



# **FITNESS & NUTRITION EXPERT PROGRAM**

## **FITNESS SESSION 4:**

Muscular Concepts



## What we are going to cover



### **DIFFERENT TYPES OF MUSCLES**

#### **MUSCULAR ANATOMY**

- Muscle Function and Structure
- Special characteristics of muscle tissue
- Muscle contraction and muscle mechanics

### **THE NERVOUS SYSTEM AND ITS CONNECTION TO STRENGTH**

#### **MAJOR MUSCLE GROUPS**

- Action and Attachment points
- How to train each Major Muscle Group!

#### **THE FITT PRINCIPLE FOR STRENGTH TRAINING**

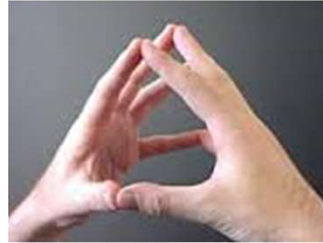
- Benefits of resistance training
- Recommended strength training guidelines





## What you need before we start

1. Water
2. Put your finger tips together
3. Take 3 deep breaths



## Muscles!



## Types of muscles

THERE ARE THREE TYPES OF MUSCLE IN THE BODY:

### Skeletal

- Voluntary muscle, controlled consciously
- Moves the body by pulling on bones of the skeleton
- Allows us to walk, dance, bit an apple, play the guitar

### Smooth

- Involuntary muscle, controlled unconsciously
- Found within the walls of internal organs
- Ex. Stomach, intestine, bladder, and blood vessels

### Cardiac

- Controls itself with assistance from the nervous and endocrine systems
- Only in the heart
- Propels the blood through the blood vessels



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Martini, F.H., Ober, W.C., Bartholomew, E.F., Nath, J.L. (2013). Visual Essentials of Anatomy and Physiology. 205

## Muscular Anatomy

### Muscle Functions

- Movement of bones or fluids
  - Ex. Blood, lymph
- Maintaining posture and body position
- Stabilizing joints
- Maintain body temperature
- Support soft tissues
- Guard entrances and exits
- Provide nutrient reserves



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Maintain body temp - Heat generation – shivering, fidgeting, muscle contraction require energy, when energy is used, some gets converted to heat  
Support soft tissue – abdominal cavity wall, pelvic floor support visceral organs, held protect from injury  
Guard entrances and exits – encircle opening of the digestive and urinary tracts – provide voluntary control – swallowing, defecating, urinating  
Nutrient reserves – body can break down protein in the muscles to be used as fuel

Martini, F.H., Ober, W.C., Bartholomew, E.F., Nath, J.L. (2013). Visual Essentials of Anatomy and Physiology. 205

## Muscular Anatomy

### Special Characteristics of Muscle Tissue

- Excitability: Ability to receive and respond to stimuli
- Contractibility: Ability to shorten when stimulated
- Extensibility: Ability to be stretched
- Elasticity: Ability to recoil to resting length

### Skeletal Muscle

- Each muscle is served by ONE artery, ONE nerve, and One or more veins
- Contains connective tissue
- Over 600 throughout the body

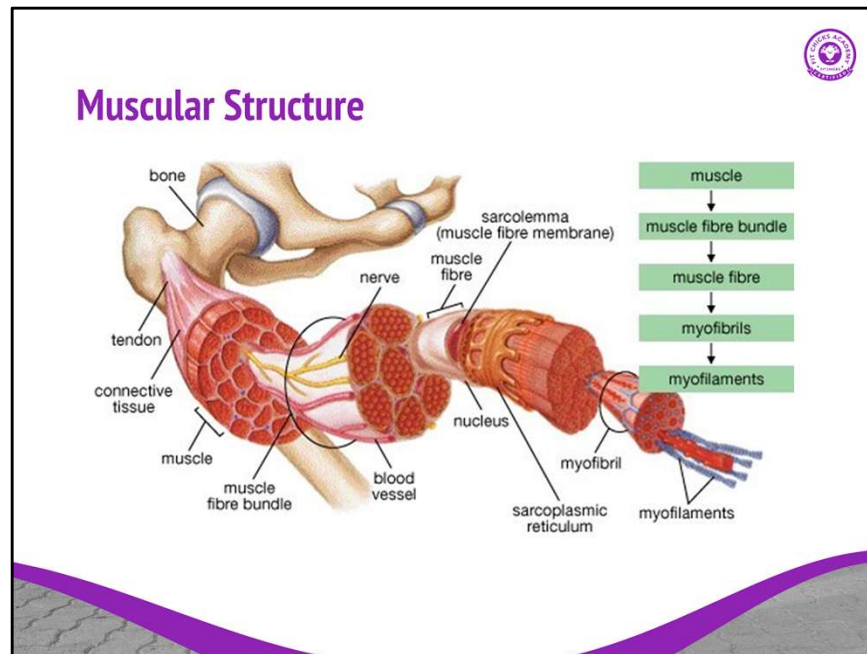


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A skeletal muscle contains:

- Connective tissues that harness the force of contraction
- Blood vessels that nourish,
- Nerves that control the contraction





<https://notinmycolour.com/flexin-part-2-muscle-anatomy/>

Myo = muscle

A muscle is made up of muscle fiber bundles

A muscle fiber bundle (also known as a muscle fascicle) is made up of muscle fibers

A muscle fiber is made up of myofibrils

Myofibrils are made up of myofilaments (actin and myosin)

A single muscle can contain thousands of muscle fibers

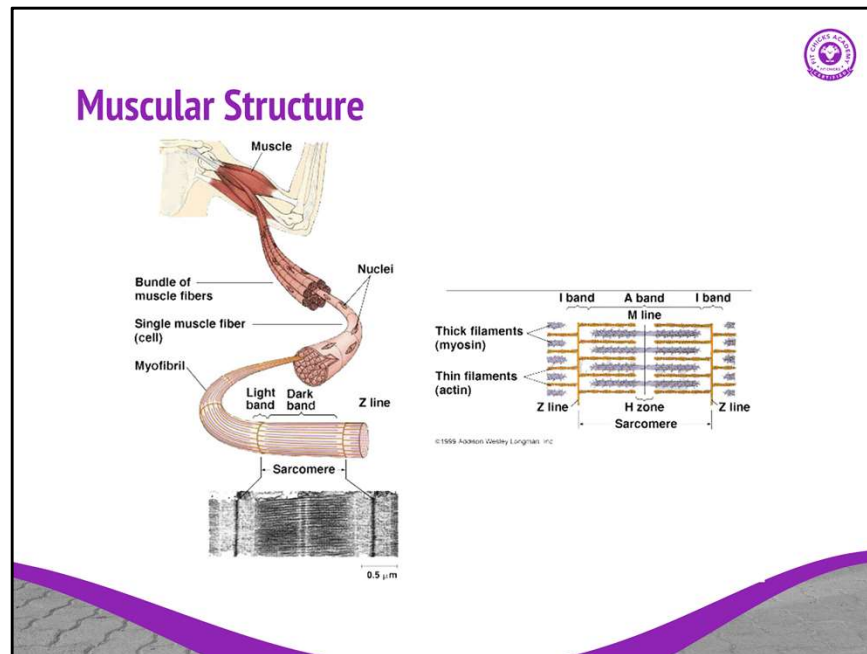


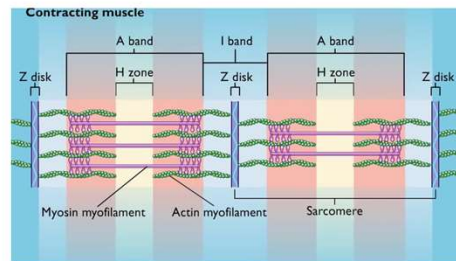
Diagram of the muscle further broken down – here you can see the contractile unit of a muscle – the sarcomere

Wilmore, J.H., Costill, D.L., Kenney, W.L. (2008). Structure and function of exercising muscle. Physiology of Sport and Exercise Fourth Edition. USA Human Kinetics

## Muscular Structure

### Sarcomere

- Smallest contractile unit of a muscle fiber
- The region of a myofilament between two successive Z discs
- Composed of thick (myosin) and thin (actin) myofilaments



Here's a short video explaining what happens in a sarcomere during a muscle contraction

<https://www.youtube.com/watch?v=onxb-28ZjVg>


The thick filaments (myosin) run the entire length of the A band

The thin filaments (actin) run the length of the I band and partway into the A band

Z disk anchors the thin filaments and connects the myofibrils to one another

H zone – the light mid region where filaments do not overlap

M line (see previous slide) – holds adjacent thick filaments together



## Muscular Contraction


### Contraction

- The generation of force
- Requires energy (ATP)
- Does not necessarily cause shortening of the fiber


### Sliding Filament Model of Contraction

- In the relaxed state, thin and thick filaments overlap only slightly
- During contraction, myosin heads bind to actin, detach and bind again, to propel the thin filaments toward the M line
- As H zones shorten and disappear, sarcomeres shorten, muscle cells shorten, and the whole muscle shortens

<https://www.youtube.com/watch?v=cnAbzz3N0ak>



Martini, F.H., Ober, W.C., Bartholomew, E.F., Nath, J.L. (2013). Visual Essentials of Anatomy and Physiology. 212



## Muscular Contraction

**Different types of muscle contraction**

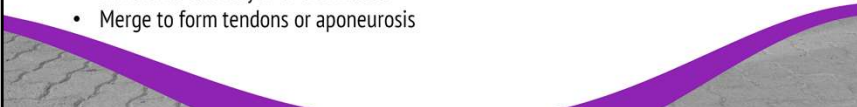
- Isotonic – muscle changes in length and moves the load
  - Concentric - the muscle shortens and does work
  - Eccentric – the muscle contracts as it lengthens
- Isometric
  - The load is greater than the tension the muscle is able to develop
  - Tension increases to the muscles capacity, but the muscle neither shortens or lengthens

**Different types of muscle fibers**

- Slow oxidative fibers – needs oxygen, slow to contract - long endurance
- Fast oxidative fibers and Fast glycolytic fibers - quick, powerful bursts

**Connective tissue**

- Surrounds each layer of the muscle
- Merge to form tendons or aponeurosis



Eccentric contractions (sometimes called ‘negatives’) are when the muscle contracts while lengthening at the same time.

(ex. if you are lowering a weight after a bicep curl very slowly, your bicep muscle is contracting to prevent the weight from falling quickly but lengthening as well – this is great way to build strength! ie. Negative chin-ups)

Video on muscle contractions:

<https://www.youtube.com/watch?v=PHTUlwCnCe8>

Normal muscle tone will always have a few heads attached to always be ready for contraction

A “tight” muscle or a knot is when more myosin heads are attached to actin than in normal tone.

