

- Improving Muscular strength and Endurance



# Muscular Strength and Endurance in Daily Life

## Benefits of Strength training :

- Reduce joint and/or muscle injuries from exercise
- Reduce low back pain
- Delay and reduce age-related decreases in strength
- Help prevent osteoporosis
- Increase resting energy expenditure (also called resting metabolic rate)



# How Muscles Work

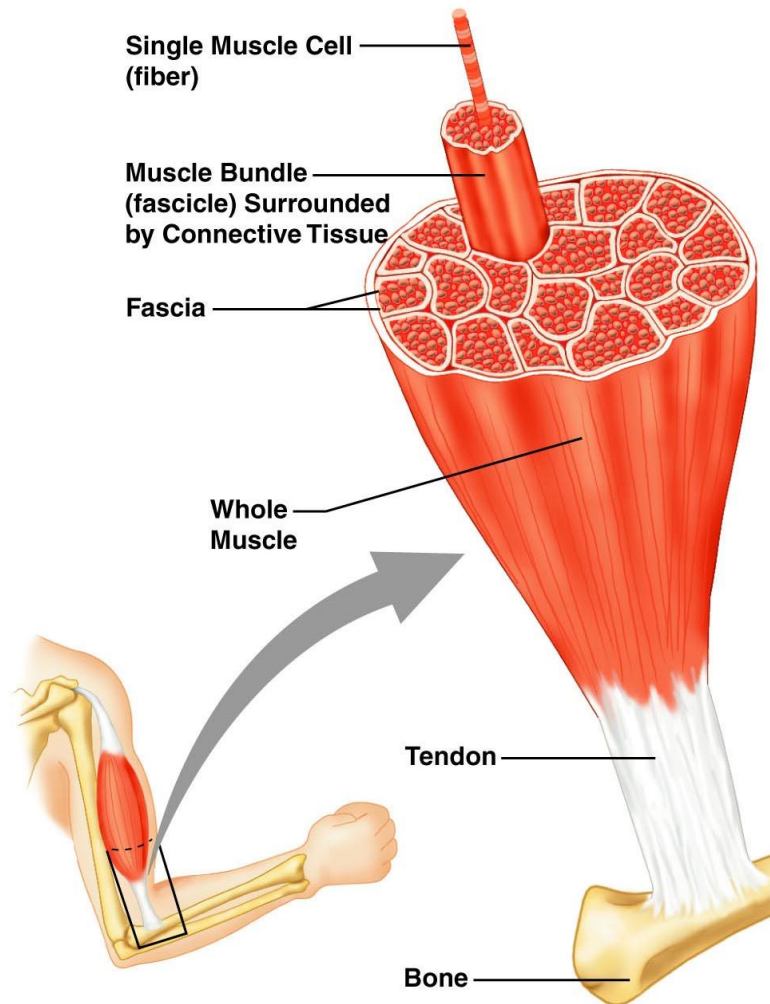
- There are about 600 skeletal muscles in the body
- Muscles shorten or lengthen during muscle action, causing the bones and body to move

