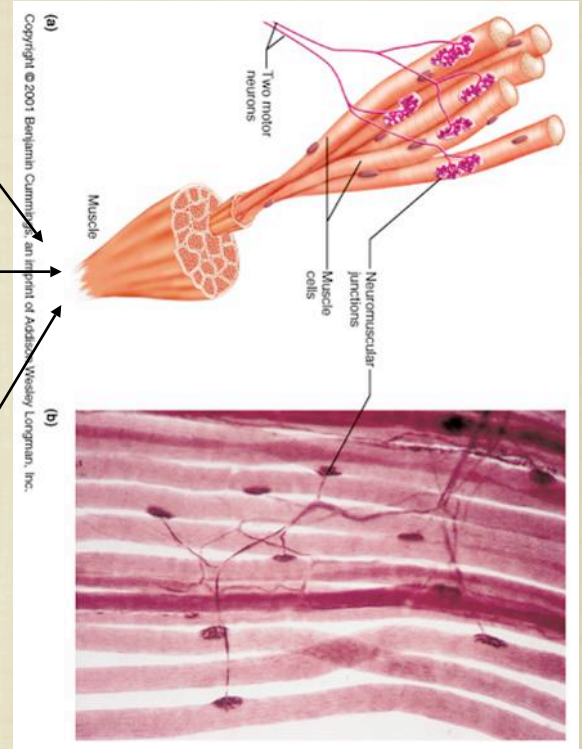
IIA



I

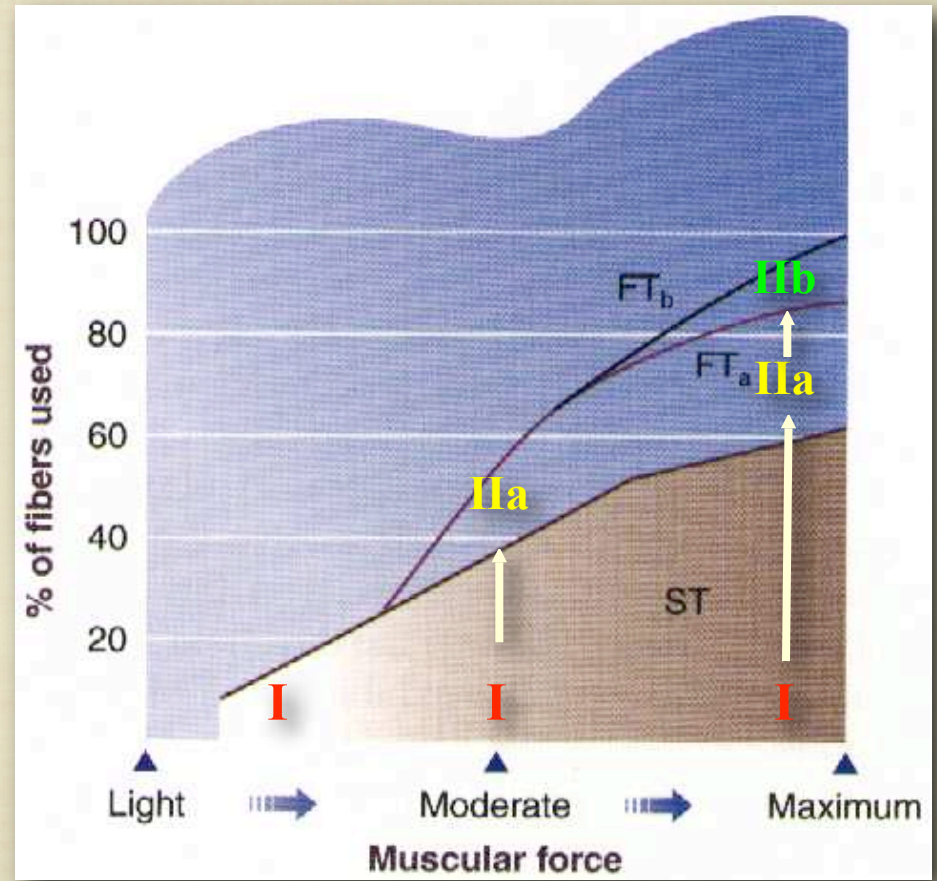


A SINGLE MUSCLE WITH IIB, IIA, AND I MUSCLE FIBERS

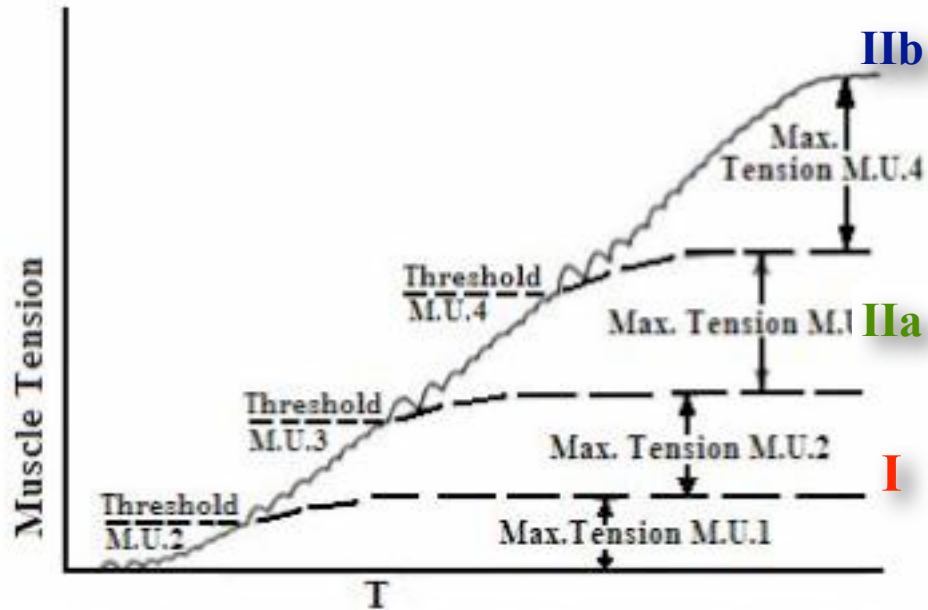


MOTOR UNITS

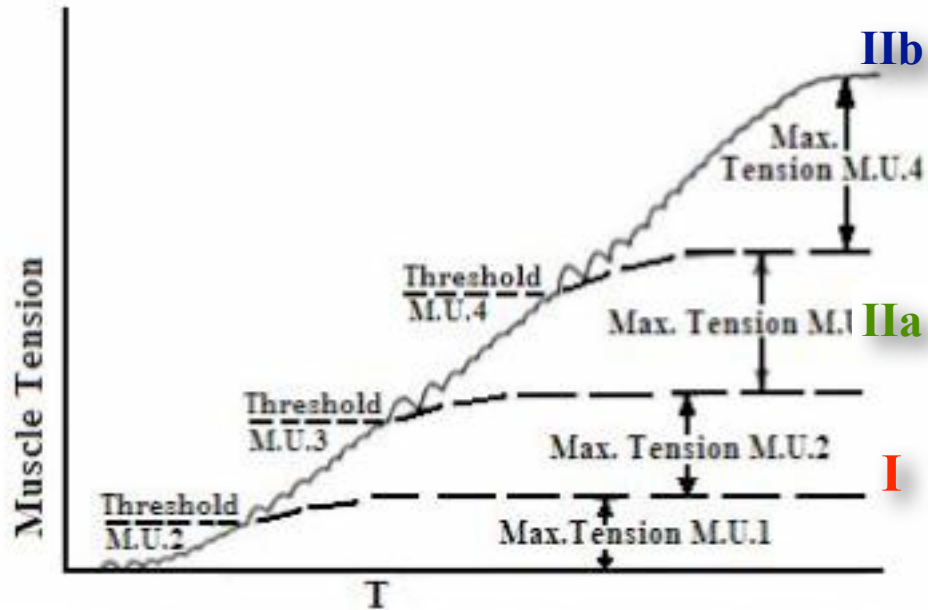
- NOTE THE ORDER OF RECRUITMENT



MOTOR UNITS

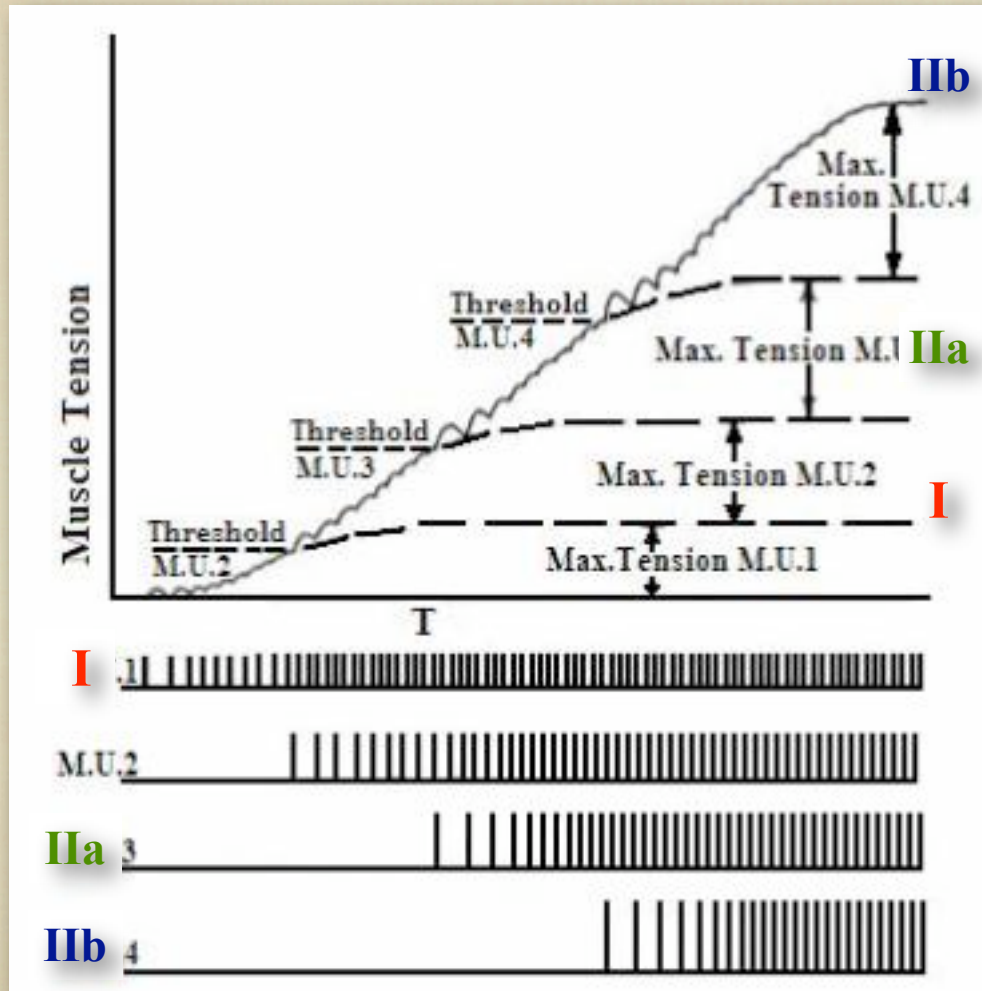


MOTOR UNITS