Muscle fiber types

– fast - activities like HIIT, sprinting, weight lifting – training muscular strength (they need to work quickly)

- Slow - endurance type activities like running, cycling – training muscular endurance

(they need to work slowly for a longer period of time)

Tendon – bundle of connective tissue attaching muscle to bone

Aponeurosis – a broad sheet of connective tissue that attaches over a broad area, may involve more than one bone (ex. Lumbar aponeurosis)

Martini, F.H., Ober, W.C., Bartholomew, E.F., Nath, J.L. (2013). Visual Essentials of Anatomy and Physiology. 221

## Principles of Muscle Mechanics

### Important contractile properties

1. Length-tension relationship
    - There is an optimal length for max force production
  2. Force velocity relationship
    - Highest force is generated at slowest velocity
- Same principle applies to contraction of a single muscle fiber and a whole muscle
  - Contraction produces tension, the force exerted on the load or object to be moved
  - Contraction does not always shorten a muscle
    - Isometric – no shortening, muscle tension increases but does not exceed load
    - Isotonic – muscle shortens because muscle tension exceeds the load
  - Force and duration of contraction vary in response to stimuli or different frequencies



Length-tension – there is an optimal length for maximum force production (force production is critically influenced by limb position)

- Try to do a push-up starting with arms straight then try to do one starting at the bottom position of the push-up.

Force-velocity – highest force is generated at slowest velocity (can't move heavy objects very quickly)

- If you are going to pick up a piano, you will do it slow and controlled (unless you are superwoman!)

## Principles of Muscle Mechanics

**Force of a muscle contraction is affected by:**

**Number of muscle fibers stimulated**

- Recruitment

**Relative size of the fibers**

- Hypertrophy increase strength

**Frequency of stimulation**

- Increased frequency allows time for more effective transfer of tension to non-contractile components

**Length- tension relationship**

- Muscles contract most strongly when muscle fibers are 80 – 120% of their normal resting length



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## Muscle Fatigue

### Muscle Fatigue

- Physiological inability to contract
- Occurs when
  - Ion balances interfere with nervous system stimulus ( $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^+$ )
  - Prolonged exercise can damage the myofilaments and surrounding structures
- Total lack of ATP causes contractures (continuous contractions)
  - Occurs rarely, during states of continuous contraction



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Contractures – see this a lot in the elderly, body always favors flexion (reflex).

## The Nervous System

### Movement requires the nervous system to work with the muscles

- Skeletal muscles are voluntary muscles stimulated and controlled by the brain and the nervous system.
- When you think about moving, your brain decides which muscles are necessary to make that movement happen.
- Electrical impulses are sent via the spinal cord and nerves to the appropriate muscles (Action Potential).
- Once the movement has started, we get feedback which is sent to the brain to process and decide what to do next
- Proprioception
  - The sense of where one body part is located in relation to others and in relation to gravity.



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[http://www.medicinenet.com/how\\_muscles\\_work\\_and\\_respond\\_to\\_resistance\\_exercise-page3/views.htm](http://www.medicinenet.com/how_muscles_work_and_respond_to_resistance_exercise-page3/views.htm)

- Skeletal muscles are stimulated by somatic motor neurons
- The impulses travel from the central nervous system along the motor nerve to skeletal muscle
- Each axon (part of a nerve) forms several branches as it enters a muscle
- Each axon terminal (the end of a nerve) forms a neuromuscular junction with a single muscle fiber
- The neuromuscular junction sits midway along the length of a muscle fiber
- The axon terminal and muscle fiber are separated by a gel-filled space called the synaptic cleft
- Synaptic vesicles contain the neurotransmitter, acetylcholine (Ach) – which is required to contract the muscle
- The nerve impulse arrives at the axon terminal, Ach is released, this causes an action potential which leads to the release of Calcium and causes the muscle to contract
- <https://www.youtube.com/watch?v=N4TmS9bAB8w>

## The Nervous System

**A skeletal muscle controls muscle tension by the number of motor units stimulated**

### Motor Unit

- The nerve-muscle functional unit
- A single motor neuron and all (four to several hundred) the muscle fibers it supplies

### Small motor unit

- In muscles that control fine movement (fingers, eyes)

### Large motor unit

- In large weight bearing muscles
- Muscle fibers from a motor unit are spread throughout the muscle so that a single motor unit causes weak contraction of an entire muscle
- Motor units in a muscle usually contract asynchronously to help prevent fatigue



[http://www.medicinenet.com/how\\_muscles\\_work\\_and\\_respond\\_to\\_resistance\\_exercise-page3/views.htm](http://www.medicinenet.com/how_muscles_work_and_respond_to_resistance_exercise-page3/views.htm)

Martini, F.H., Ober, W.C., Bartholomew, E.F., Nath, J.L. (2013). Visual Essentials of Anatomy and Physiology. 220



## Strength and Neural Recruitment

- To be strong, you need both muscle mass AND neurological patterning
- When you lift weights regularly, you create new patterns of communication between the brain, nerves, neuromuscular junction, and muscle fibers. Every time you do that movement, those neuro-connections get stronger.
- Your absolute strength does depend on your muscle mass but it also depends on your neurological ability to recruit more muscle fibers. You can lift more if you can recruit and fire 50,000 vs. 25,000 fibers.
- Muscle recruitment allows people to get so much stronger in the first few weeks of a new strength training program before increasing the mass of muscle.
- Motor neurons in the muscle and nervous system die as people get older but exercise can reverse that process.

## Strength and Neural Recruitment

Sitting around with tons of muscle you don't use would be a waste of energy for your body


When you start to demand work from your body, it will adapt by:

1. Changing how your nervous system recruits and activates the muscles (neurological changes)
2. Changing the muscles themselves (morphological changes)

If you don't use it, you lose it!



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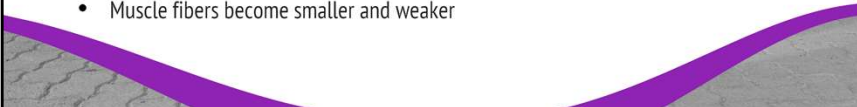
## Morphological Changes

**Hypertrophy = Getting Bigger!**

- Enlargement of stimulated muscles
- Results from repeated, exhaustive stimulation of skeletal muscle
- Muscle fibers develop more mitochondria, glycolytic enzymes, and larger glycogen reserves
- These muscle fibers have more myofibrils and these myofibrils contain more thick and thin myofilaments
- No new muscle fibers are created; they just increase in volume and size
- Since tension production is proportional to the cross-sectional area of a muscle, strength increases

**Atrophy = Getting Smaller**

- A skeletal muscles loses mass and tone when it is not regularly stimulated by a motor unit
- Muscle fibers become smaller and weaker

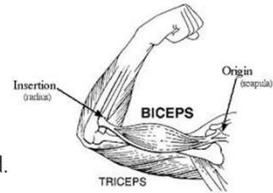


Hypertrophy is an increase in muscle fiber size – increase in size and amount of contractile proteins (actin and myosin)  
The repeated, exhaustive stimulation of skeletal muscle results in small micro tears.  
When the body repairs these micro tears, muscle growth occurs.

Further detail in how a muscle increases in size/repairs itself:  
<https://www.unm.edu/~lkravitz/Article%20folder/hypertrophy.html>

## Muscle Attachments


- Muscles attach on each side of a joint and when the muscle contracts or shortens, the joint moves.
  - Ex The bicep muscle crosses the front part of the elbow. When you do a bicep curl, the muscle contracts, the elbow flexes and the weight is lifted.
- In most cases one end of a muscle is fixed in position, and the other end moves during a contraction
- **Origin**
  - Where a muscle attaches to the bone closest to the center of the body
  - Where the fixed end is
- **Insertion**
  - Where a muscle attaches to bone farthest from the center of the body.
  - Where the movable end attaches to another structure
- **Action**
  - The specific movement a muscle makes when it contracts



Ex. The biceps origin is on the scapula and the humerus, and its insertion is on radius.

<https://www.youtube.com/watch?v=8WE-bOH2loA>

Martini, F.H., Ober, W.C., Bartholomew, E.F., Nath, J.L. (2013). Visual Essentials of Anatomy and Physiology. 228



## Agonist/Antagonist

- When a muscle contracts or shortens, it pulls the insertion towards the origin and causes the joint to move.
- With complex movements, muscles work in groups rather than individually. Their cooperation makes a particular movement more efficient.
- To return the joint to its original position, the reciprocal muscle on the other side of the joint must contract and shorten.
- The muscles working together creates a "reciprocal" synergy that is called the agonist/antagonistic system.

**Agonist:**

- The prime mover mostly responsible for producing a particular movement

**Antagonist:**

- Opposes the movement of the agonist

Martini, F.H., Ober, W.C., Bartholomew, E.F., Nath, J.L. (2013). Visual Essentials of Anatomy and Physiology. 228

There are also synergist muscles that contract to help the larger agonist work efficiently. They synergists provide additional pull near the insertion or may stabilize the point of origin. Ex. The brachioradialis assists the biceps and helps stabilize the elbow joint.








### Antagonistic Muscle Groups List



 Biceps \_\_\_\_\_ Pairs with \_\_\_\_\_ Triceps 

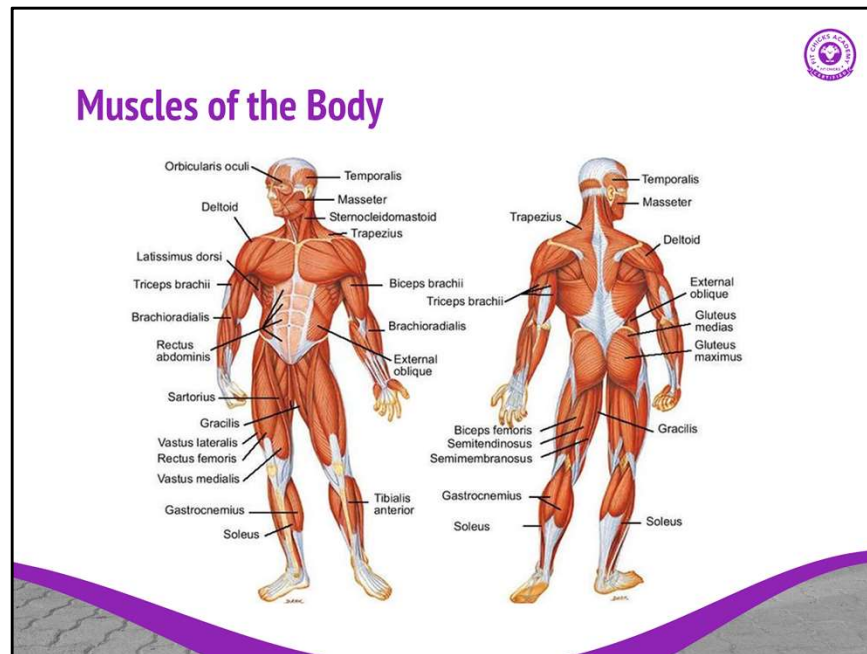
 Back \_\_\_\_\_ Pairs with \_\_\_\_\_ Chest 

 Abs \_\_\_\_\_ Pairs with \_\_\_\_\_ Lower back 

 Shoulders \_\_\_\_\_ Pairs with \_\_\_\_\_ Chest / Back 

 Quadriceps \_\_\_\_\_ Pairs with \_\_\_\_\_ Hamstring 

 Tibialis anterior(shin) \_\_\_\_\_ Pairs with \_\_\_\_\_ Calf muscle 



<http://actionreactionpt.com/balancing-muscle-groups/>

These are all the major muscles of the body, this diagram does not label to muscles of the forearm, hand, deep lower leg or feet.

