

Muscle Performance

Force – Velocity
Length - Tension

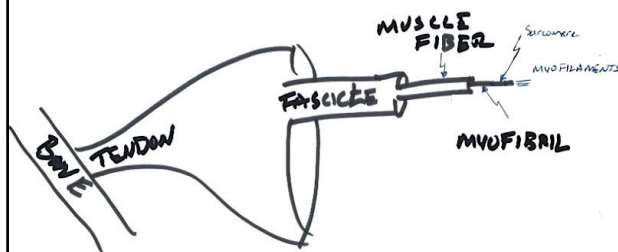
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Muscle Performance Testing

- In Vitro
 - Testing outside the body.
- In Vivo
 - Inside the living body.

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Gross Structure of Muscle



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Muscle Characteristics

- Human body contains over 400 skeletal muscles
 - 40-50% of total body weight
- Characteristics
 - Irritability
 - Ability to respond to a stimulus
 - Contractility
 - Ability to shorten
 - Extensibility
 - Ability to lengthen
 - Elasticity
 - Ability to return to resting length



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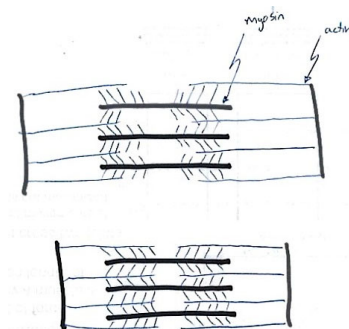
Muscle Function

- Primary functions related to human movement:
 - Produce Movement
 - Maintain Posture
 - Stabilize Joints
- Other functions:
 - Protection
 - Regulation of body temperature
 - ...

} Generate Force

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The Sliding Filament Model



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Muscle Function

- **Agonist:** (prime mover) functions to cause a movement
- **Antagonist:** functions to resist movement
- **Stabilizer:** functions to fixate an area so another movement can occur
- **Synergist:** assist another muscle
- **Neutralizer:** functions to prevent undesired movement

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Muscle Function: Muscle Action

- Isometric: No change in muscle length
- Isotonic: Change in length (same external weight)
 - Concentric
 - muscle length shortens during contraction
 - Eccentric
 - muscle length increases during contraction
- Isokinetic: Angular speed is constant during contraction
 - Concentric
 - Eccentric

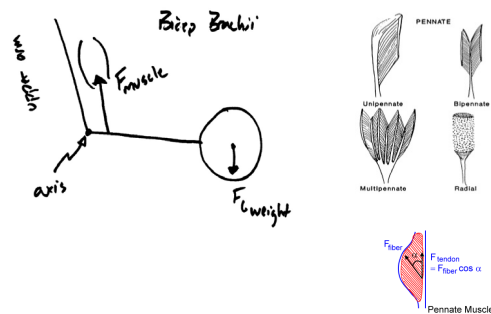
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Muscle Performance

- How well muscle functions are carried out.
 - i.e., ability to generate force
- Factors that influence muscle performance:
 - Pennation angle
 - Angle of attachment
 - Length-tension relationship
 - Force-velocity relationship
 - *Fatigue*

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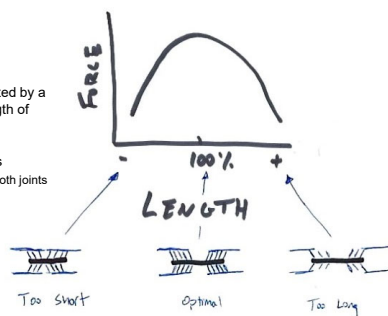
Muscle Performance: Angle of Attachment and Pennation



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Muscle Performance: Length-Tension Relationship

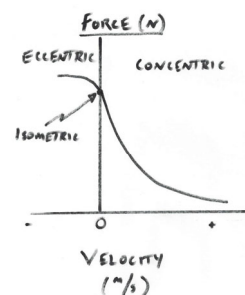
- The amount of force generated by a muscle is dependent on length of muscle.
- Muscles that cross two joints
 - concurrent movements at both joints not maximized



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Muscle Performance: Force – Velocity Relationship

The amount of force generated by muscle is dependent on the velocity of contraction.



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Summary

- **Muscle Structure**
 - Irritability, Contractility, Extensibility, Elasticity
- **Muscle Function**
 - Agonist, Antagonist, Stabilizer, Synergist, Neutralizer
 - Isometric, concentric, eccentric
- **Muscle Performance**
 - Length tension
 - Force velocity
 - Angle of attachment / pennation