NUMBER (AND ORDER) OF MU

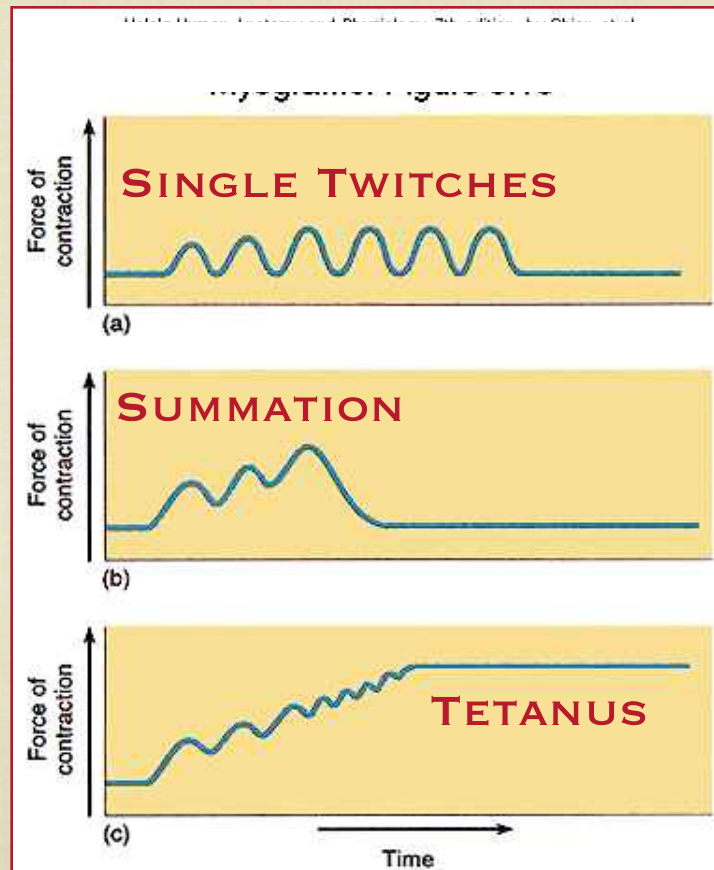
MOTOR UNITS



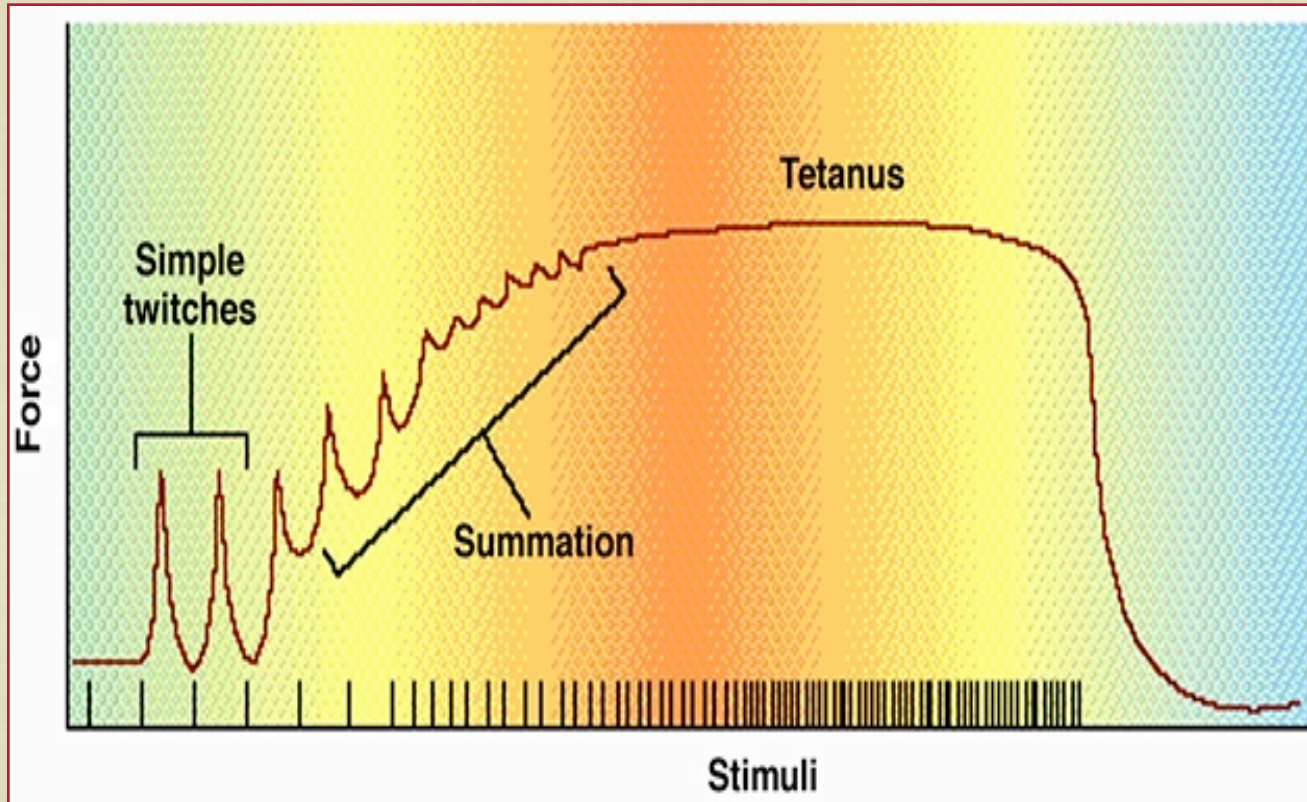
NUMBER (AND ORDER) OF MU

FREQUENCY

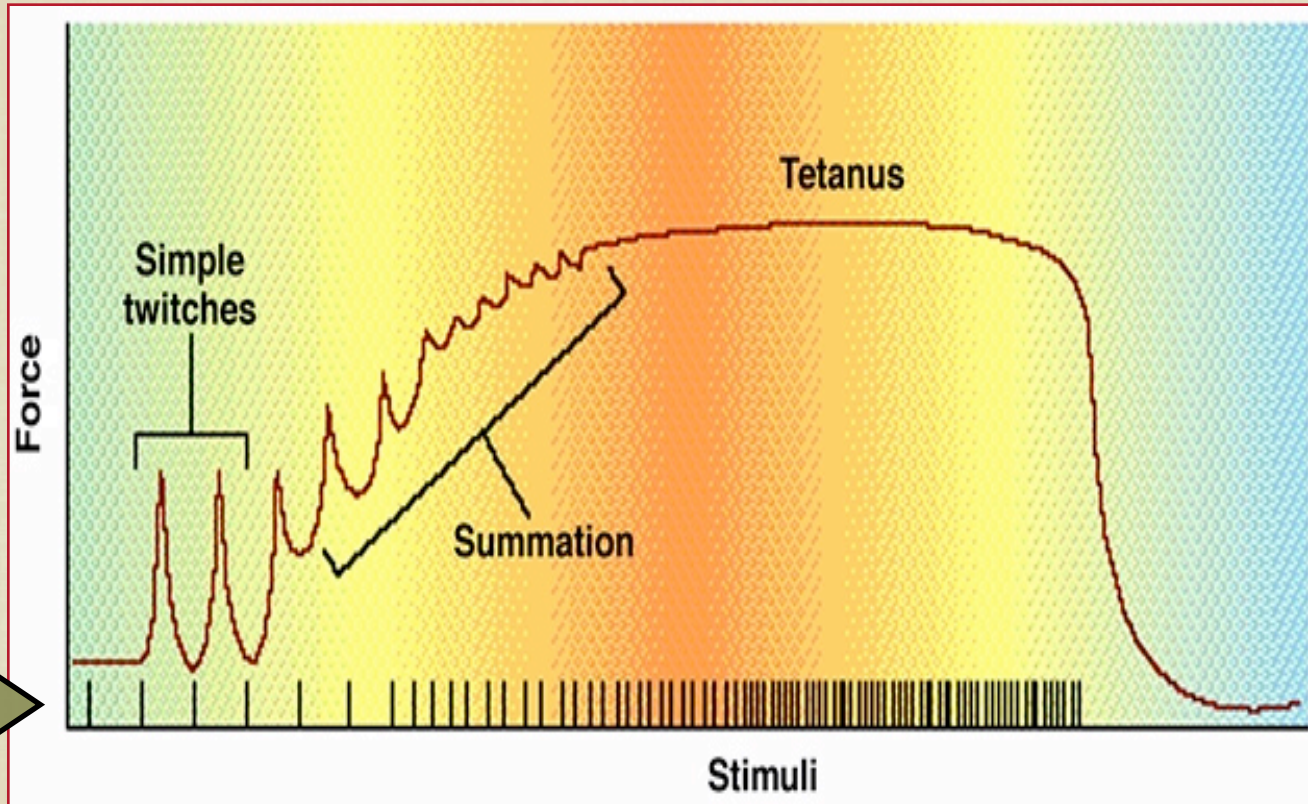
MOTOR UNITS



MOTOR UNITS



MOTOR UNITS









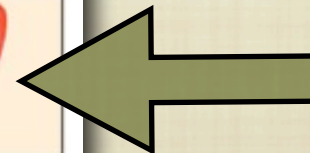
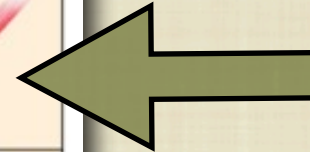
NOTE THE FREQUENCY OF STIMULATION