## Muscles of the Arms

### Upper arm

#### Anterior

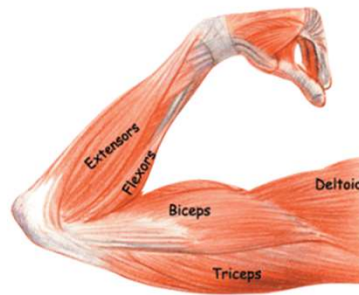
- Biceps Brachii
- Brachialis
- Brachioradialis

#### Posterior

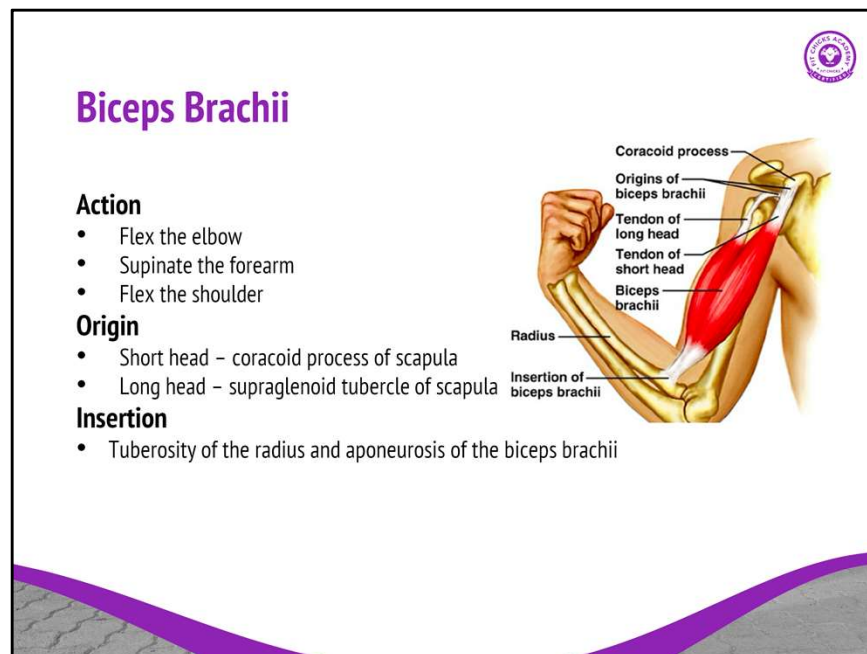
- Triceps brachii

### Forearms

- Wrist flexors
- Wrist extensors



<https://workouttrends.com/arm-muscles-and-workout>



<https://coreem.net/core/biceps-and-triceps-tendon-rupture/>  
 Biel, Andrew (2010). Trail Guide to the Body. 95

Strength Training Anatomy:

Biceps Brachii, Brachialis?

Curls p. 6-15

Brachioradialis p. 9

O – Anterior scapula

I – proximal radius

When clients are doing curls you want to make sure their shoulders are properly stabilized. Always think about shoulders back and chest. You can also watch for your clients neck bobbing forward trying to compensate/counter the weight.

## Brachialis and Brachioradialis

### Brachialis

#### Action

- Flex the elbow

#### Origin

- Distal half of anterior surface of humerus

#### Insertion

- Tuberosity and coronoid process of ulna

### Brachioradialis

#### Action

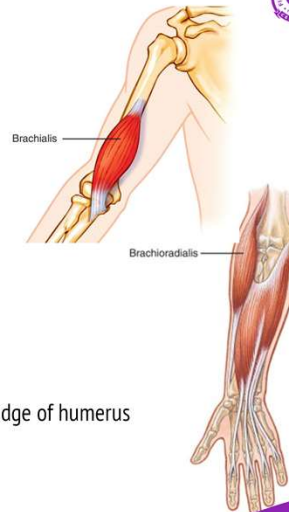
- Flexes the elbow
- Assists to pronate and supinate the forearm

#### Origin

- Proximal two-thirds of the lateral supracondylar ridge of humerus

#### Insertion

- Styloid process of radius



**What exercises would help me train these muscles?**

<https://medical-dictionary.thefreedictionary.com/brachialis>

<https://medical-dictionary.thefreedictionary.com/brachioradialis>

Biel, Andrew (2010). Trail Guide to the Body. 132-133

Brachialis – also known as baby bicep

I- proximal, medial ulna

Brachioradialis – also known as the drinking muscle

Strength Training Anatomy:

Curls p. 6-12

Brachioradialis p. 9

Brachialis p 6-12

What exercise targets are three muscles at once? (pg 9)

## Biceps Brachii, Brachialis and Brachioradialis



What exercises would help me train these muscles?

- Bicep curls
- Concentration curls
- Incline dumbbells curls
- Hammer curls (target all 3 bc forearm is supinated)
- Preacher curls
- Machine curls
- Etc...

### Equipment needed

- Dumbbells
- Resistance bands
- Barbells
- Cables
- E-Z curl bar



© JEFIT

<https://www.jefit.com/exercises/100/Dumbbell-Bicep-Curl>

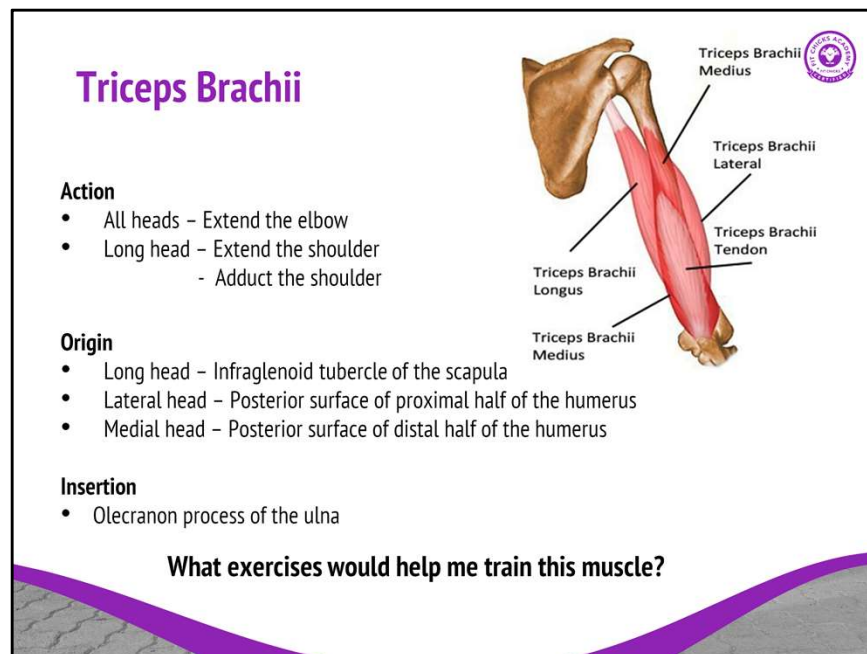
Strength Training Anatomy:

Curls p. 6-12

Brachioradialis p. 9

Brachialis p 6-12

What exercise targets are three muscles at once? (pg 9)



<http://build-muscle-101.com/tricep-exercises/>

Biel, Andrew (2010). Trail Guide to the Body. 97

Which triceps exercise is better to hit all three heads of the muscle group, push downs or lying triceps extensions? – think about where the muscle attaches  
- Lying triceps extensions bc you will be recruiting the long head as well

Strength Training Anatomy:

Triceps?

Extensions p. 24

Kickbacks p. 20

Dips p. 23

Push-downs p. 13

## Triceps Brachii

What exercises would help me train this muscle?

- Triceps extensions
  - Skull crushers
  - Overhead (seated or standing)
- Kickbacks
- Dips
- Push-downs

**Equipment needed:**

- Dumbbells
- Barbells
- E-A curl bar
- Cables
- Bench



<https://www.jefit.com/exercises/236/Dumbbell-Lying-Supine-Two-Arm-Triceps-Extension>

Which triceps exercise is better to hit all three heads of the muscle group, push downs or lying triceps extensions? – think about where the muscle attaches  
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Strength Training Anatomy:

Triceps?

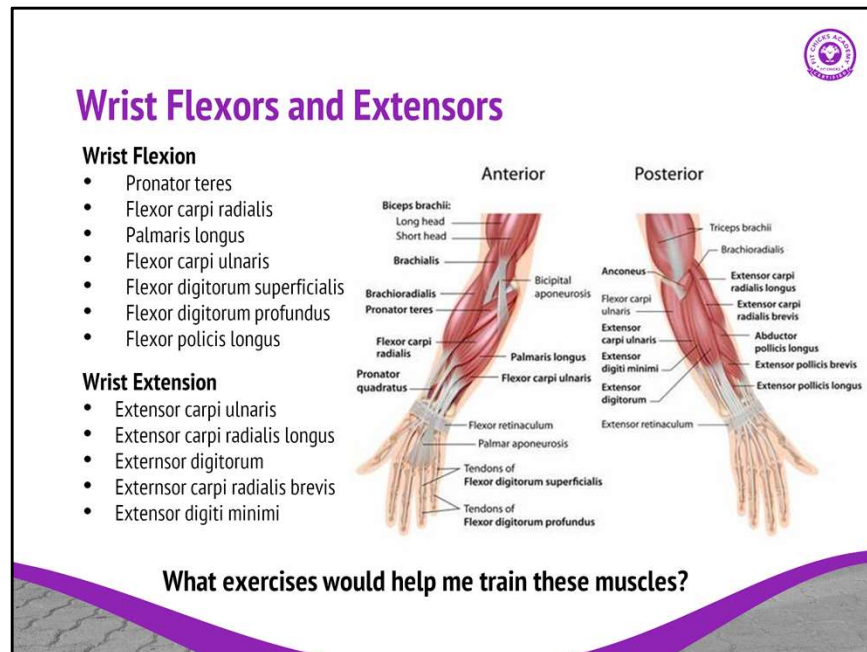
Extensions p. 24

Kickbacks p. 20

Dips p. 23

Push-downs p. 13





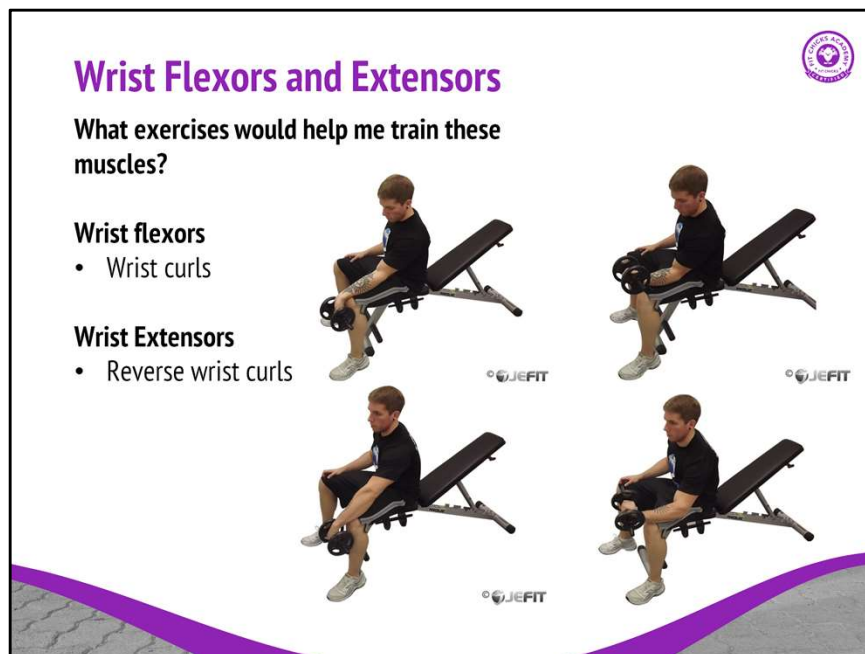
<https://www.nielasher.com/blogs/video-blog/61769541-trigger-point-therapy-treating-the-wrist-flexor-muscles>