Muscle structures: fibers, fascia, tendons

Muscle function is controlled by motor units: motor nerves and muscle fibers



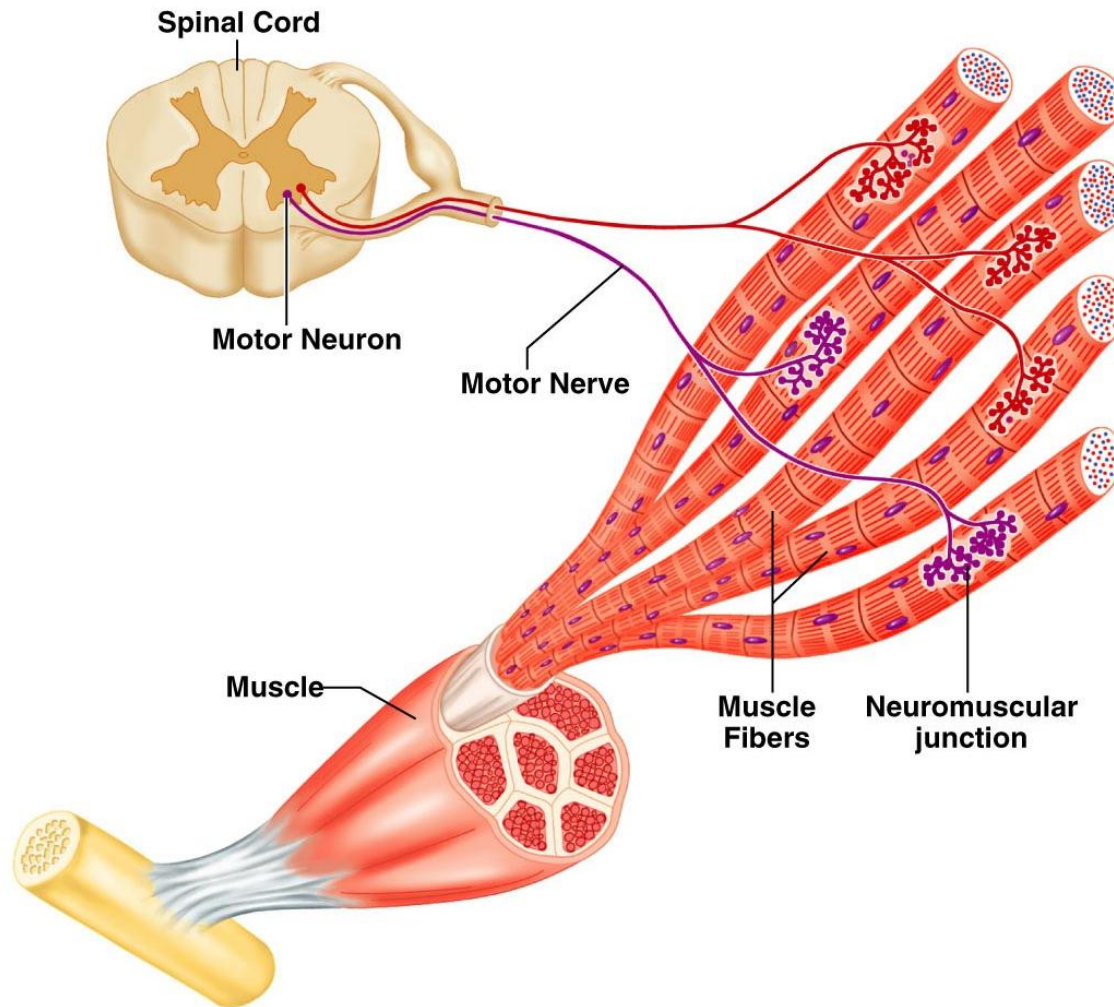
# Structure of Skeletal Muscle



**Figure 4.1**



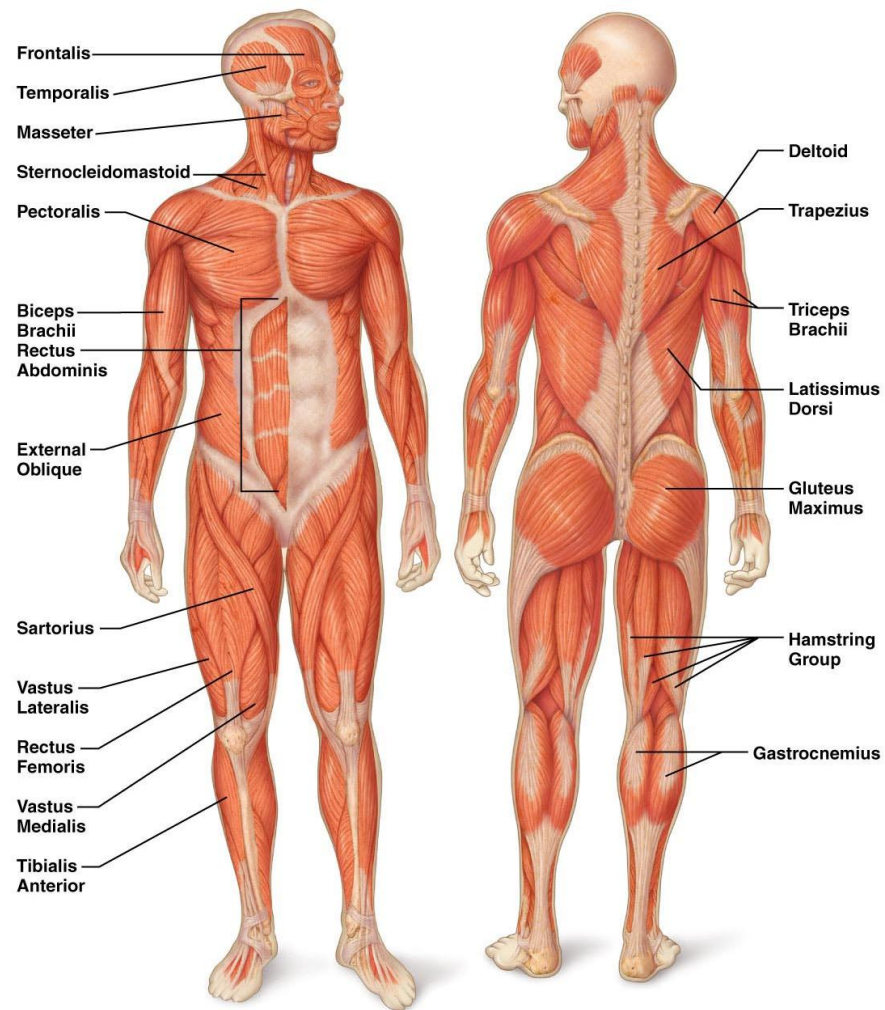
# A Motor Unit: motor nerves & muscle fibers