MOTOR UNITS

1. THE NUMBER (AND TYPE) OF MOTOR UNITS
2. THE FREQUENCY OF STIMULATION

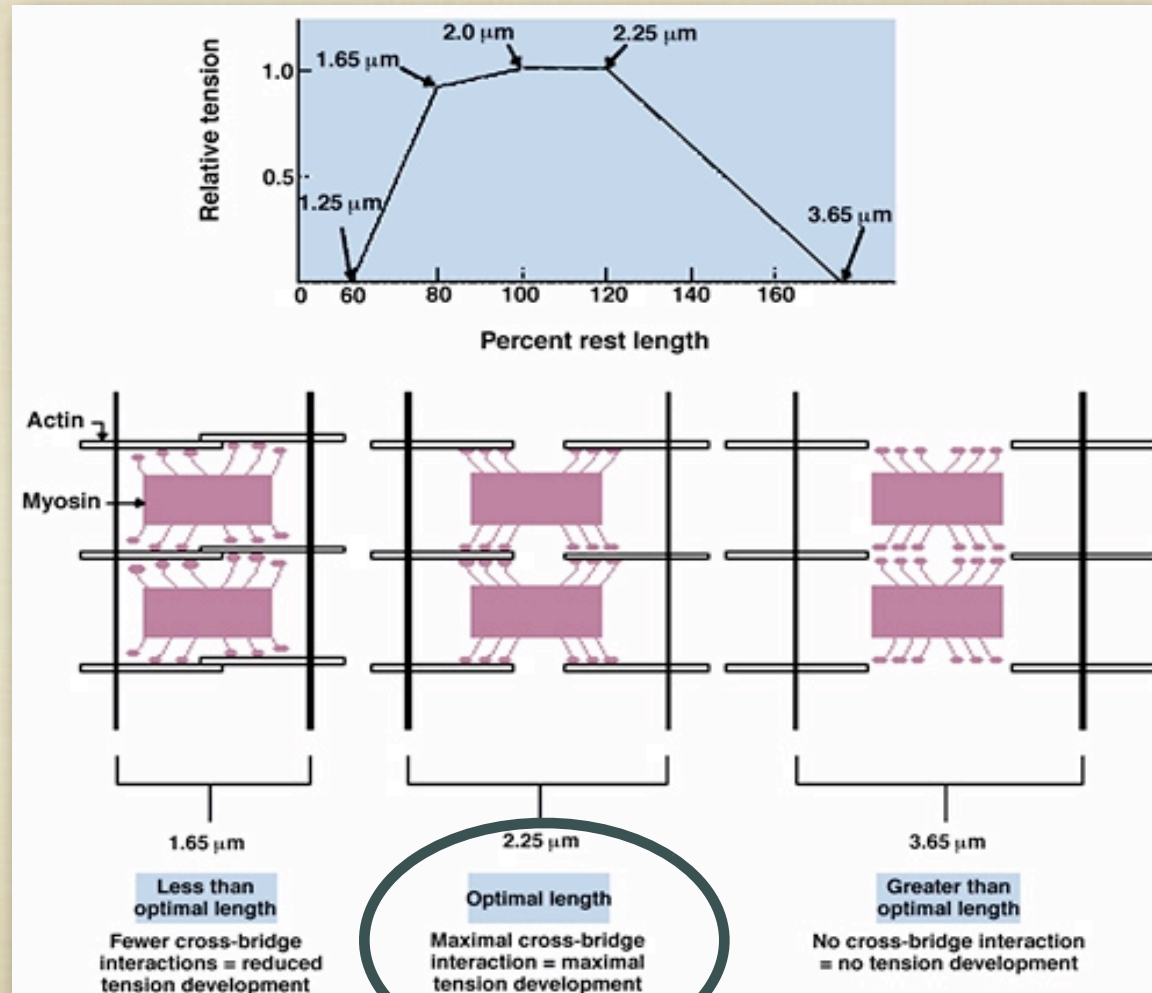
FIBER ARRANGEMENT

Classification	Example	Diagram
Longitudinal	Sartorius	
Fusiform	Biceps brachii	
Radiate	Gluteus medius	
Unipennate	Tibialis posterior	
Bipennate	Gastrocnemius	
Circular	Orbicular oculi (and sphincters)	