#### Wrist Flexors?

- Most of the wrist flexors attach to the medial epicondyle and into the palm of the hand
- Wrist curls pg. 17

#### Wrist Extensors?

- Most wrist extensors attach to the lateral epicondyle and into the back of the hand
- Reverse wrist curls pg. 16



<https://www.jefit.com/exercises/1081/Dumbbell-One-Arm-Seated-Wrist-Curl>

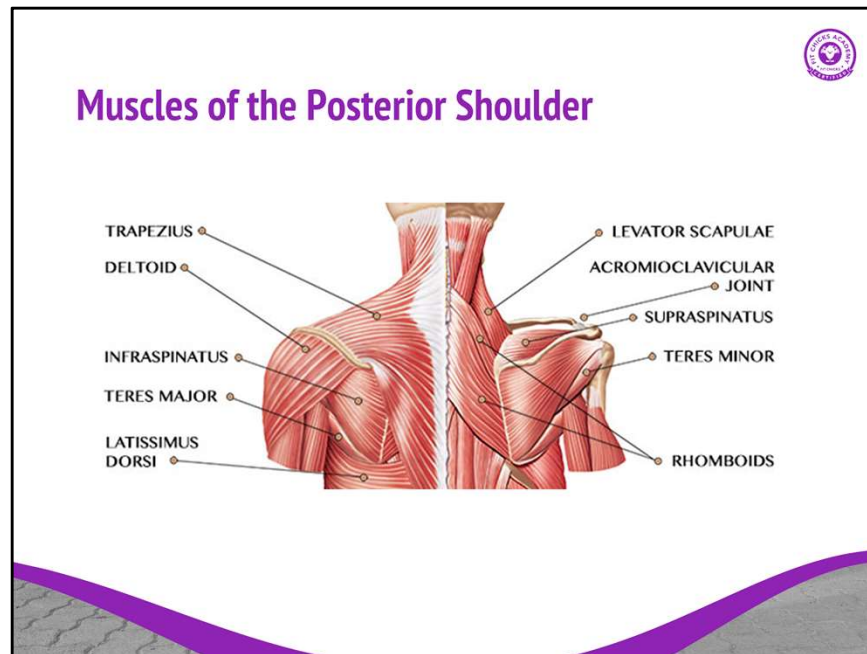
<https://www.jefit.com/exercises/1083/Dumbbell-One-Arm-Seated-Reverse-Wrist-Curl>

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Wrist Extensors?

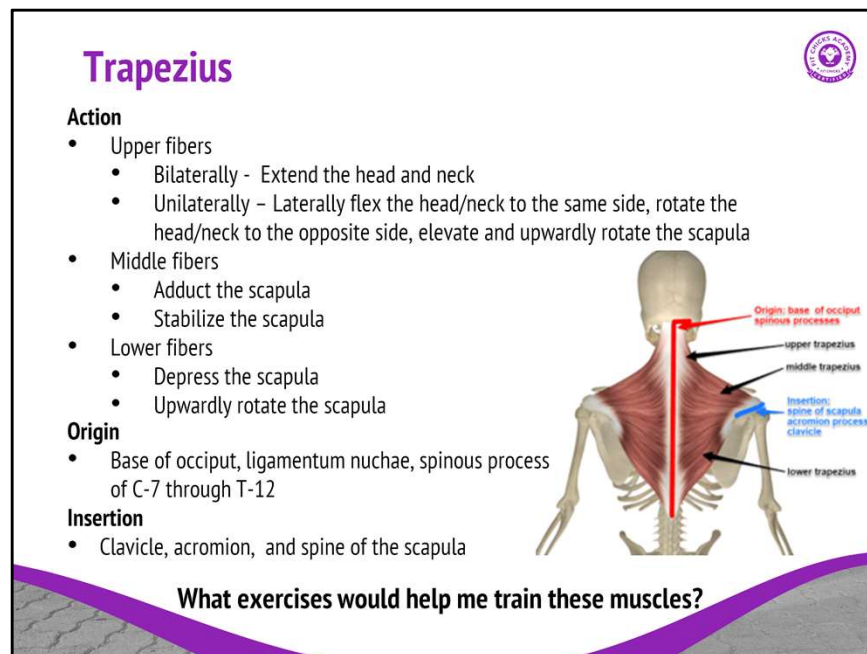
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<https://www.youtube.com/watch?v=D3GVKjeY1FM>

[Http://clickmypicture.com/shoulder-muscle-anatomy/shoulder-muscle-anatomy-shoulder-muscle-shoulder-muscles-how-to-improve-function-and-avoid/](http://clickmypicture.com/shoulder-muscle-anatomy/shoulder-muscle-anatomy-shoulder-muscle-shoulder-muscles-how-to-improve-function-and-avoid/)

<https://hurnechiropractic.com/resources/posts/muscles/PecMajMin/>



<https://www.yoganatomy.com/trapezius-muscle-yoga-anatomy/>  
 Biel, Andrew (2010). Trail Guide to the Body. 69

check pg 115-119 in Strength Training Anatomy:  
 Rows: 94-101  
 Lower: 91, 86

Upper Trapezius?  
 Shrugs (p.115)

Mid Trapezius?  
 Rows (p. 98)

Lower Trapezius?  
 Chin ups (p. 86)

Low trap punch - [https://www.bodiempowerment.com/advanced-posture-exercises/YTWL's \(y's specifically\) - https://suzannekasper.com/2016/08/17/shoulder-stability-exercises-ytwli-raise/](https://www.bodiempowerment.com/advanced-posture-exercises/YTWL's(y's%20specifically)-https://suzannekasper.com/2016/08/17/shoulder-stability-exercises-ytwli-raise/)

Wall slides/angles - <https://www.womenshealthmag.com/fitness/a20699625/wall-slide/>

## Trapezius

What exercises would help me train these muscles?

### Upper fibers

- Barbell shrug
- Dumbbell shrug

### Middle fibers

- Row
  - Seated
  - Bent over
  - T-bar

### Lower fibers

- Face pulls
- Wall slides
- Low trap punch
- YTWL's
- Pull up shrug



<https://www.skimble.com/exercises/11876-bent-over-row-to-fly-how-to-do-exercise>

<https://www.womenshealthmag.com/fitness/a20699625/wall-slide/>

<https://weighttraining.guide/exercises/barbell-shrug/>

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Wall slides/angles - <https://www.womenshealthmag.com/fitness/a20699625/wall-slide/>

## Rhomboids

### Action

- Adduct the scapula
- Elevate the scapula
- Downwardly rotate the scapula

### Origin

- Major – Spinous processes of T2-T5
- Minor – Spinous processes of C7-T1

### Insertion

- Major – Medial border of the scapula between the spine of the scapula and inferior angle
- Minor – Upper portion of medial border of the scapula, across from the spine of the scapula

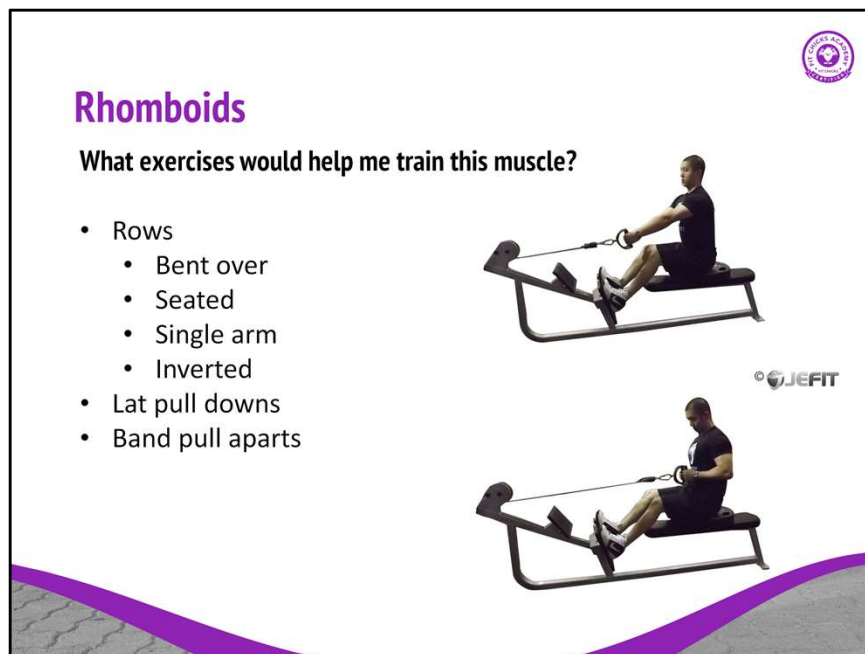


**What exercises would help me train this muscle?**

Biel, Andrew (2010). Trail Guide to the Body. 82  
<http://www.musclesused.com/rhomboid/>

Strength Training Anatomy:  
 p.94- 95, 97-101  
 Rows, Lat Pull Downs p. 91

another good ex not in the book – band pull aparts (also develops posteriors delts)



Biel, Andrew (2010). Trail Guide to the Body. 82  
<http://www.musclesused.com/rhomboid/>

Strength Training Anatomy:  
p.94- 95, 97-101  
Rows, Lat Pull Downs p. 91

another good ex not in the book – band pull aparts (also develops posteriors delts)



## Latissimus Dorsi

### Action

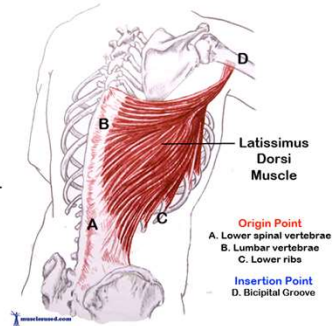
- Extend the shoulder
- Adduct the shoulder
- Medially rotate the shoulder

### Origin

- Inferior angle of scapula, spinous processes of T6-T12, last three or four ribs, thoracolumbar aponeurosis, and posterior iliac crest

### Insertion

- Intertubercular groove of the humerus



\*\*Teres major also perform these three actions but has a different O&I.