**Figure 4.3**



# Major Muscles of the Body



**Figure 4.2**



# Muscle of the Day

## ***Pectoralis-*** *major & minor*

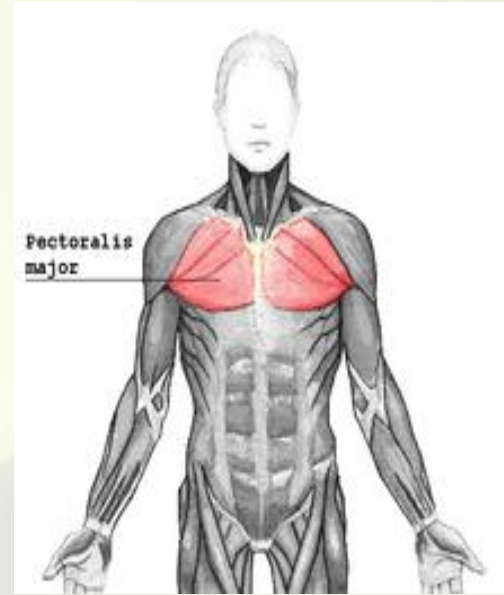
Action: Flexes and Adducts arms

Location: Chest

Exercises to strengthen:

Free Weights: Bench Press, Flies

Other Exercises: Push ups, dips



[http://en.wikipedia.org/wiki/Pectoralis\\_major\\_muscle](http://en.wikipedia.org/wiki/Pectoralis_major_muscle)



# Muscle of the Day

## *Trapezius*

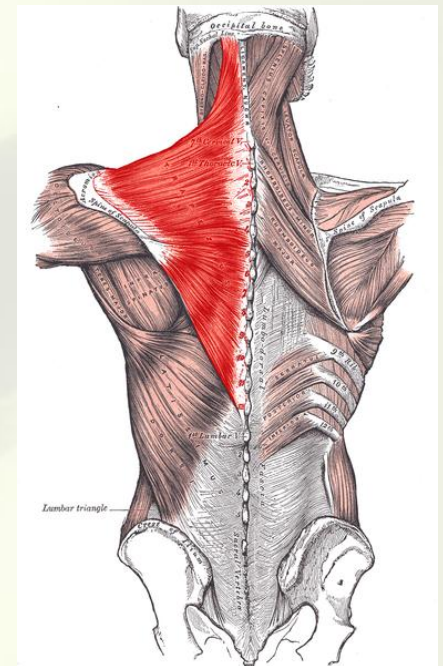
Action: Elevates shoulders and moves arms

Location: Upper back

Exercises to strengthen:

Free Weights: Shoulder shrugs

Other Exercises: Upright rows



<http://en.wikipedia.org/wiki/Trapezius>



# Muscle of the Day

## *Bicep*

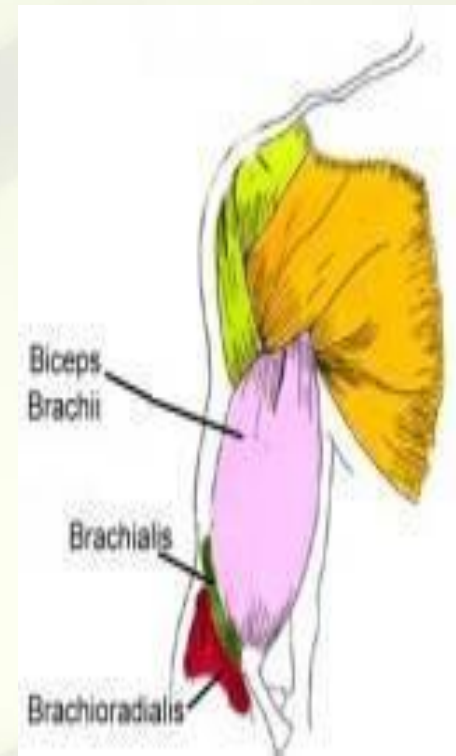
Action: Flexes arm

Location: Upper arm anterior

Exercises to strengthen:

Free Weights: Bicep Curl,  
Preacher Curl, Roman curl

Other Exercises: Pull Ups, Bench Press, Push Ups



# Muscle of the Day

## *Tricep*

Action: Extends Arm

Location: Upper arm posterior

Exercises to strengthen:

Free Weights: Tricep Extension,  
Tricep Kick-backs, Dips

Other Exercises: Pull Ups, Bench Press, Push Ups



# Muscle of the Day

## ***Deltoids***

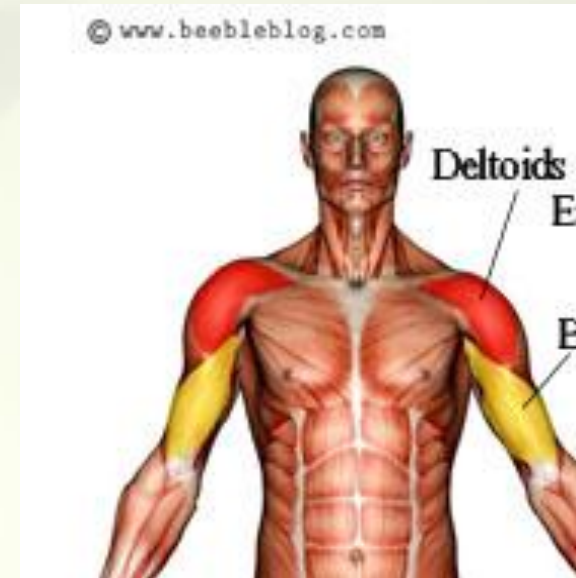
Action: Shoulder movement

Location: Shoulder abduction

Exercises to strengthen:

Free Weights: Lateral & Front Arms Raises

Other Exercises: Push Ups, Chest Press



# Muscle of the Day

## ***Latissimus Dorsi***

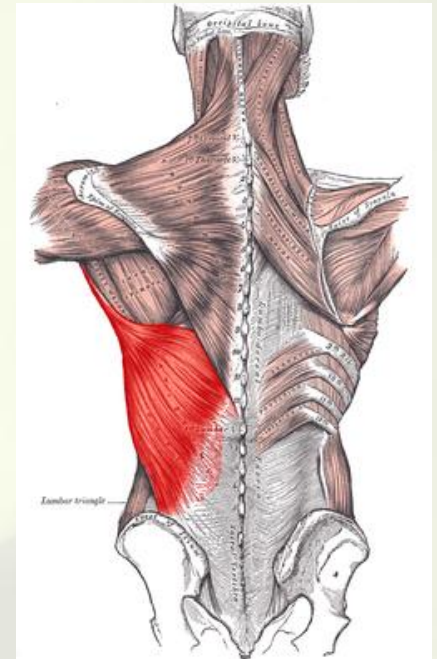
Action: Extends trunk at the waist

Location: Lateral mid-back region

Exercises to strengthen:

Free Weights: bent over row,

Other Exercises: upright row, lat pull down,  
pull ups,



[http://en.wikipedia.org/wiki/Latissimus\\_dorsi\\_muscle](http://en.wikipedia.org/wiki/Latissimus_dorsi_muscle)

# Muscle of the Day

## ***Rectus Abdominus***

Action: Flexes trunk at the waist & aids with breathing

Location: Ribs to pelvis

Exercises to strengthen:

Free Weights: Sit ups, crunches, leg lifts

Other Exercises: Abdominal curl machine, Stability Ball curl ups (core workouts)





# Muscle of the Day

## *Side Oblique*

Action: turns trunk at the waist & aids with breathing

Location: Ribs to pelvis

Exercises to strengthen:

Free Weights: Abdominal Twists / crunches, leg lifts

Other Exercises: Abdominal curl machine, Stability Ball twist curl ups (core workouts)





# Muscle of the Day

## ***Quadricep (4 Muscles)***

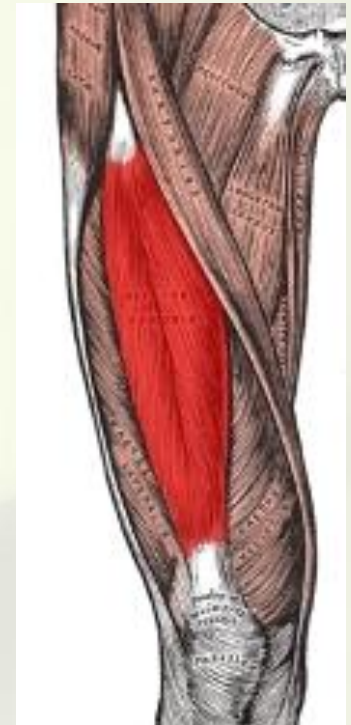
Action: Extends Leg at Knee joint

Location: Upper leg anterior

Exercises to strengthen:

Free Weights: Lunge, Squat, Wall Sit

Other Exercises: leg extension, leg press,



# Muscle of the Day

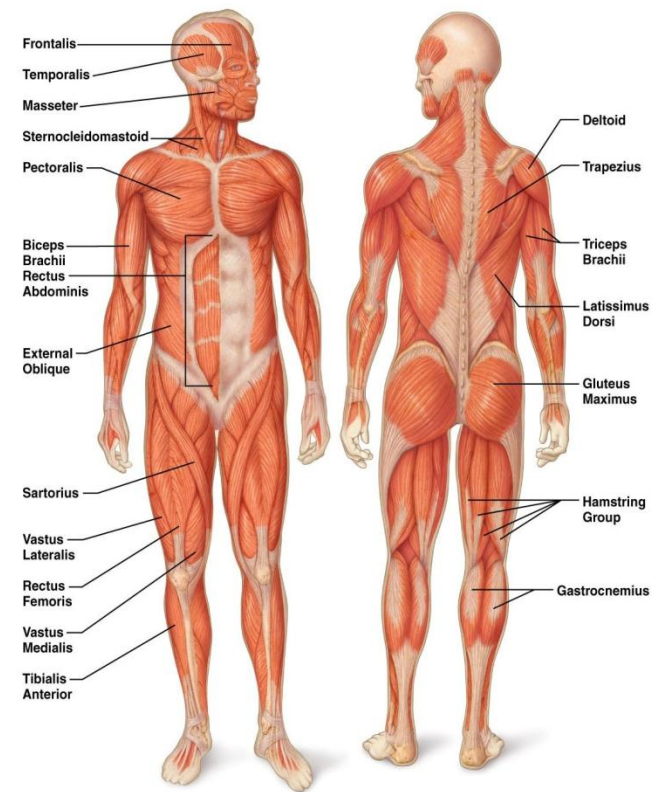
## Gluteus Maximus

Action: allows for power movements..jumps, sprints,etc.

Exercises to strengthen

Free Weights: Lunge, Squat, Wall Sit

Machine Exercises: leg press, squat , dead lift



# Muscle of the Day

## ***Hamstring (3 muscles)***

Action: Flexes Leg at Knee joint

Location: Upper leg posterior

Exercises to strengthen:

Free Weights: Lunge, Squat, Wall Sit

Machine Exercises: leg curl, leg press



# Muscle of the Day

## ***Gastrocnemius***

Action: Heel Raise

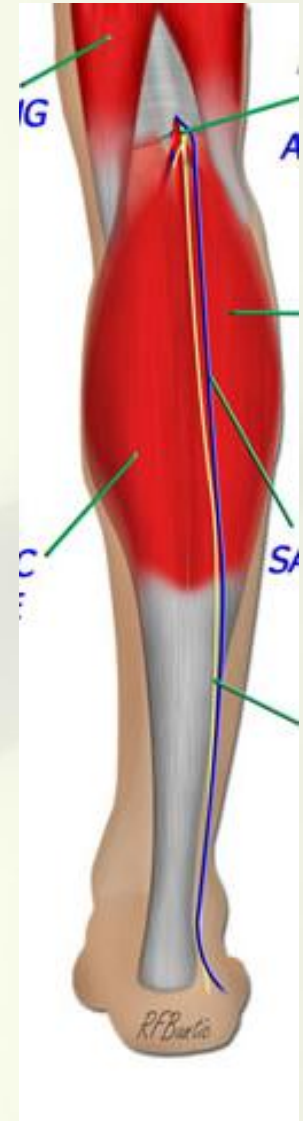
Location: Posterior Lower leg

Exercises to strengthen:

Free Weights: Heel Raises

Other Exercises: Seated Toe Press

Standing Toe Press



# Three Major Categories of Skeletal Muscle Exercise

## **Isotonic** (dynamic)

- Movement of a body part at a joint
- Most exercise and sports are isotonic

## **Isometric** (static)

- Uses muscle tension but involves no movement
- Good way to develop strength after injury

## **Isokinetic**

- Performed at a constant velocity
- Often done with machines that provide resistance throughout the full range of motion



# Categories of Muscle Action

## **Concentric action** (positive work)

- Causes movement of a body part against resistance or gravity
- Occurs when muscles shorten
- Example: upward arm movement during a bicep curl

## **Eccentric action** (negative work)

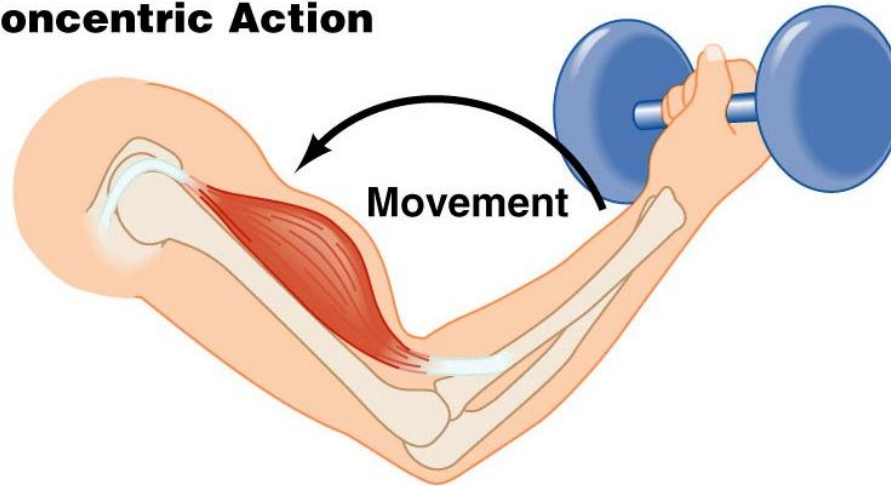
- Controls movement of a body part with resistance or gravity
- Occurs when muscles lengthen
- Example: downward arm movement during a bicep curl