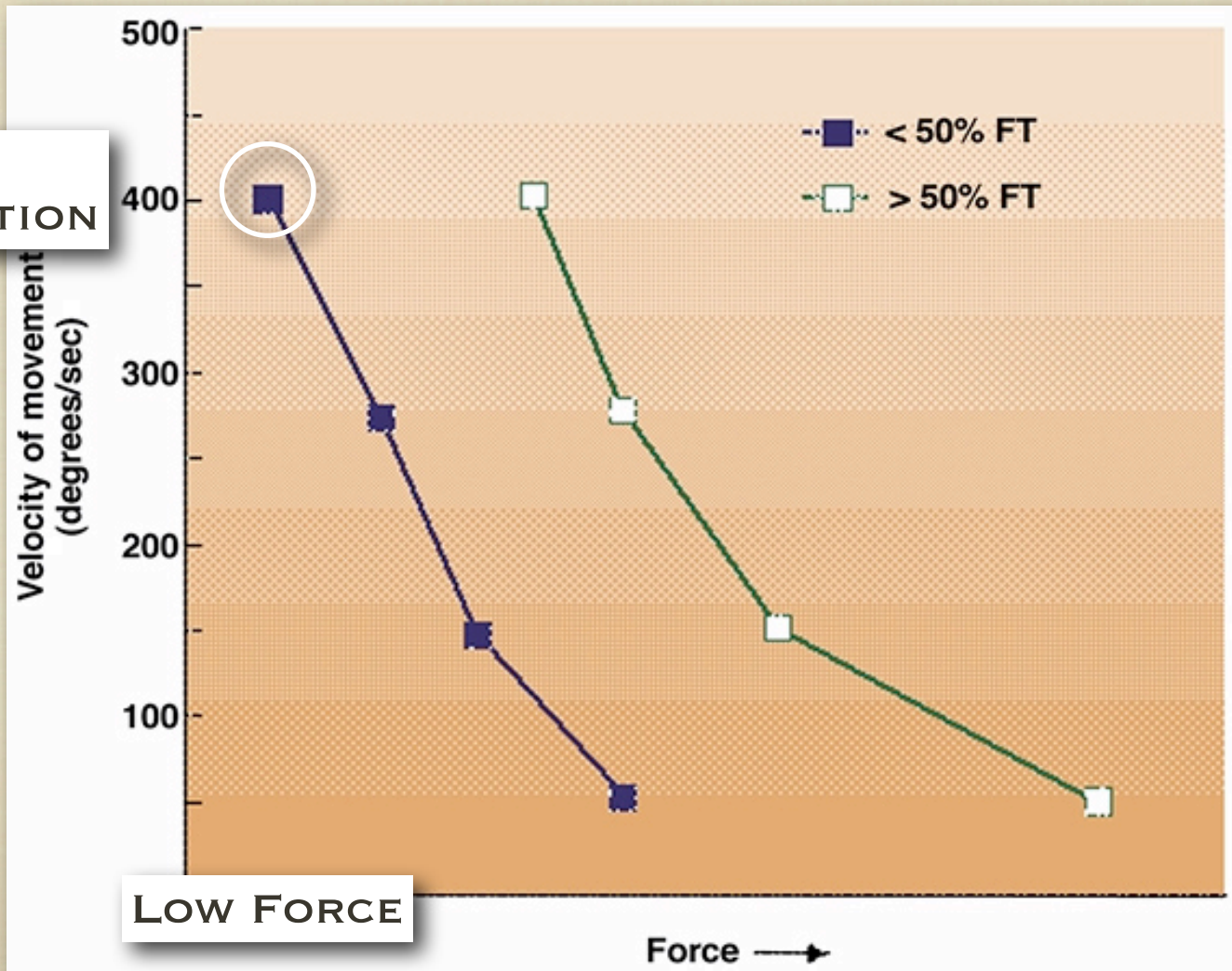
STRONGER

MUSCLE LENGTH



SPEED OF CONTRACTION

FAST
CONTRACTION



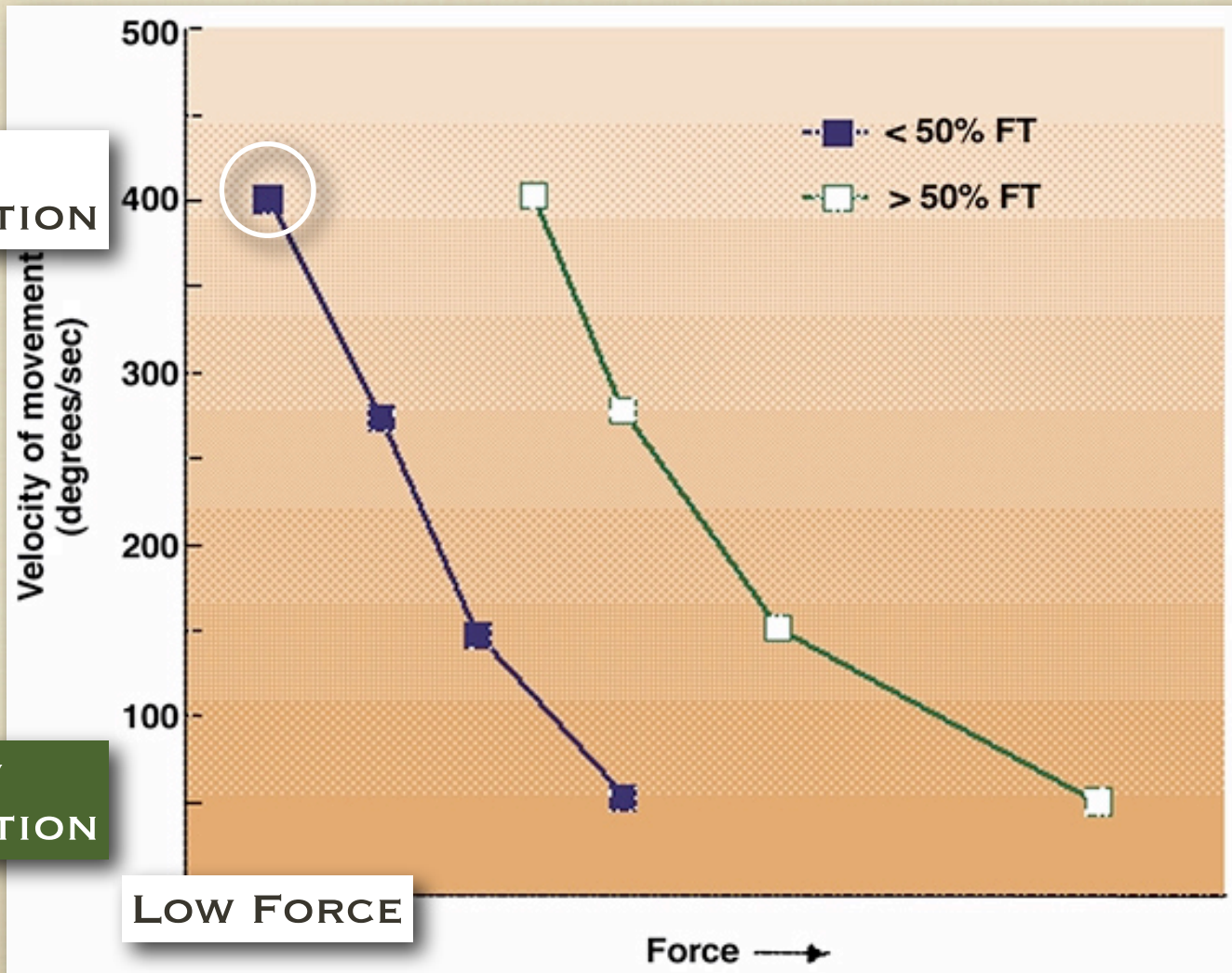
LOW FORCE

Force →

SPEED OF CONTRACTION

FAST
CONTRACTION

SLOW
CONTRACTION

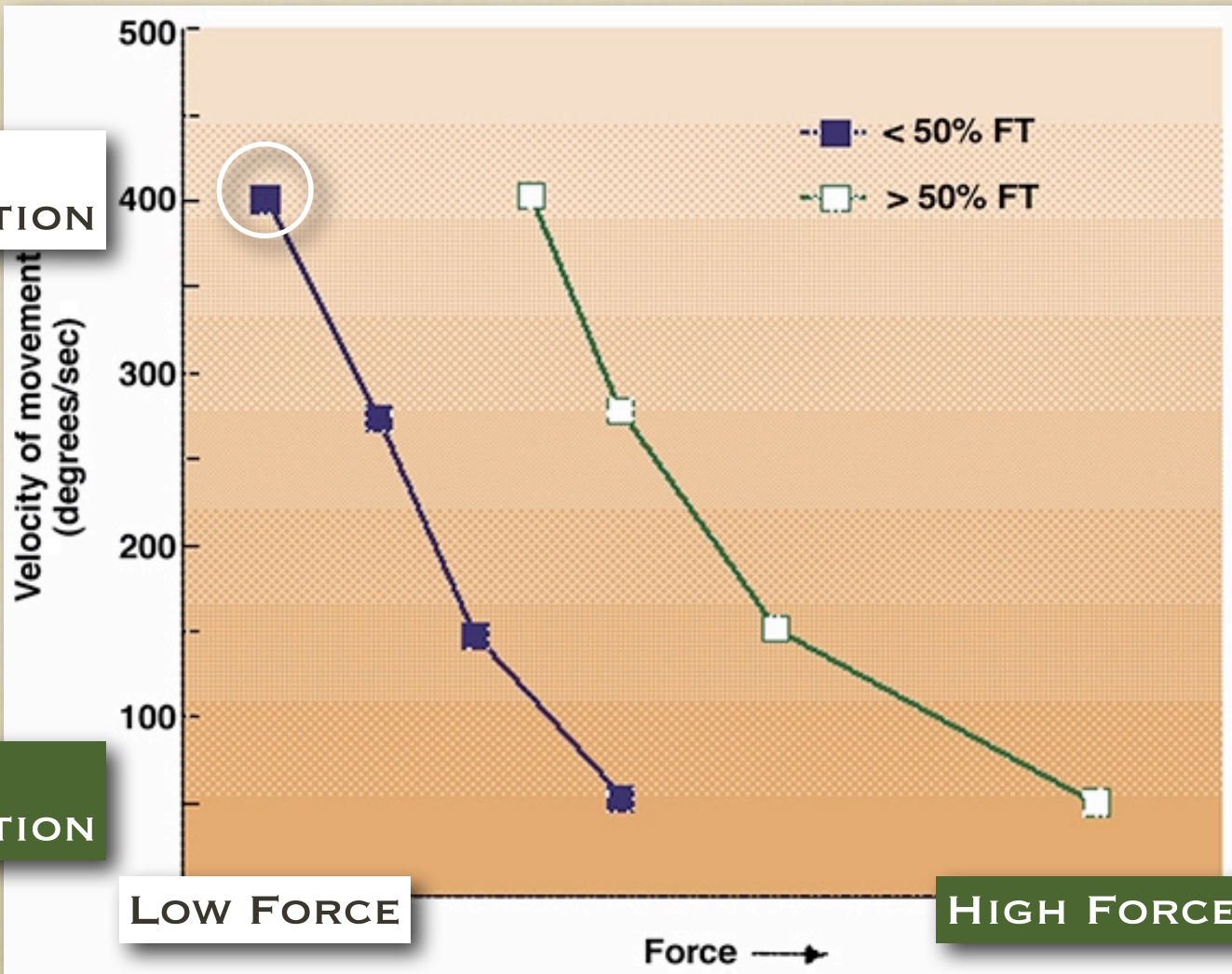


LOW FORCE

Force →

SPEED OF CONTRACTION

FAST
CONTRACTION



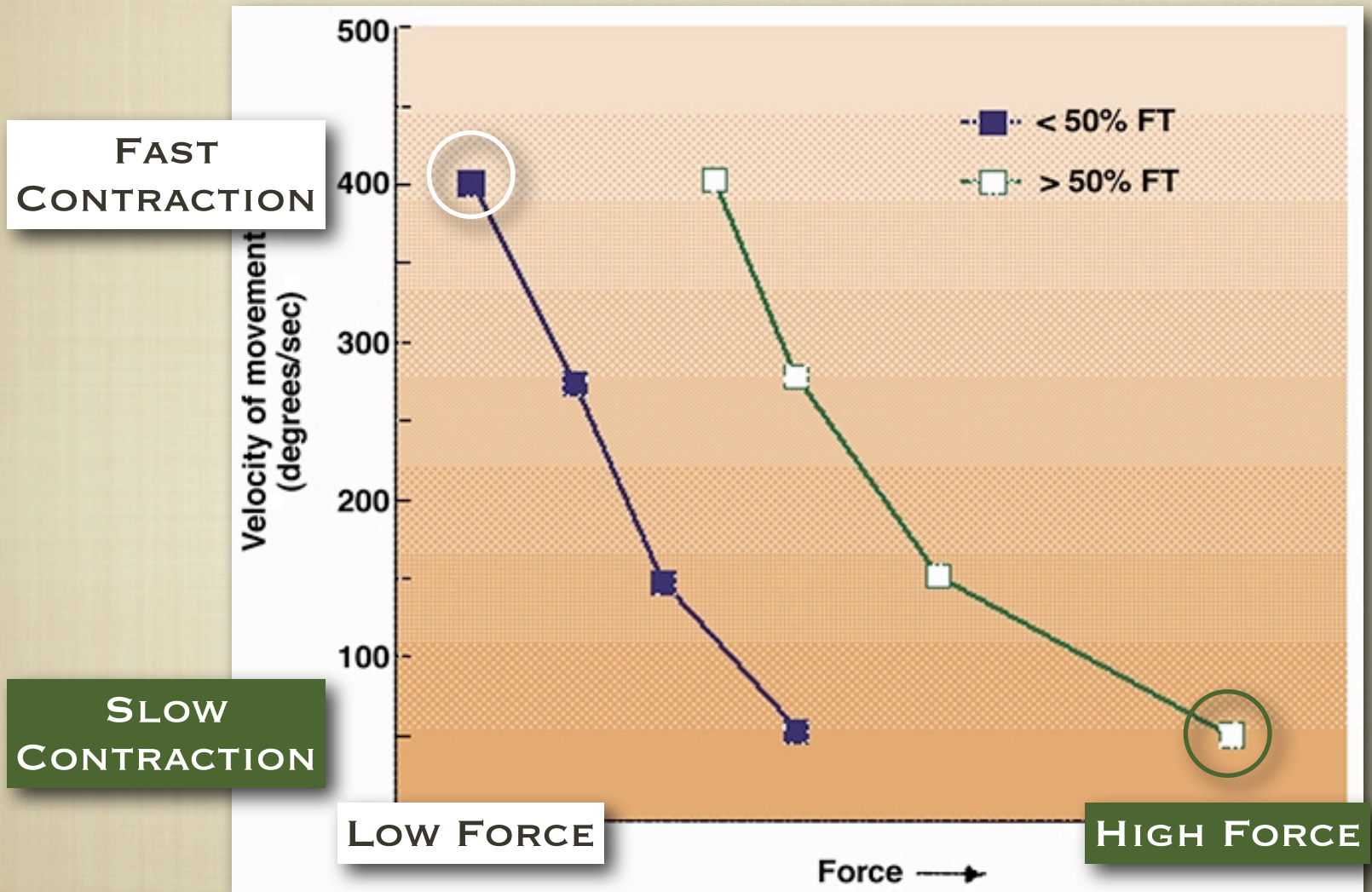
SLOW
CONTRACTION

LOW FORCE

HIGH FORCE

Force →

SPEED OF CONTRACTION



FORCE REGULATION SUMMARY

- MOTOR UNITS
 - NUMBER
 - FREQUENCY
- FIBER ARRANGEMENT
- MUSCLE LENGTH
- SPEED OF CONTRACTION



MYTHS

MYTHS

1. **A BIGGER MUSCLE IS NOT ALWAYS THE STRONGER MUSCLE.**

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1. **A BIGGER MUSCLE IS NOT ALWAYS THE STRONGER MUSCLE.**

2. **STRONGER IS NOT ALWAYS BETTER.**

■ **STRENGTH = FORCE PRODUCED**

■ **POWER = FORCE PRODUCED X DISTANCE / TIME**

MUSCLE FATIGUE



HOW IS FATIGUE DEFINED?