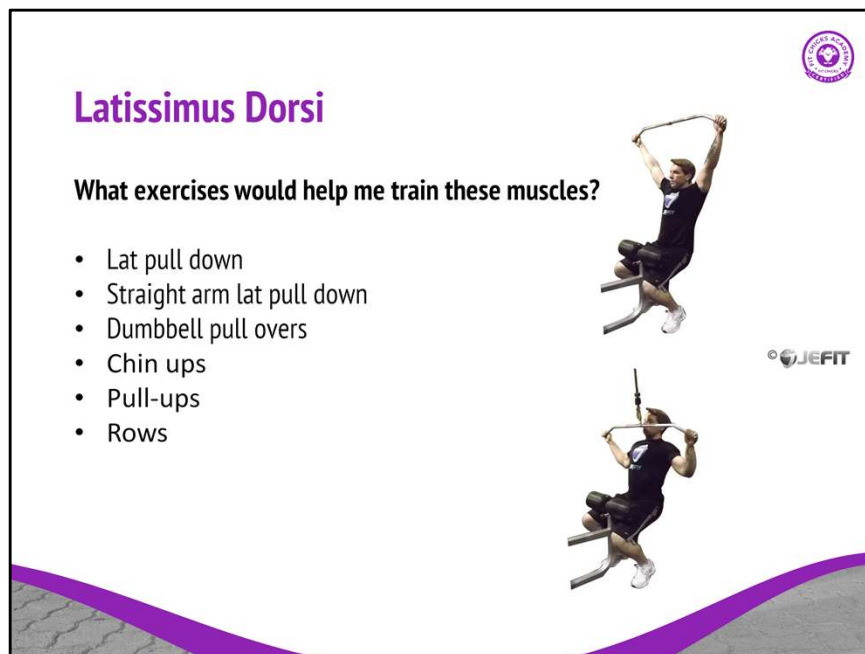
**What exercises would help me train these muscles?**

Biel, Andrew (2010). Trail Guide to the Body. 71  
<http://www.musclesused.com/latissimus-dorsi/>

Strength Training Anatomy:  
p. 86: chin ups.

what chin up variation should i do to develop the width of the back?

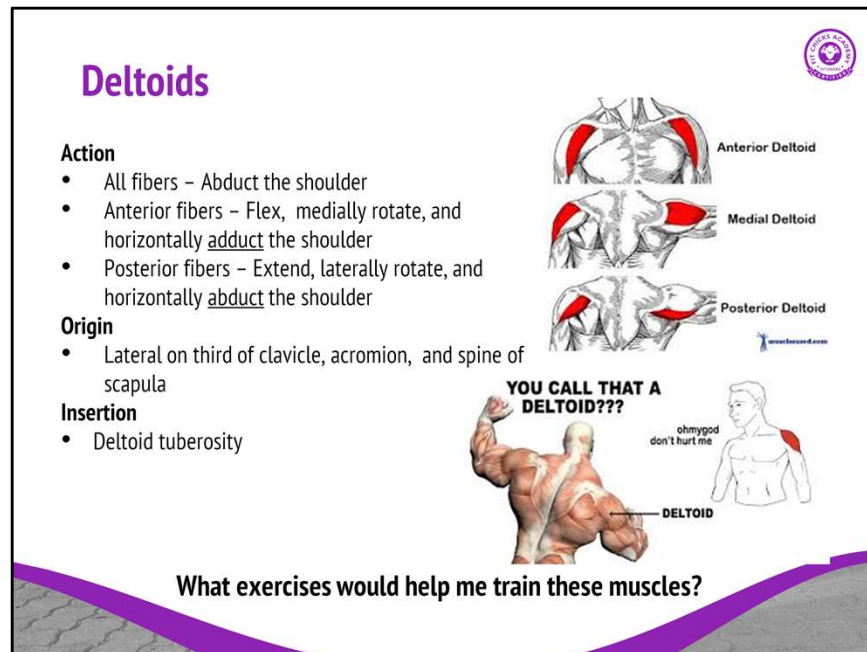
Latissimus Dorsi?  
Lat Pull Downs p. 90  
Rows p. 94



Strength Training Anatomy:  
p. 86: chin ups.

what chin up variation should i do to develop the width of the back?

Latissimus Dorsi?  
Lat Pull Downs p. 90  
Rows p. 94



Biel, Andrew (2010). Trail Guide to the Body. 67

Strength Training anatomy:

p. 34 front press

p. 40 arnold press

question: what should you watch for when doing a standing overhead shoulder press? p. 34

what would be a better choice for a beginner; arnold press or dumbbell press?

Deltoids:

Overhead Press p. 35

Arnold Press p. 40

Bent Over Lateral Raise p.41

Etc, etc!

## Deltoids



What exercises would help me train these muscles?

- Shoulder press
- Arnold press
- Lateral raises
- Front raises
- Upright row
- Rear delt raise
- Push press



<http://beaufortpersonaltraining.com/beaufort-fitness-shoulder-press/>

Strength Training anatomy:

p. 34 front press

p. 40 arnold press

question: what should you watch for when doing a standing overhead shoulder press? p. 34

what would be a better choice for a beginner; arnold press or dumbbell press?

Deltoids:

Overhead Press p. 35

Arnold Press p. 40

Bent Over Lateral Raise p.41

Etc, etc!

## Muscles of the Rotator cuff

### Supraspinatus

#### Action

- Abduct the shoulder
- Stabilize the shoulder

#### Origin

- Supraspinous fossa of the scapula

#### Insertion

- Greater tubercle of the humerus

### Subscapularis

#### Action

- Medially rotate the shoulder
- Stabilize the head of the humerus in glenoid cavity

#### Origin

- Subscapular fossa of the scapula

#### Insertion

- Lesser tubercle of the humerus



Biel, Andrew (2010). Trail Guide to the Body. 75

Strength Training anatomy:  
p. 37 for injuries:

Rotator Cuff:  
Cable or band rotations p. 50

## Muscles of the Rotator cuff

### Infraspinatus and Teres Minor

#### Action

- Laterally rotate the shoulder
- Adduct the shoulder
- Stabilize the head of the humerus in glenoid cavity

#### Origin

- Infraspinatus – Infraspinous fossa of scapula
- Teres Minor – Upper two thirds of lateral border of the scapula

#### Insertion

- Infraspinatus and Teres Minor – Greater tubercle of the humerus



**What exercises would help me train these muscles?**

Biel, Andrew (2010). Trail Guide to the Body. 75  
Strength Training Anatomy:  
p. 37 for injuries:

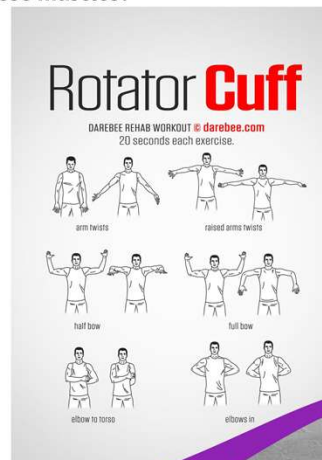
Rotator Cuff?  
Cable or band rotations p. 50

## Muscles of the Rotator cuff



What exercises would help me train these muscles?

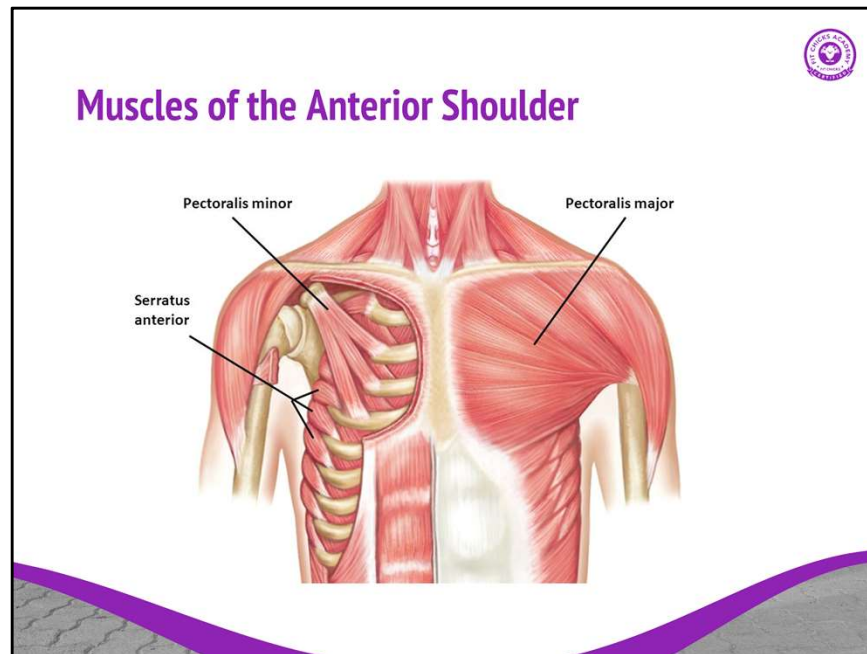
- Face pulls with external rotation
- External arm rotations
  - Dumbbell
  - Band
  - Cable
- Lateral raises



<https://darebee.com/workouts/rotator-cuff-workout.html>

Strength Training Anatomy:  
p. 37 for injuries:

Rotator Cuff?  
Cable or band rotations p. 50




<https://www.youtube.com/watch?v=D3GVKjeY1FM>

[Http://clickmypicture.com/shoulder-muscle-anatomy/shoulder-muscle-anatomy-shoulder-muscle-shoulder-muscles-how-to-improve-function-and-avoid/](http://clickmypicture.com/shoulder-muscle-anatomy/shoulder-muscle-anatomy-shoulder-muscle-shoulder-muscles-how-to-improve-function-and-avoid/)

<https://hurnechiropractic.com/resources/posts/muscles/PecMajMin/>





## Pectoralis Major

**Pectoralis Major**

**Action**

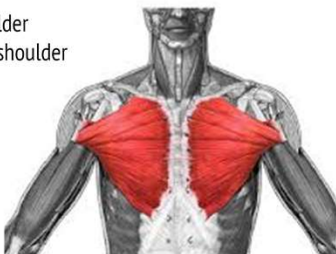
- All fibers – Adduct and medially rotate the shoulder
- Upper fibers – Flex and horizontally adduct the shoulder
- Lower fibers – Extend the shoulder

**Origin**

- Medial half of clavicle, sternum, and cartilage of ribs 1-6

**Insertion**

- Crest of greater tubercle of humerus



**What exercises would help me train these muscles?**

Biel, Andrew (2010). Trail Guide to the Body. 89

Strength Training Anatomy:  
 check out pg. 70 for morphology of pec tears and  
 pg. 76: push=ups  
 62-84

question: what does working your pecs do for the appearance of breasts? p.62

Pectoralis Major?

Dips p. 74

Bench Press p. 73

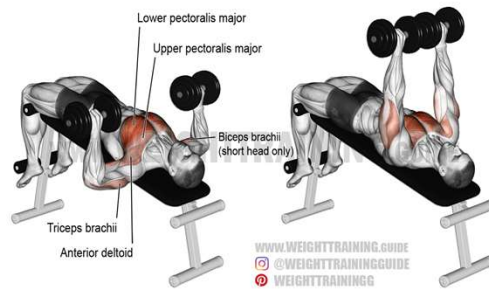
Push ups. p. 76

Flys p. 81

## Pectoralis Major

What exercises would help me train these muscles?