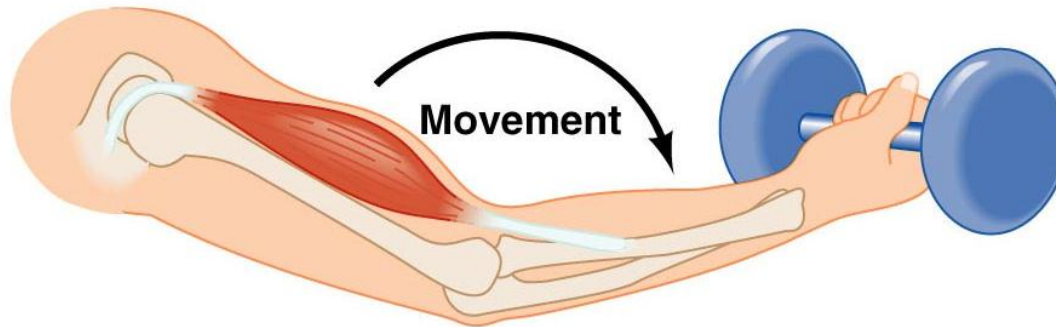


# Concentric and Eccentric Muscle Actions

## Concentric Action



## Eccentric Action



**Figure 4.4**



# Types of Skeletal Muscle Fibers

Three types:

## Slow-twitch fibers

- Contract slowly
- Generate little force but are resistant to fatigue

## Fast-twitch fibers

- Contract quickly
- Generate lots of force, but fatigue quickly

## Intermediate fibers

- Combination of other two types: contract rapidly, produce great force and resist fatigue



# Variations in Fiber Type

Most people have roughly equal numbers of all three types

Elite endurance runners/marathoners have more slow-twitch fibers

Elite speed runners/sprinters have more fast-twitch fibers

Some evidence exists that fibers might be able to convert from one type to another through training