TYPES OF FATIGUE

1. CENTRAL FATIGUE

2. PERIPHERAL FATIGUE

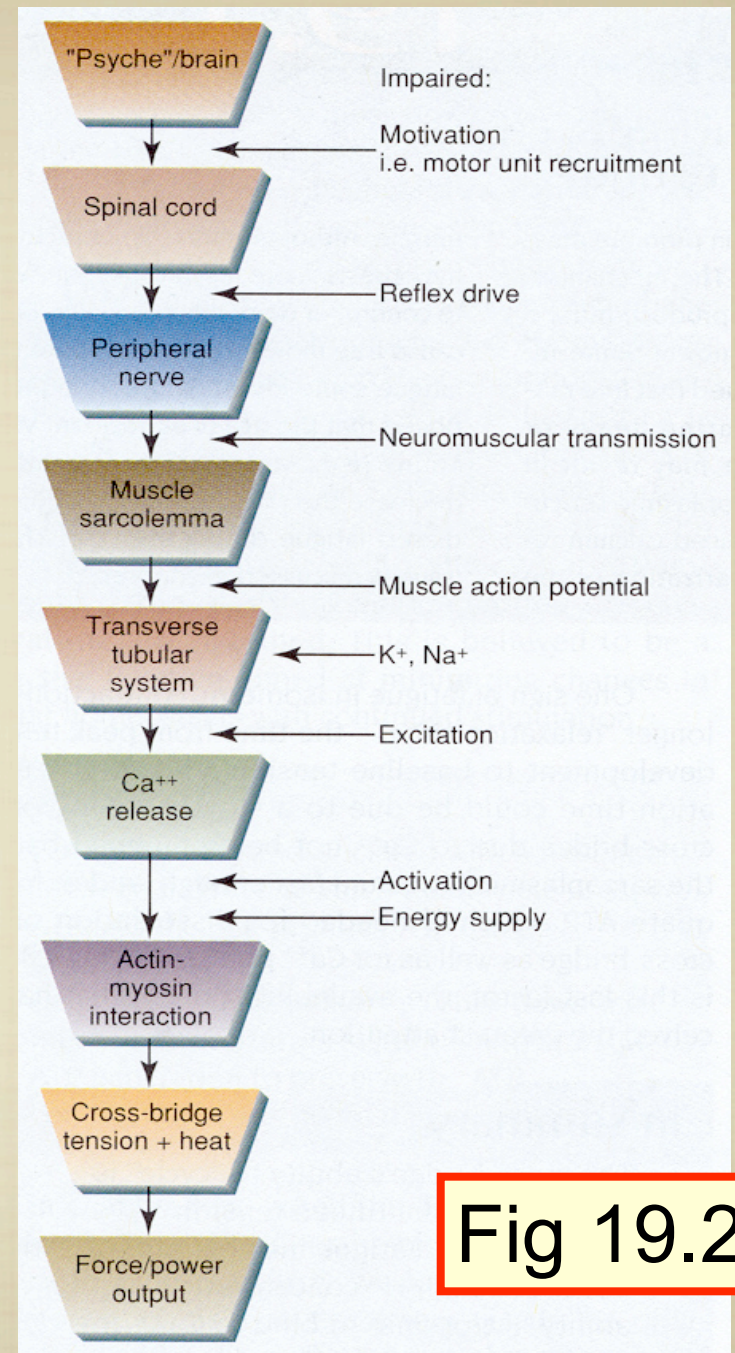
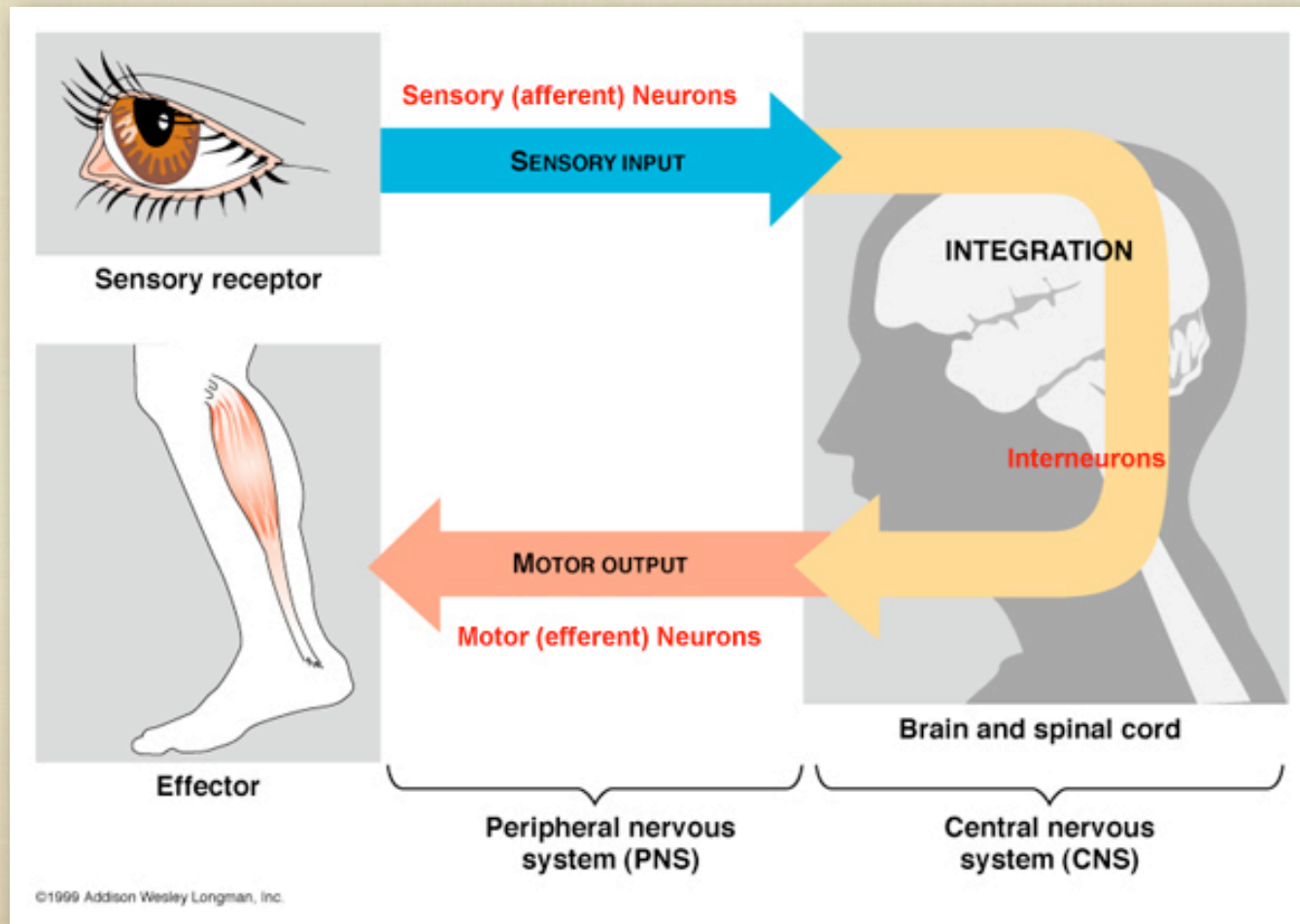
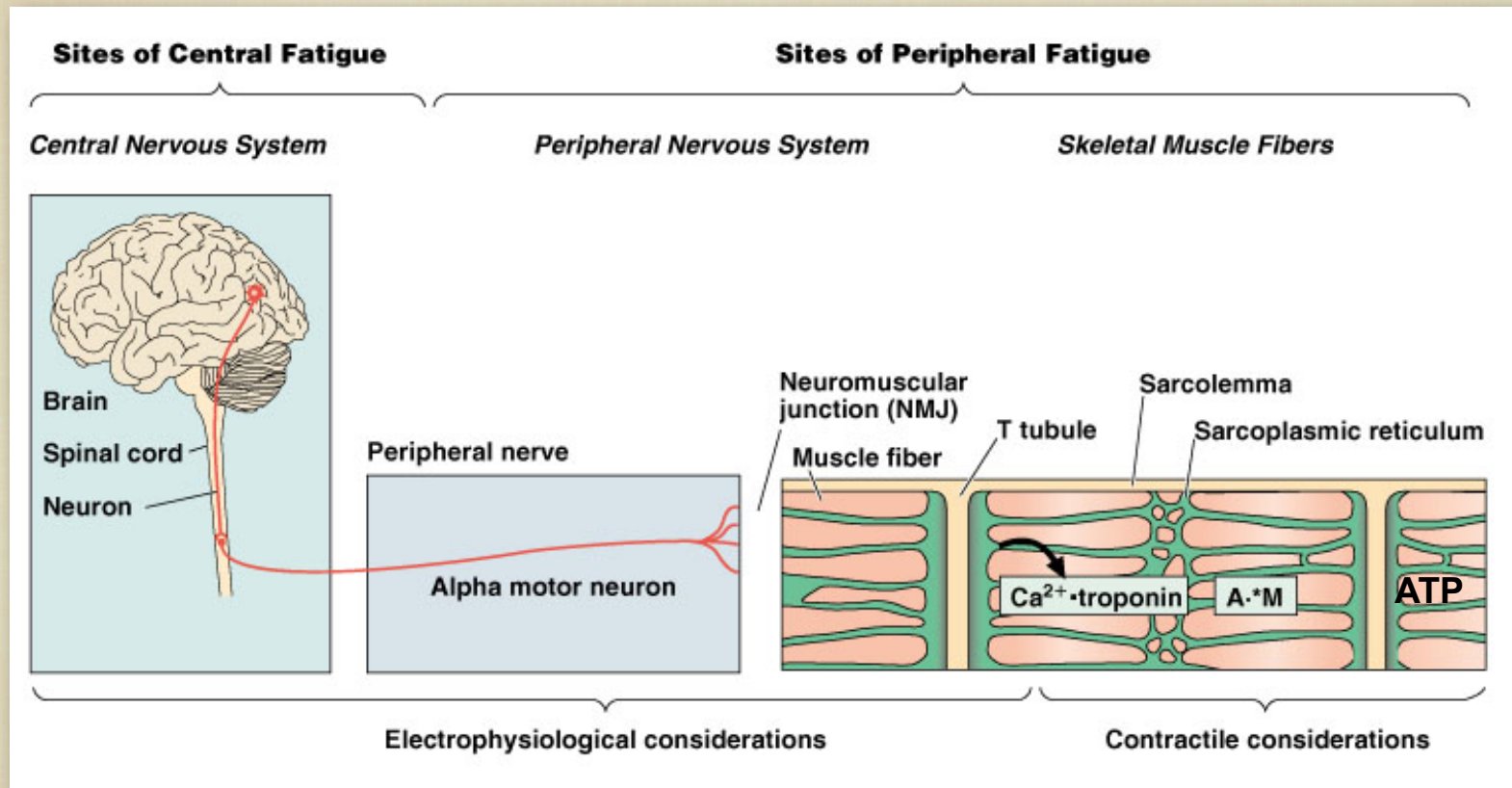