- Chest press
  - Barbell
  - Dumbbell
  - Single arm
- Push-ups
- Parallel bar dips
- Chest flys



<https://weighttraining.guide/exercises/decline-dumbbell-bench-press/>

Strength Training Anatomy:  
check out pg. 70 for morphology of pec tears and  
pg. 76: push=ups  
62-84

question: what does working your pecs do for the appearance of breasts? p.62  
Pectoralis Major?

Dips p. 74

Bench Press p. 73

Push ups. p. 76

Flys p. 81

## Pectoralis Minor and Serratus Anterior



### Pectoralis Minor

#### Action

- Depress the scapula
- Abduct the scapula
- Downwardly rotate the scapula

#### Origin

- Third, fourth, and fifth ribs

#### Insertion

- Medial surface of coracoid process of the scapula



### Serratus Anterior

#### Action

- Abduct the scapula
- Upwardly rotate the scapula
- Depress the scapula
- Hold the medial border against the rib cage

#### Origin

- External surface of ribs 1-8/9

#### Insertion

- Anterior surface of medial border of the scapula

**What exercises would help me train these muscles?**

<https://hurnechiropractic.com/resources/posts/muscles/PecMajMin/>  
Biel, Andrew (2010). Trail Guide to the Body. 87,92

When you see people that have a winged scapula – generally their serratus anterior is weak. It is important to address this bc if their scapula isn't sitting properly and they are not able to stabilize it then it will compromise other movements and could result in injury

Serratus Anterior – scapular push-ups, forearm wall slides

## Pectoralis Minor and Serratus Anterior



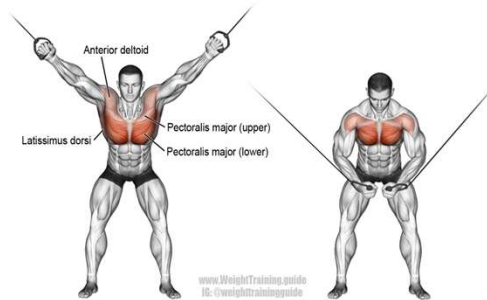
What exercises would help me train these muscles?

### Pectoralis Minor

- High cable cross over
- Chest flys

### Serratus Anterior

- Push-ups
- Scapular push-ups
- Forearms wall slides

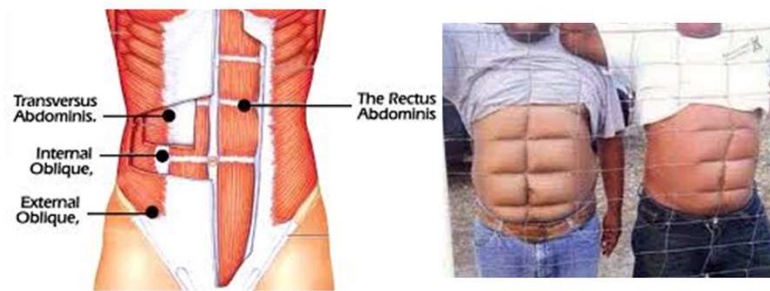


<https://weighttraining.guide/exercises/high-cable-cross-over/>


When you see people that have a winged scapula – generally their serratus anterior is weak. It is important to address this bc if their scapula isn't sitting properly and they are not able to stabilize it then it will compromise other movements and could result in injury

Serratus Anterior – scapular push-ups, forearm wall slides

## Muscles of the Anterior Torso



<https://helloconfidence.com/2015/03/20/all-about-that-core/>



## Rectus abdominis

**Action**


- Flex the vertebral column
- Tilt the pelvis posteriorly

**Origin**

- Pubic crest, pubic symphysis

**Insertion**

- Cartilage of ribs 5,6,7 and xiphoid process



**What exercises would help me train these muscles?**

Biel, Andrew (2010). Trail Guide to the Body. 210

The great debate on neutral spine and crunches/sit-ups. Every trainer and health care professional out there has their own opinion on whether or not crunches and sit ups are “bad” for you. It is up to you as a trainer to do your own research and decide which camp you want to be in.

Read pg. 171 and look up Stuart McGill. He has a lot of info on neutral spine for core ex's.

173: question: What are some ways to make sit-ups easier for beginners?

Some info to check out: <https://uwaterloo.ca/applied-health-sciences/hes-got-our-backs>

Rectus Abdominis?

Crunches p.172

Discuss p. 171

<https://www.youtube.com/watch?v=033ogPH6NNE>

## Rectus abdominis

What exercises would help me train these muscles?

- Crunches
- Sit-ups
- Leg raises



<https://www.coachmag.co.uk/exercises/abs-workout/172/instant-six-pack-fix-bench-leg-raises>

The great debate on neutral spine and crunches/sit-ups. Every trainer and health care professional out there has their own opinion on whether or not crunches and sit ups are “bad” for you. It is up to you as a trainer to do your own research and decide which camp you want to be in.

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Rectus Abdominis?

Crunches p.172

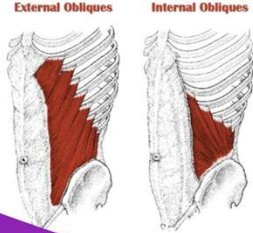
Discuss p. 171

<https://www.youtube.com/watch?v=033ogPH6NNE>



## Obliques

<p><b>External Oblique</b></p> <p><b>Action</b></p> <ul style="list-style-type: none"> <li>• Unilaterally – laterally flex the spine to the same side and rotate to the opposite side</li> <li>• Bilaterally – Flex the spine</li> </ul> <p><b>Origin</b></p> <ul style="list-style-type: none"> <li>• External surfaces of ribs 5-12</li> </ul> <p><b>Insertion</b></p> <ul style="list-style-type: none"> <li>• Anterior part of iliac crest, abdominal aponeurosis to linea alba</li> </ul>	<p><b>Internal Oblique</b></p> <p><b>Action</b></p> <ul style="list-style-type: none"> <li>• Unilaterally – Laterally flex and rotate the spine to the same side</li> <li>• Bilaterally – Flex the spine</li> </ul> <p><b>Origin</b></p> <ul style="list-style-type: none"> <li>• Lateral inguinal ligament, iliac crest, and thoracolumbar fascia</li> </ul> <p><b>Insertion</b></p> <ul style="list-style-type: none"> <li>• Internal surface of lower three ribs, abdominal aponeurosis to linea alba</li> </ul>
--	---



**What exercises would help me train these muscles?**

Biel, Andrew (2010). Trail Guide to the Body. 210  
<http://www.kingofthegym.com/internal-oblique/>  
<http://www.kingofthegym.com/external-oblique/>

Strength Training Anatomy:

p.185

Obliques?

Side plank

Static oblique hold: [https://www.youtube.com/watch?v=G\\_odstU0H6I](https://www.youtube.com/watch?v=G_odstU0H6I)

p. 184

- Spinal Rotation (Russian twist)
- Lateral flexion (side plank with hip dip)
- Aids in Posterior Pelvic tilt)



## Obliques

What exercises would help me train these muscles?

- Trunk rotations
- Dumbbell side bends
- Roman chair side bends
- Russian twist
- Side plank
- Side plank with twist



<https://blog.paleohacks.com/oblique-exercises/>

Strength Training Anatomy:

p.185

Obliques?

Side plank

Static oblique hold: [https://www.youtube.com/watch?v=G\\_odstU0H6I](https://www.youtube.com/watch?v=G_odstU0H6I)

p. 184

- Spinal Rotation (Russian twist)
- Lateral flexion (side plank with hip dip)
- Aids in Posterior Pelvic tilt)

## Transverse Abdominis

### Action

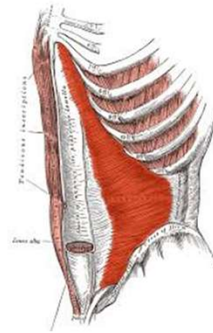
- Compress abdominal contents

### Origin

- Lateral inguinal ligament, iliac crest, thoracolumbar fascia, and internal surface of ribs 6-12

### Insertion

- Abdominal aponeurosis to linea alba



What exercises would help me train these muscles?

Biel, Andrew (2010). Trail Guide to the Body. 210

Strength Training Anatomy:

Transverse Abdominis?

Deadlifts p. 108

p. 113

Plank

Bracing

<https://www.youtube.com/watch?v=dglhzlp474A>

- Function: Activate the core musculature and stabilize the pelvis and low back prior to movement of the body.

- Action: 'bracing'

## Transverse Abdominis

What exercises would help me train these muscles?

- Dead bug
- Bird dog
- Plank
- Hollow holds
- Heel slides
- Flutter kicks



<https://www.theguardian.com/lifeandstyle/shortcuts/2017/oct/18/how-to-do-perfect-plank-exercise>

Strength Training Anatomy:

Transverse Abdominis?

Deadlifts p. 108

p. 113

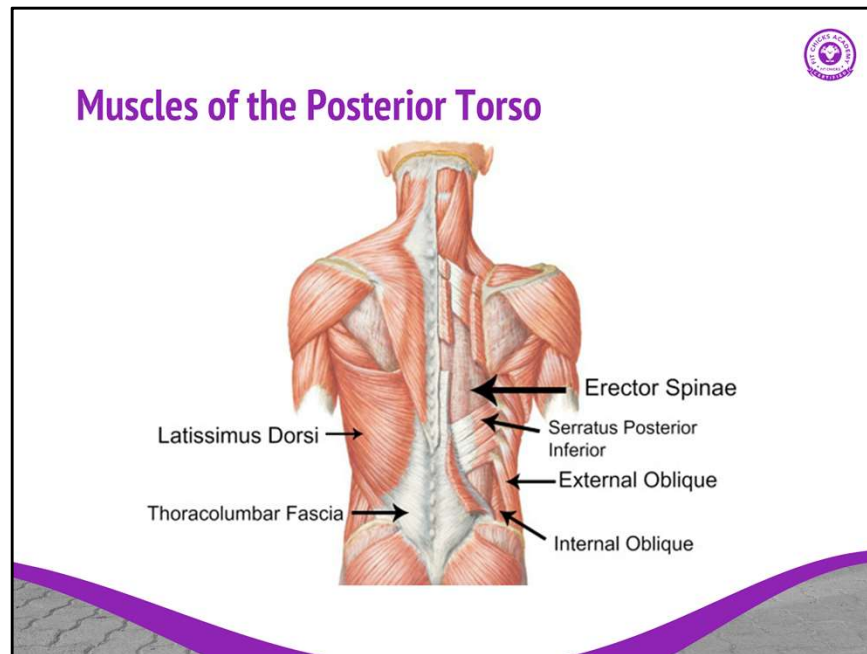
Plank

Bracing

<https://www.youtube.com/watch?v=dglhzlp474A>

• Function: Activate the core musculature and stabilize the pelvis and low back prior to movement of the body.