**Fiber recruitment** is the process of involving more muscle fibers to increase muscle force



# Muscle Fiber Recruitment and Muscular Force

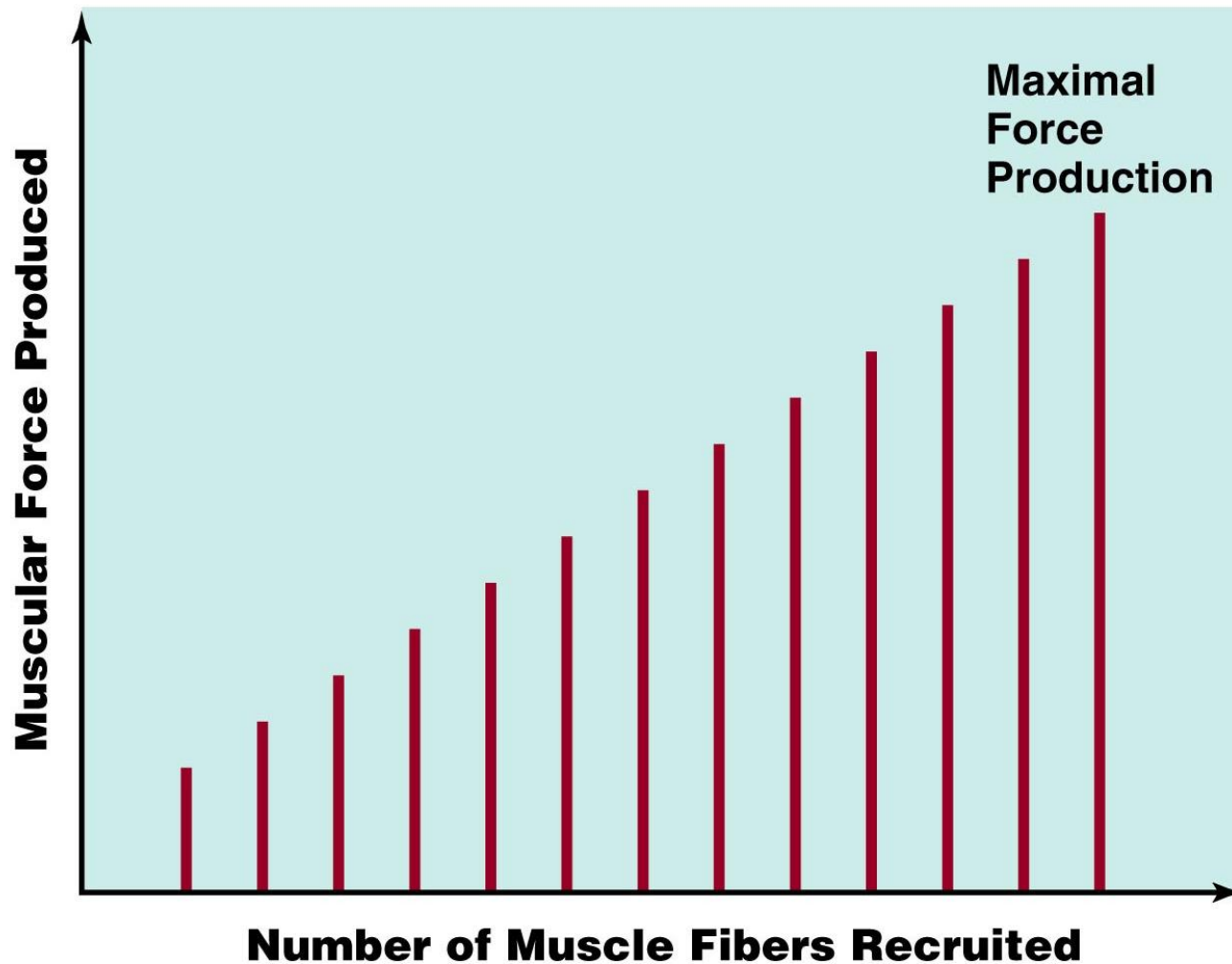


Figure 4.6



# Time in Recruitment of Muscle Fiber Type

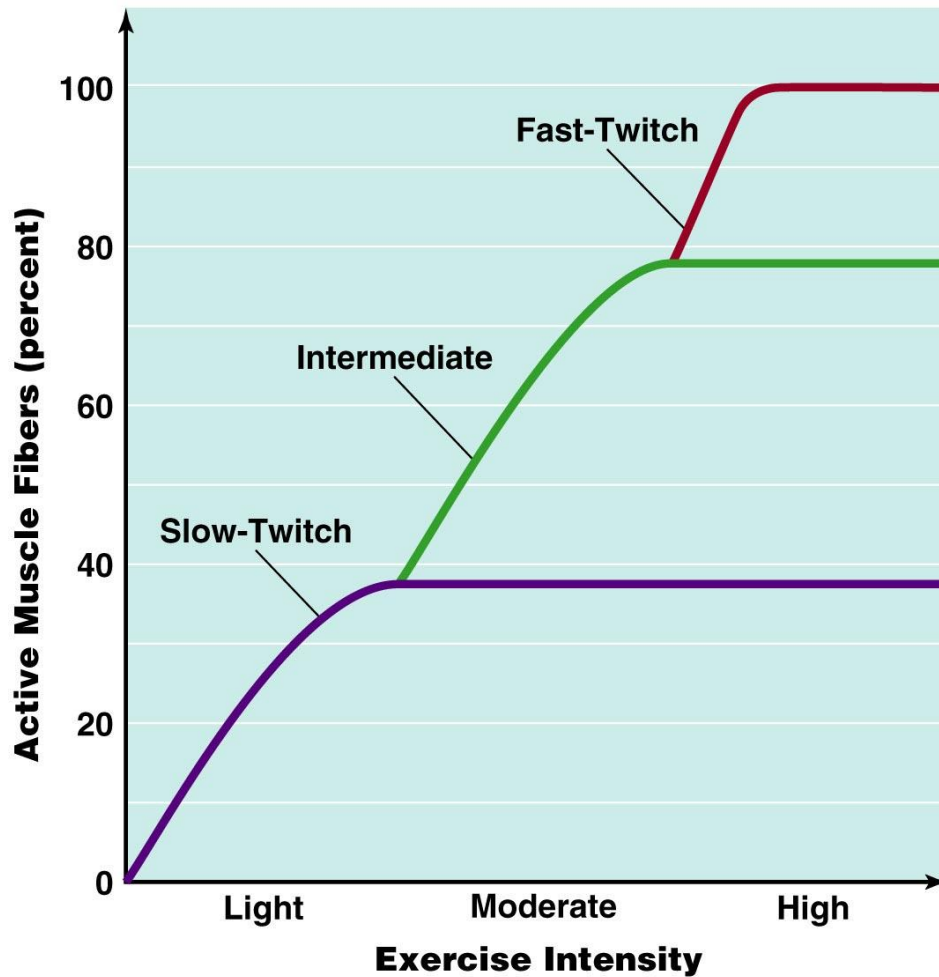


Figure 4.5



# Muscular Strength

Depends on:

Size of the muscle (primary factor)

- The larger the muscle, the greater the force produced

Number of muscle fibers recruited during a movement

- The more fibers that are stimulated, the greater the force generated





# Principles for Designing a Strength and Endurance Program

- 1. Apply **overload principle** (lift greater weight than normal) use with strength and endurance exercise programs. Sometimes called Progressive Resistance Exercises
- 2. **Progression:** must progressively increase the amount of resistance in the training
- 3. Use **Specificity of Training**
- Development of muscle strength and endurance is specific to both the muscle group being exercised and the training intensity
- High-intensity training increases muscle size & strength
- Low-intensity training increases endurance