Fig 19.2

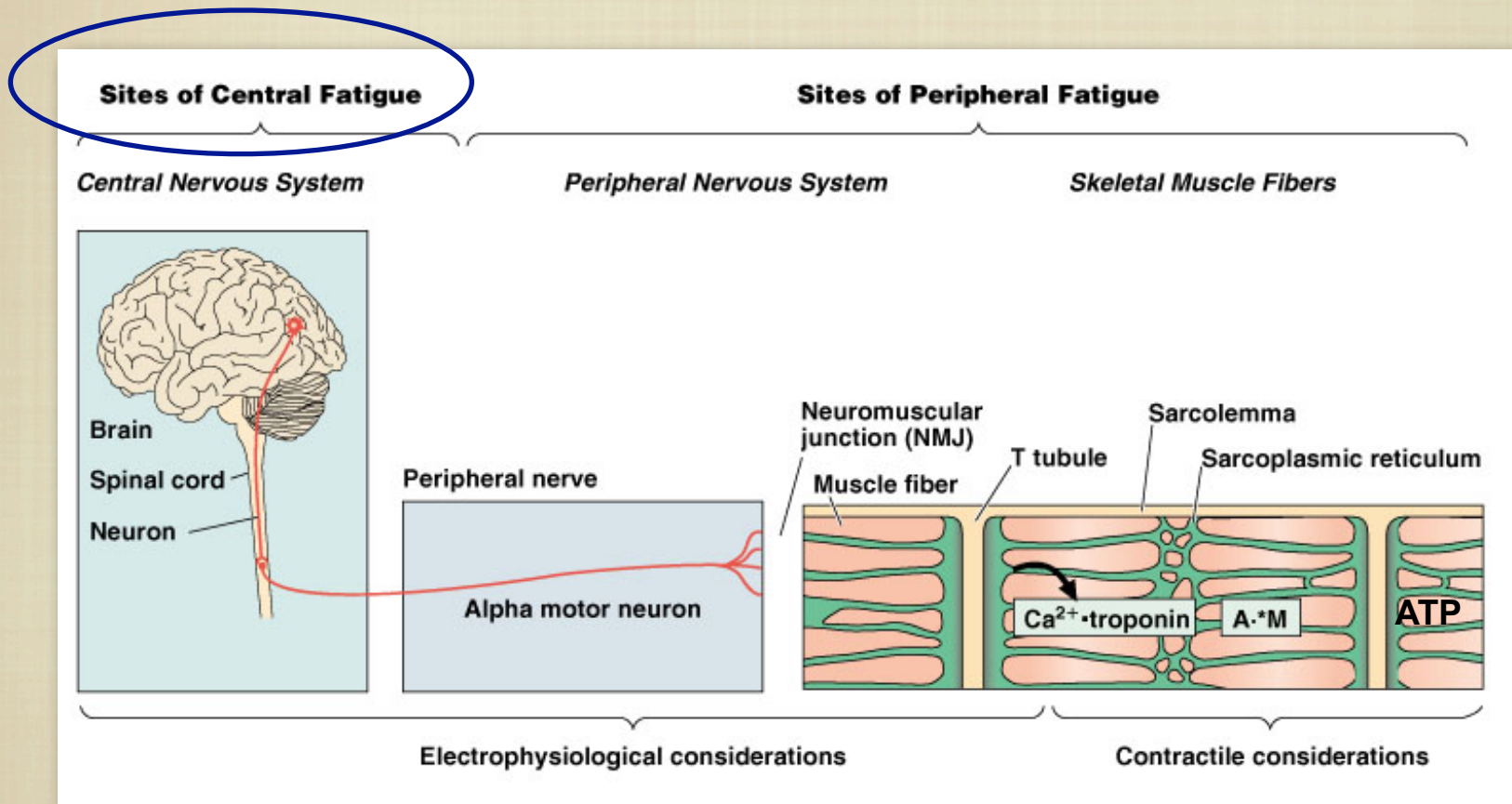
CENTRAL FATIGUE



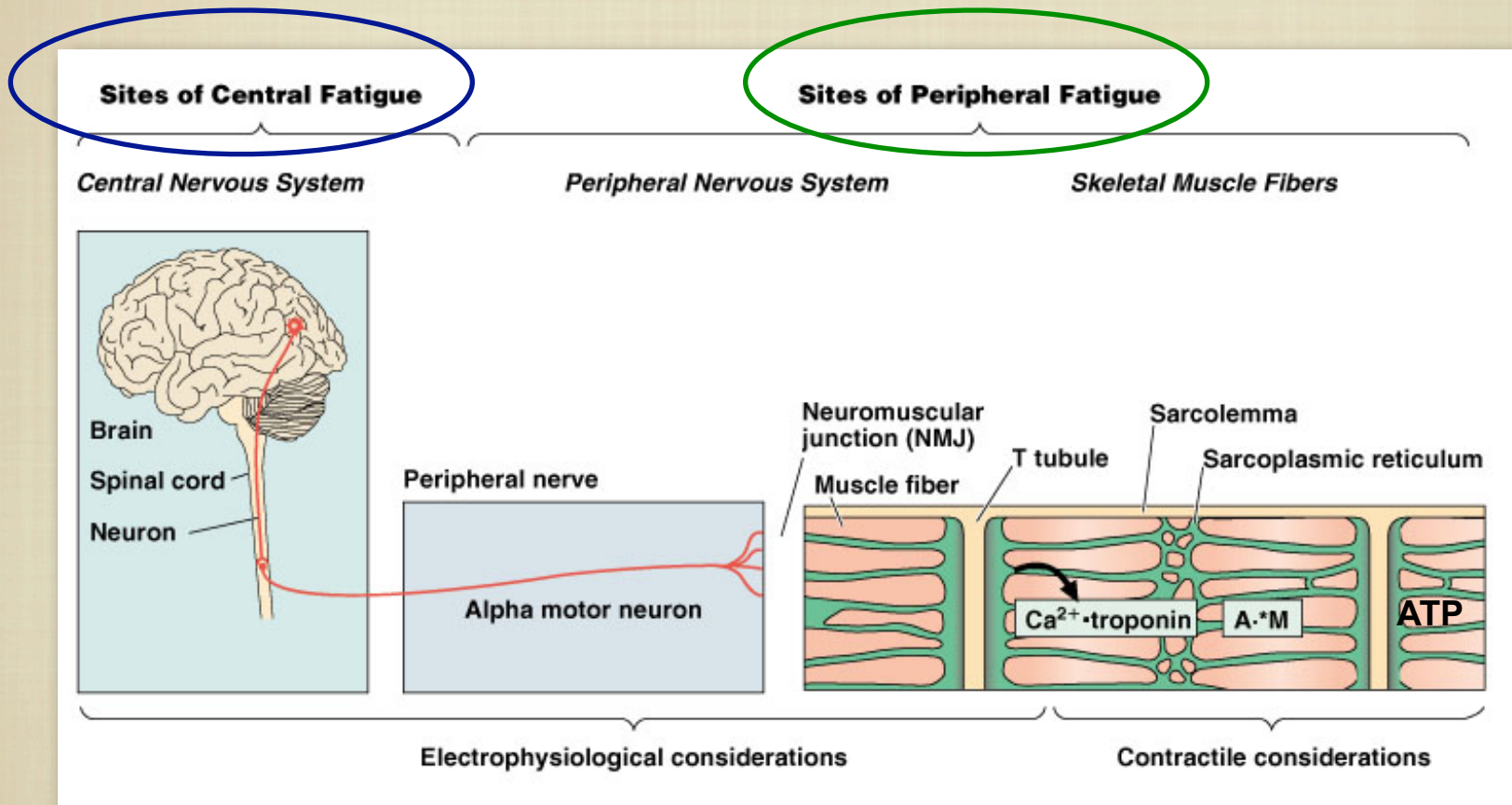
PERIPHERAL FATIGUE



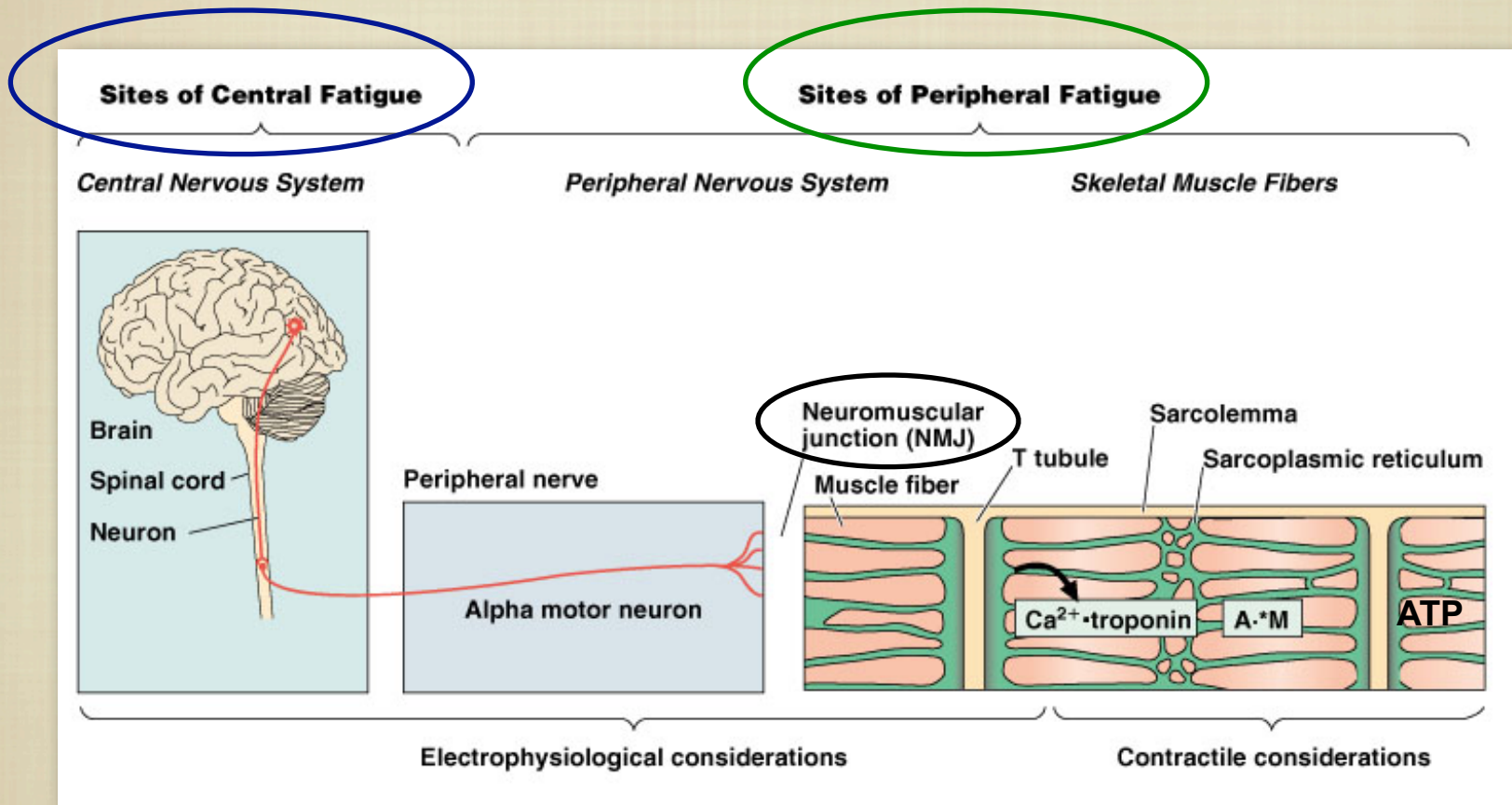
PERIPHERAL FATIGUE



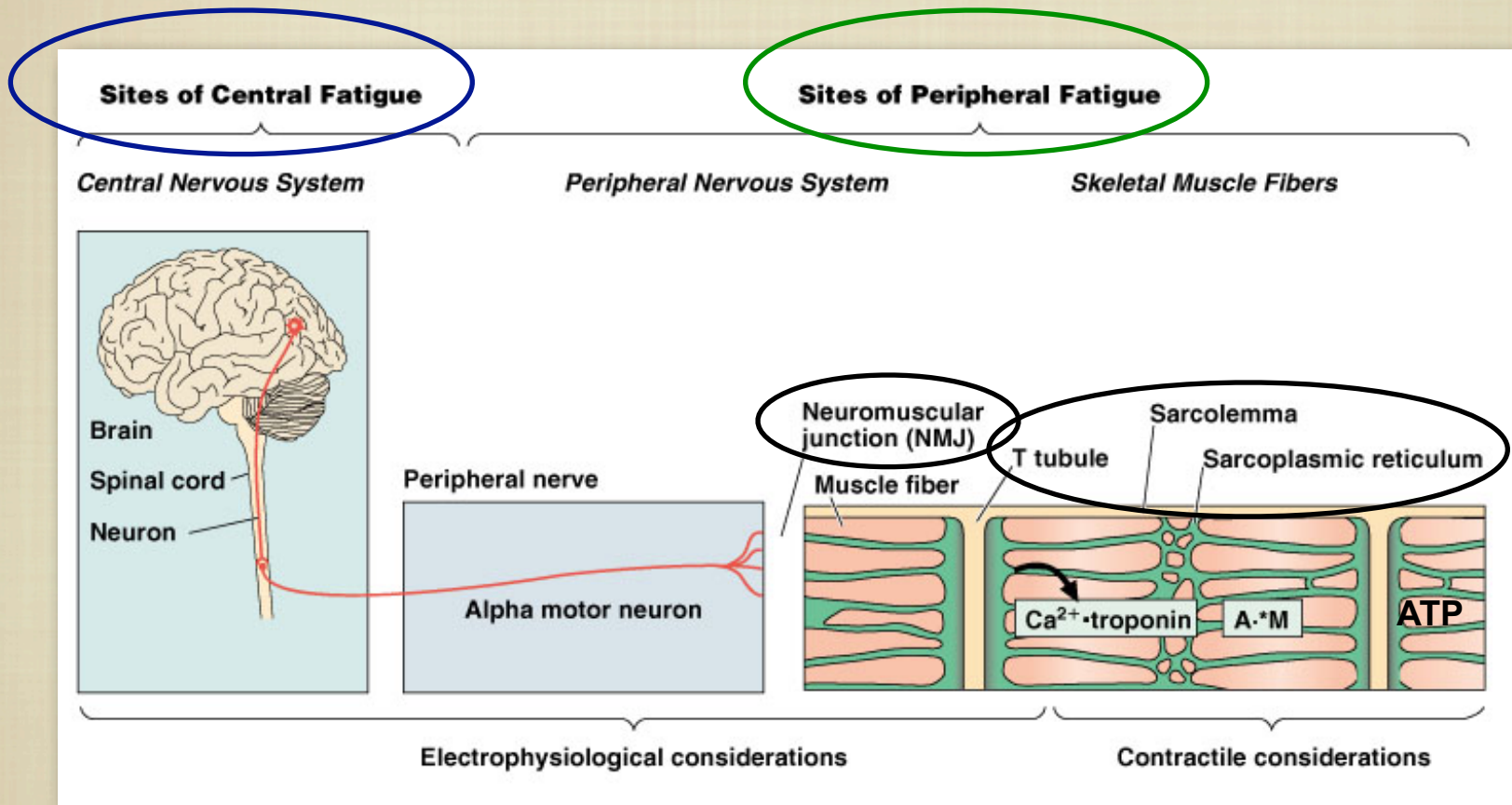
PERIPHERAL FATIGUE



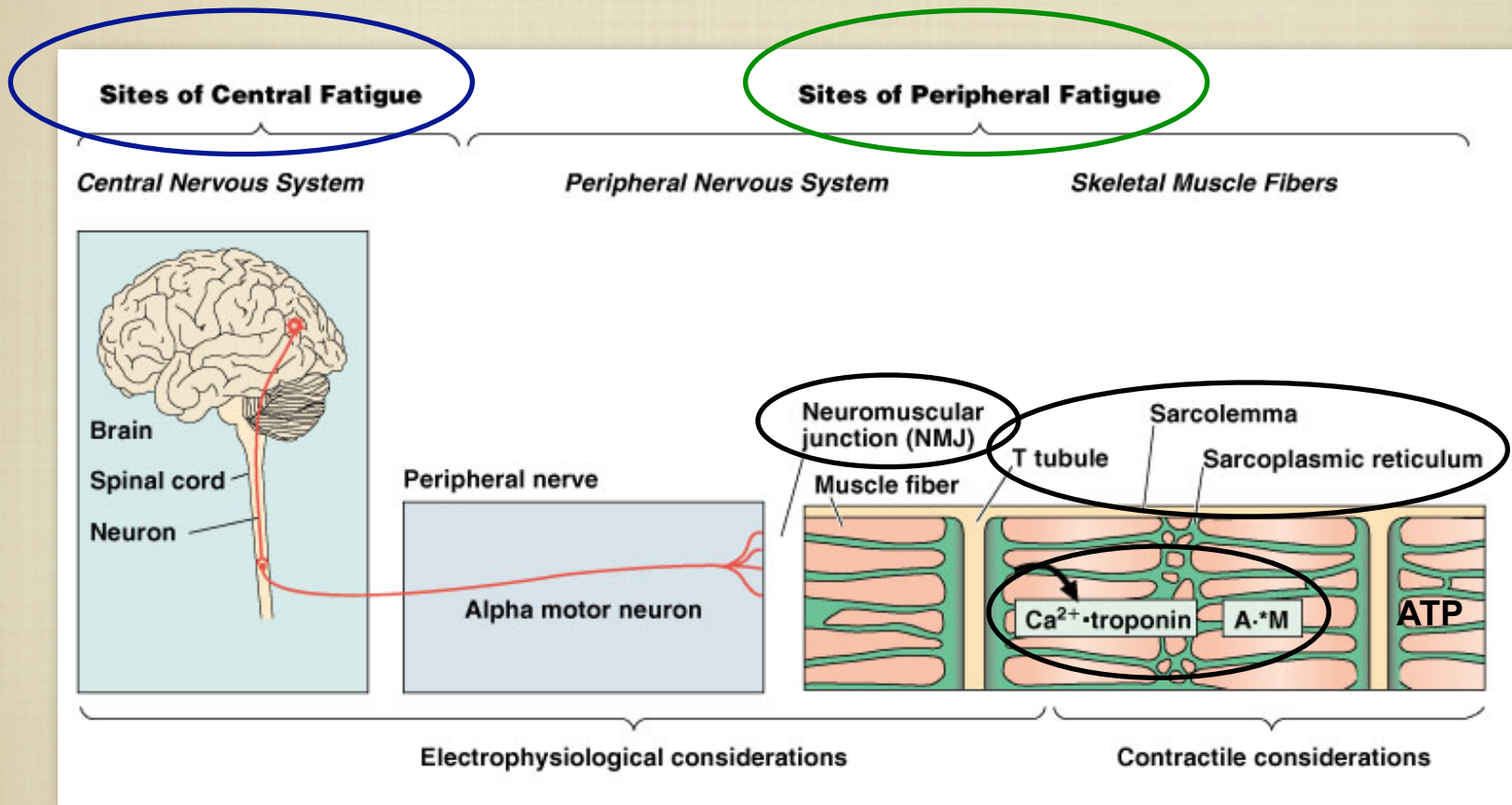
PERIPHERAL FATIGUE



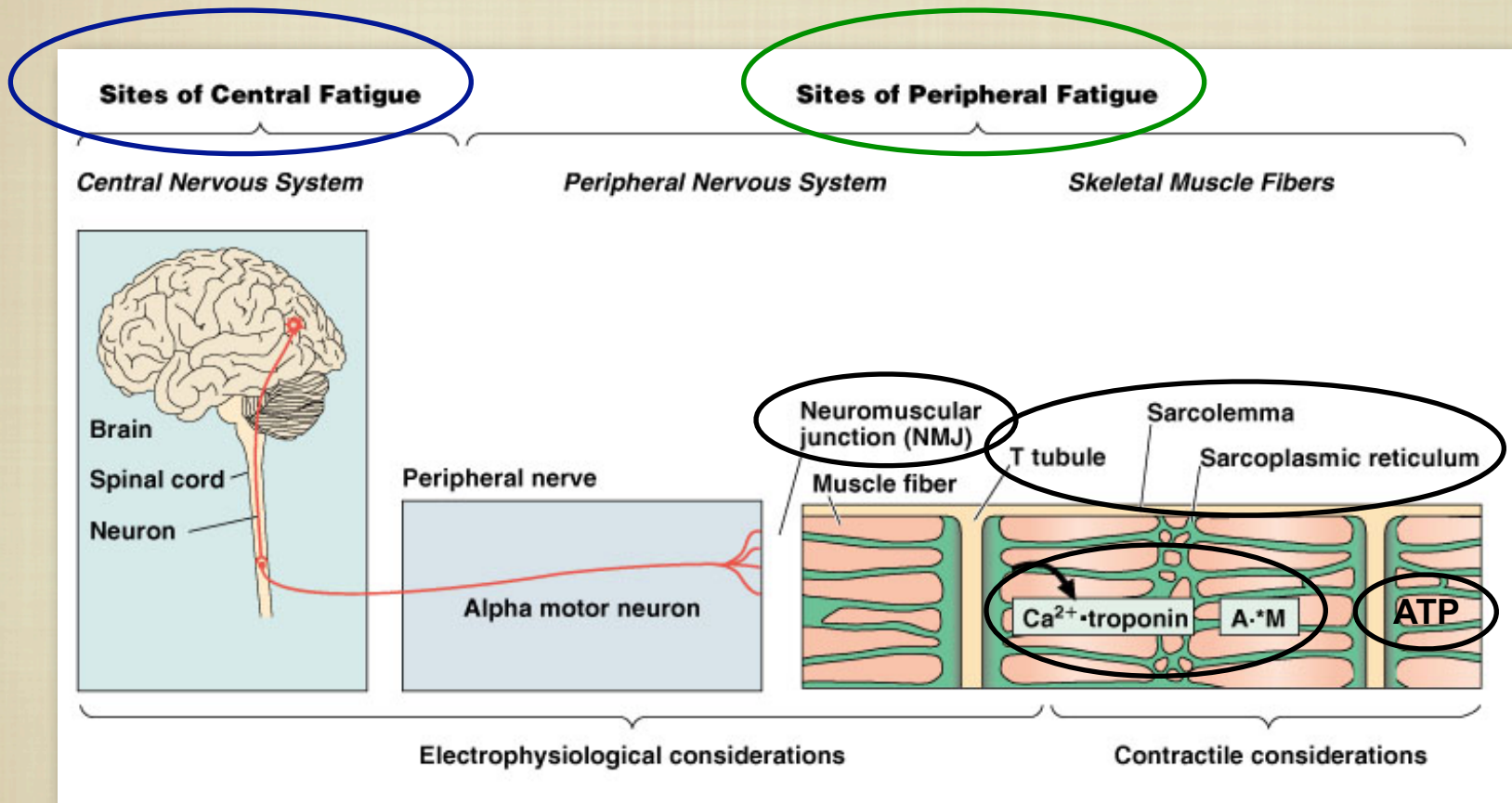
PERIPHERAL FATIGUE



PERIPHERAL FATIGUE



PERIPHERAL FATIGUE



MUSCLE SORENESS

ACUTE
SORENESS

ACID BUILD UP

EDEMA



DELAYED ONSET MUSCLE SORENESS (DOMS)

Proposed Model to Explain Delayed Muscular Soreness

Strenuous Exercise

↓

Structural damage to muscle cells

↓

Calcium leaks out of sarcoplasmic reticulum

↓

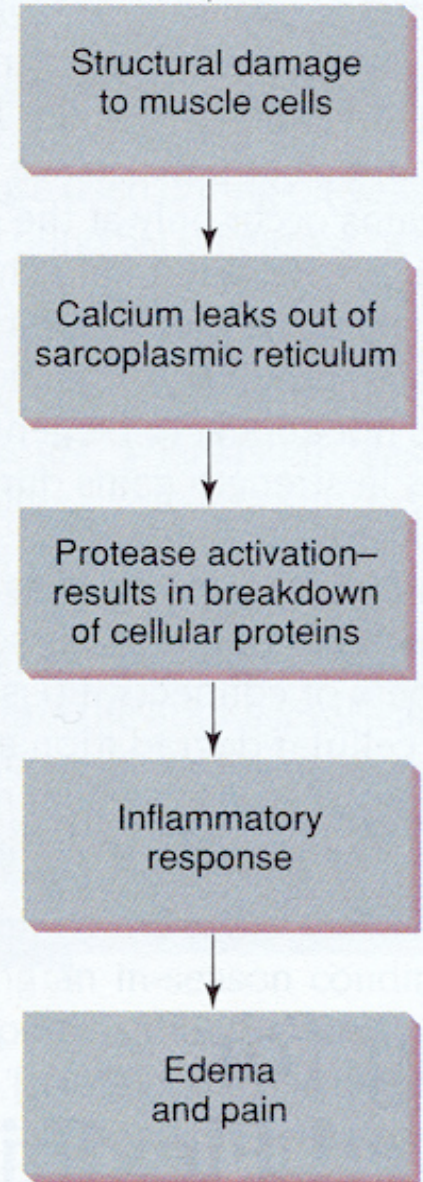
Protease activation—results in breakdown of cellular proteins