• Action: 'bracing'



<https://helloconfidence.com/2015/03/20/all-about-that-core/>

## Erector Spinae

### Action

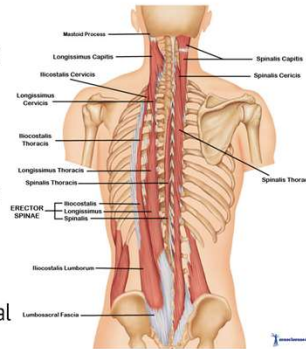
- Unilaterally – Laterally flex the spine to the same side
- Bilaterally – Extend the spine

### Origin

- Common tendon that attaches to the posterior surface of sacrum, iliac crest, spinous processes of the lumbar and last two thoracic vertebrae

### Insertion

- Various attachments at the posterior ribs, spinous and transverse processes of the thoracic and cervical vertebrae, and mastoid process of temporal bone



What exercises would help me train these muscles?

<http://www.musclesused.com/erector-spinae-2/>  
Biel, Andrew (2010). Trail Guide to the Body. 197

Strength Training Anatomy:

Erector Spinae?

Deadlifts p. 108

p. 113

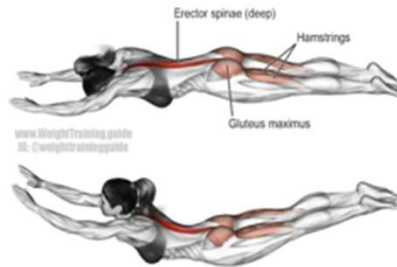
Bird Dogs

Plank

## Erector Spinae

What exercises would help me train these muscles?

- Back extensions
- Supermans
- Glute bridge
- Bird dog
- Good mornings
- Bent over rows
- Deadlifts
- Rack pulls



<https://www.setforset.com/blogs/news/13-best-erector-spinae-exercises>

Strength Training Anatomy:

Erector Spinae?

Deadlifts p. 108

p. 113

Bird Dogs

Plank



## Muscles of the Hip



\* Adductors not shown

## Hip Adductors

### Action

- All – Adduct and medially rotate the hip
- Except Gracilis – Flex the hip –
  - Flex and medially rotates the flex knee
- Posterior fibers of adductor magus – Extend the hip

### Origin

- Various attachments on pubic bone

### Insertion

- Various attachments along femur
- Except Gracilis – tibia



What exercises would help me train these muscles?

<http://www.stopchasingpain.com/hip-adductor-mojo/>  
Biel, Andrew (2010). Trail Guide to the Body. 319 -321

Strength Training Anatomy:

Pg 129

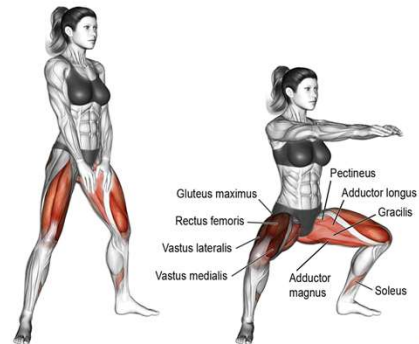
Pg 146-147



## Hip Adductors

What exercises would help me train these muscles?

- Power squats/sumo squats
- Plie squats
- Resisted adduction
- Lateral lunges



<https://weighttraining.guide/exercises/bodyweight-sumo-squat/>

Strength Training Anatomy:

Pg 129

Pg 146-147

## Hip Flexors

### Action

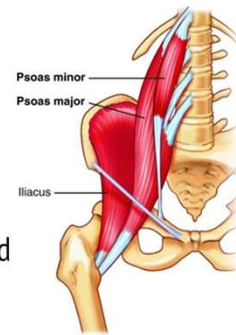
- Flex the hip
- Flex the trunk
- Tilt pelvis anteriorly

### Origin

- Anterior lumbar vertebrae (Psoas) and iliac fossa (Iliacus)

### Insertion

- Lesser trochanter of the femur



What exercises would help me train these muscles?

<https://deansomerset.com/hip-flexors-arent-tight-theyre-overworked-heres/>  
Biel, Andrew (2010). Trail Guide to the Body.



## Hip Flexors

What exercises would help me train these muscles?

- High knees
- Leg raises
- Resisted hip flexion
- Lunges



<https://www.healthline.com/health/fitness-exercise/hip-flexor-exercises#takeaway>

## Gluteal Muscles

### Glute Max

#### Action

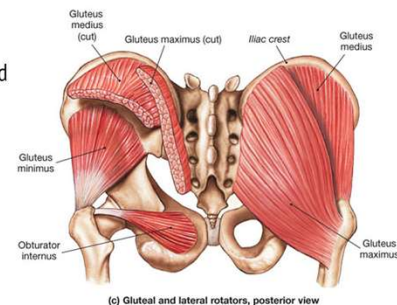
- Upper fibers - Extend, laterally rotate and abduct the hip
- Lower fibers - Adduct the hip

#### Origin

- Coccyx, edge of sacrum, posterior iliac crest

#### Insertion

- Iliotibial band and gluteal tuberosity



What exercises would help me train these muscles?

Biel, Andrew (2010). Trail Guide to the Body. 315-316

Strength Training Anatomy:

Glute Max?

Flutter kick, bird dogs, hip bridge p. 162, cable kick backs p. 159

Without isolation: lunges, Squats, Deadlifts, etc p. 156 Glute Med?

Cable Hip Abductions p. 164

Clamshells

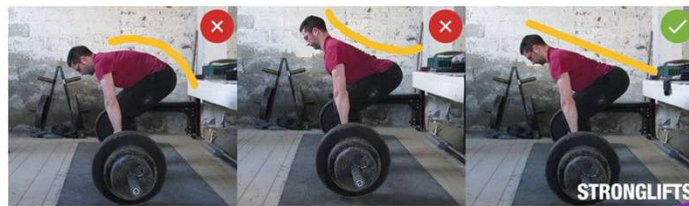
Lateral band walks



## Gluteal Muscles

What exercises would help me train these muscles?

- Deadlifts
- Glute bridge
- Hip thrust
- Resisted hip extension



<https://stronglifts.com/deadlift/#gref>

Strength Training Anatomy:

Glute Max?


Flutter kick, bird dogs, hip bridge p. 162, cable kick backs p. 159

Without isolation: lunges, Squats, Deadlifts, etc p. 156 Glute Med?

Cable Hip Abductions p. 164

Clamshells

Lateral band walks



## Gluteal Muscles

<p><b>Glute Medius</b></p> <p><b>Action</b></p> <ul style="list-style-type: none"> <li>• All fibers – Abduct the hip</li> <li>• Anterior fibers – Flex and medially rotate the hip</li> <li>• Posterior fibers – Extend and laterally rotate the hip</li> </ul> <p><b>Origin</b></p> <ul style="list-style-type: none"> <li>• Gluteal surface of ilium,</li> </ul> <p><b>Insertion</b></p> <ul style="list-style-type: none"> <li>• Lateral aspects of greater trochanter</li> </ul>	<p><b>Glute Minimus</b></p> <p><b>Action</b></p> <ul style="list-style-type: none"> <li>• Abduct the hip</li> <li>• Medially rotate the hip</li> <li>• Flex the hip</li> </ul> <p><b>Origin</b></p> <ul style="list-style-type: none"> <li>• Gluteal surface of ilium</li> </ul> <p><b>Insertion</b></p> <ul style="list-style-type: none"> <li>• Anterior aspect of greater trochanter</li> </ul>
--	--

**What exercises would help me train these muscles?**

Biel, Andrew (2010). Trail Guide to the Body. 315-316

Strength Training Anatomy:

Glute Max?

Flutter kick, bird dogs, hip bridge p. 162, cable kick backs p. 159

Without isolation: lunges, Squats, Deadlifts, etc p. 156 Glute Med?

Cable Hip Abductions p. 164



## Gluteal Muscles

What exercises would help me train these muscles?

- Resisted hip abduction
- Clamshells
- Lateral lunges
- Lateral step ups
- Monster walks



<https://www.skimble.com/exercises/28713-hip-abduction-with-band-how-to-do-exercise>

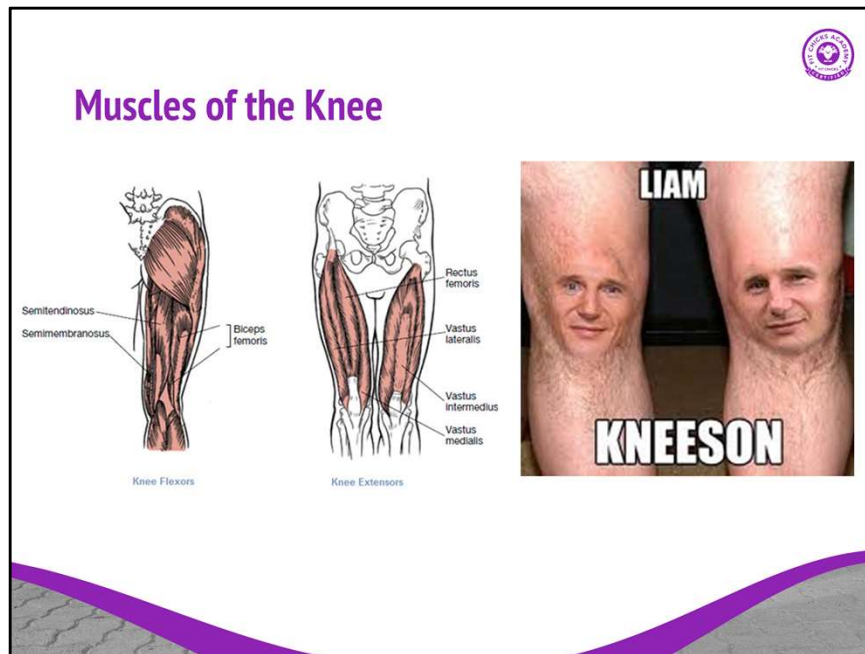
Strength Training Anatomy:

Glute Max?

Flutter kick, bird dogs, hip bridge p. 162, cable kick backs p. 159

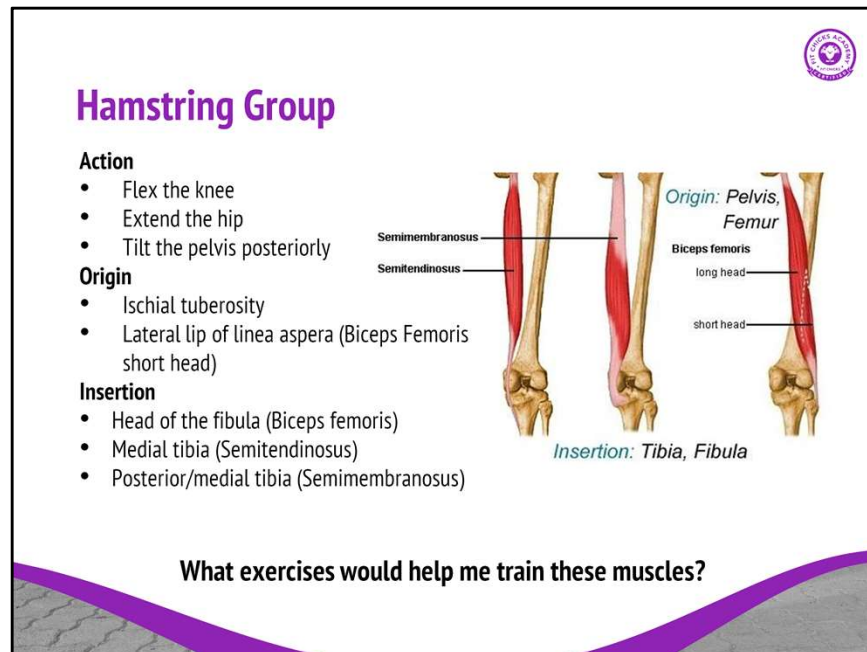
Without isolation: lunges, Squats, Deadlifts, etc p. 156 Glute Med?