↓

Inflammatory response

↓

Edema and pain



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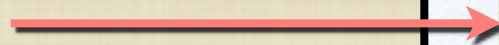
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DELAYED ONSET MUSCLE SORENESS (DOMS)

NOT DUE TO LACTIC ACID!

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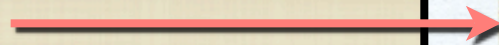
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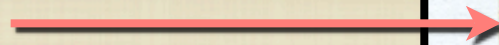
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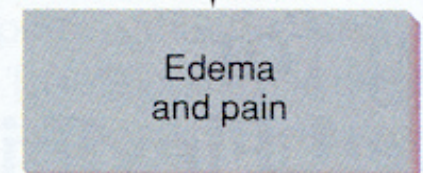
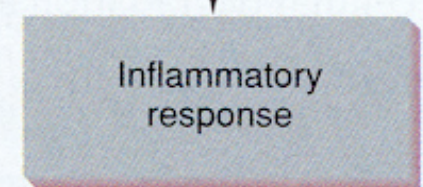
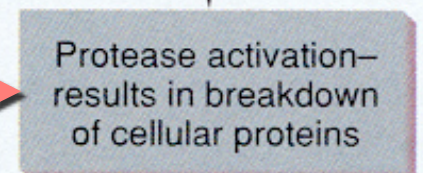
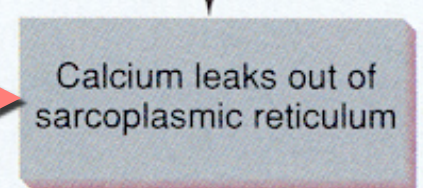
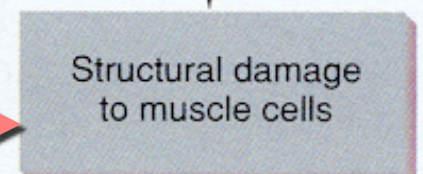
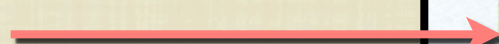
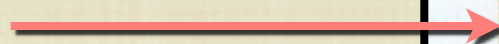
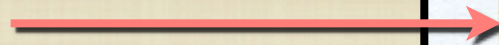
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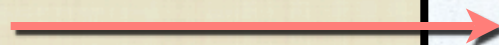
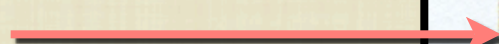
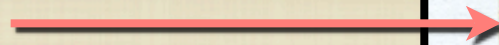
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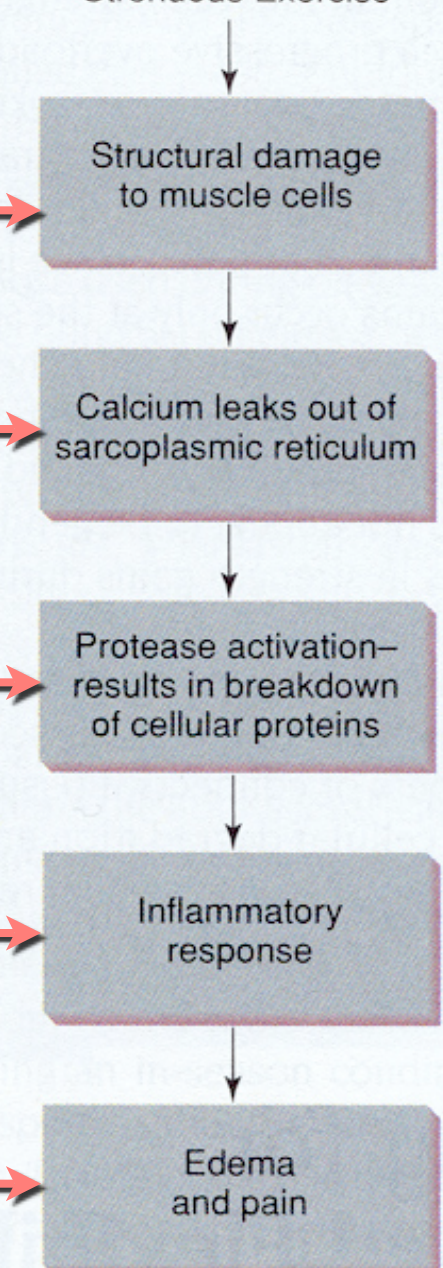
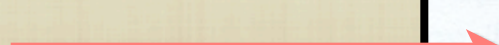
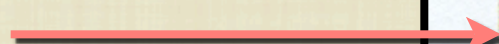
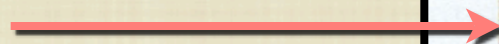
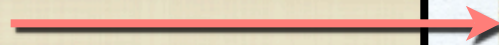
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MYTH BUSTER

- **LACTIC ACID DOES NOT CAUSE DELAYED ONSET MUSCLE SORENESS**
- **LACTATE, THE MAJOR BY-PRODUCT OF LACTIC ACID, IS REMOVED OR CLEARED WITHIN HOURS AFTER EXERCISE**