Cable Hip Abductions p. 164



<https://www.acefitness.org/fitness-certifications/resource-center/exam-preparation-blog/3594/muscles-that-move-the-leg>





Biel, Andrew (2010). Trail Guide to the Body. 312

<https://healthy-topic.com/the-hamstring-muscles-originate-on-the-let-us-know/>

Strength Training Anatomy:

Hamstrings?

Leg Curls p. 140

Good mornings p. 144

Deadlifts p. 102

Others:

Stability ball legs curls or slider leg curls

Nordic leg curls

## Hamstring Group

What exercises would help me train these muscles?

- Leg curls
  - Stability ball
  - Sliders
  - Nordic
  - Lying
  - Seated
  - Standing
- Good mornings



<https://weighttraining.guide/exercises/dumbbell-leg-curl/>

Strength Training Anatomy:

Hamstrings?

Leg Curls p. 140

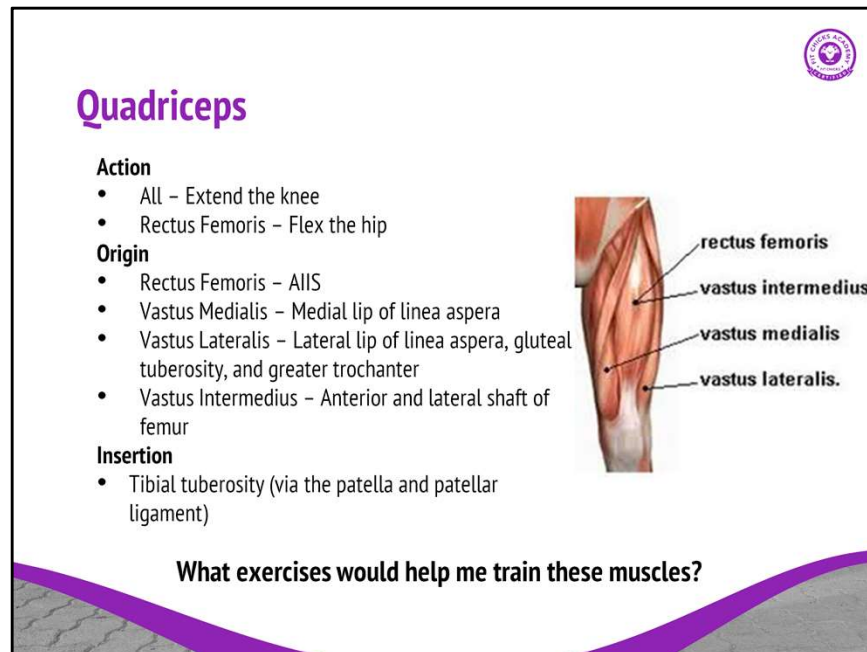
Good mornings p. 144

Deadlifts p. 102

Others:

Stability ball legs curls or slider leg curls

Nordic leg curls



## Quadriceps

### Action

- All – Extend the knee
- Rectus Femoris – Flex the hip

### Origin

- Rectus Femoris – AIIS
- Vastus Medialis – Medial lip of linea aspera
- Vastus Lateralis – Lateral lip of linea aspera, gluteal tuberosity, and greater trochanter
- Vastus Intermedius – Anterior and lateral shaft of femur

### Insertion

- Tibial tuberosity (via the patella and patellar ligament)

What exercises would help me train these muscles?

Biel, Andrew (2010). Trail Guide to the Body. 306

Strength Training Anatomy:

Isolation – pg 139 leg extensions

- there's a lot of debate on leg extensions and the impact they can have on the knee. Some argue that it puts a lot of pressure on the ACL and could potentially cause injury especially to those with previous ACL issues.

Compound – pg – 123-136

## Quadriceps

What exercises would help m train these muscles?

- Squats
- Lunges
- Split squats
- Knee extensions
- Step ups

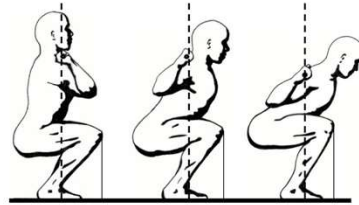


Figure 2-3-11. Bar position ultimately determines back angle, as seen in this comparison of the front squat, the high-bar squat, and the low-bar squat. Note that the bar remains balanced over the mid-foot in each case, and this requires that the back angle accommodate the bar position. This is the primary factor in the differences in technique between the three styles of squatting.



<https://pilatesofcharleston.com/how-to-squat/>

<https://stronglifts.com/squat/#gref>

<https://barbellacademy.com/how-to-high-bar-squat-your-guide-to-proper-form/>

Strength Training Anatomy:

Isolation – pg 139 leg extensions

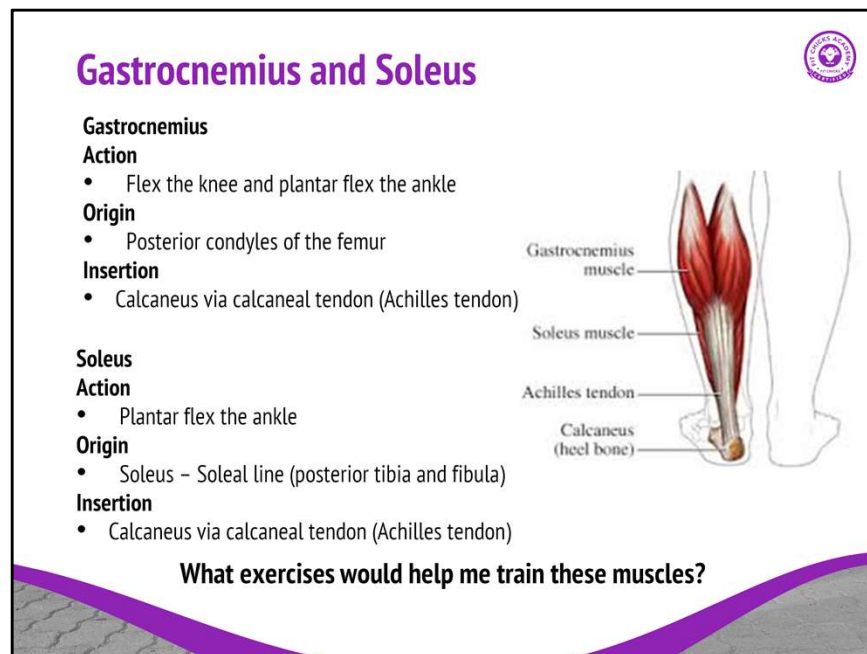
- there's a lot of debate on leg extensions and the impact they can have on the knee. Some argue that it puts a lot of pressure on the ACL and could potentially cause injury especially to those with previous ACL issues.

Compound – pg – 123-136



## Muscles of the Ankle





Biel, Andrew (2010). Trail Guide to the Body. 371

Strength Training Anatomy:  
 Gastrocnemius and soleus?  
 Calf raises p. 149

How can you isolate gastroc over soleus?

- Soleus – bend the knees bc it shortens the gastroc so you'll lose the ability of a full force contraction from the gastroc

## Gastrocnemius and Soleus



What exercises would help me train these muscles?

### Gastrocnemius

- Calf raises
  - Flat on ground
  - Step

### Soleus

- Seated calf raises



<https://theworkoutdigest.com/standing-calf-raises/>

Strength Training Anatomy:  
Gastrocnemius and soleus?  
Calf raises p. 149

How can you isolate gastroc over soleus?

- Soleus – bend the knees bc it shortens the gastroc so you'll lose the ability of a full force contraction from the gastroc

## Tibialis Anterior

### Action

- Invert the foot
- Dorsi flex the ankle

### Origin

- Lateral condyle of tibia, lateral surface of tibia, and interosseous membrane

### Insertion

- Medial cuneiform and base the first metatarsal



© 1999 ExRx.net

What exercises would help me train these muscles?

<https://www.youtube.com/watch?v=7Ox-NOJMhKo>  
Biel, Andrew (2010). Trail Guide to the Body.

Toe taps!





## Tibialis Anterior

What exercises would help me train these muscles?

- Heel walking
- Toe taps



<https://www.wikihow.com/Exercise-Tibialis-Anterior>

<https://www.youtube.com/watch?v=7Ox-NOJMhKo>

Biel, Andrew (2010). Trail Guide to the Body.

Toe taps!



## Benefits of doing resistance training

- Helps in body composition in creating lean muscle mass with a higher metabolic resting rate
- Protects bone density and muscle mass, reducing the risk of premature aging
- Improved performance for sport or daily living
- Elevates endorphins, creates a sense of well-being

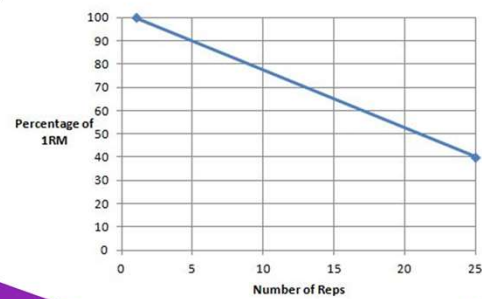
## FITT for Strength Training




### Frequency

- 2 to 4 days a week
- Rest is critical (most of the gains happen during your recovery day!)
- Approximately 48 hours needed before you train that body part again
- More rest is better than not enough rest!

### Intensity



<https://rogerwardhealthandfitness.files.wordpress.com/2012/03/graph1rm1.jpg>



## FITT Continued...

### Time

- Rest
  - Between 30 secs (beginner) - 2 mins (Power lifter)
- Tempo
  - 2:0:2:0 or more
  - The more time under tension, the harder it is

### Type

- Beginners
  - Free weights, Machines, Bodyweight, Bands, Resistance Balls
- Intermediate-Advance
  - Free weights, TRX, Kettlebells, etc

The rest period will depend on how well you client recovers between sets. You can give a guideline of 30-45s based on how they feel after each set. 30 seconds is a good starting point but if your clients goal is strength then they may need a bit longer to rest in between.

Tempo – first number is eccentric, second number is the pause or no pause at the bottom, third number is concentric, and fourth number is pause or no pause at the top.

## Recap



### DIFFERENT TYPES OF MUSCLES

#### MUSCULAR ANATOMY

- Muscle Function and Structure
- Special characteristics of muscle tissue
- Muscle contraction and muscle mechanics

### THE NERVOUS SYSTEM AND ITS CONNECTION TO STRENGTH

#### MAJOR MUSCLE GROUPS

- Action and Attachment points
- How to train each Major Muscle Group!

#### THE FITT PRINCIPLE FOR STRENGTH TRAINING

- Benefits of resistance training
- Recommended strength training guidelines



**Any questions or inquiries,  
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