# How the Body Adapts to Strength Training

- Rate of Improvement
- Depends on initial strength level:
  - May have rapid strength gains in untrained people just starting out
  - More gradual gains in people with higher relative strength levels



# How the Body Adapts to Strength Training

- Physiological Changes
- 1) increase in fiber recruitment (speed & number)
- 2) **hypertrophy**: increase in muscle size due to increase in fiber size
- Not common: Hyperplasia, the formation of new muscle fibers



# How the Body Adapts to Strength Training

## Gender Differences

- Women and men don't differ in initial responses to strength-training
- After long-term training, men show greater gains due to higher testosterone levels



- end



# Evaluating Muscular Strength and Endurance

## Muscular strength test:

- 1) One-repetition maximum (1 RM) test: determined with 10 RM
  - Measures maximum amount of weight that can be lifted one time
  - Can be substituted by the Estimated 1 RM Test, to reduce possible injury

## Muscular endurance tests:

- 1) Push-up test
- 2) Sit-up or curl-up test





## Safety Concerns

- Use spotters
- Don't drop weights
- Always warm up
- Breathe during exercises
- Use slow movements, proper technique
- Start with light weights and work up gradually



# Exercise Prescription for Weight Training (FITT)

## Frequency

- Number of training days per week
- 2-3 days per week is optimal for strength gains

## Intensity

- Measured by the Repetition Maximum (RM)
- The number of consecutive repetitions performed without resting is a Set

## Time (duration)

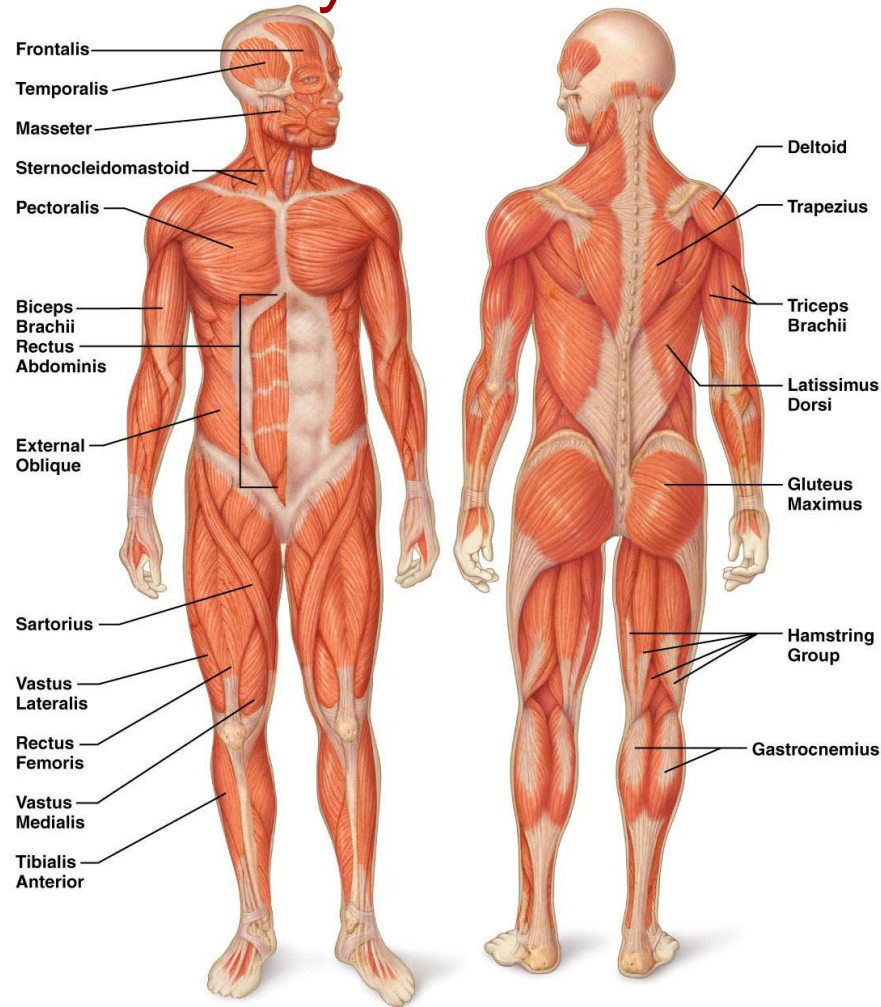
- Total number of sets performed
- Programs utilizing 3 sets result in greatest strength gains

## Type (mode)

- Choose exercises for muscle power & size, or for muscle endurance & toning



# Designing a Weight Training Program - Major Muscles of the Body



**Figure 4.2**



# Designing a Weight Training Program

- Start with large muscles and work down to small
- Alternate upper Body lifts with lower body lifts.
- Large Muscles and Lifts
- Pectoralis: chest/bench press
- Gluteus maximus: squats or leg press
- Latissimus dorsi: lat pulldown
- Quadriceps: leg extension
- Deltoids and trapezius: Up-right row – shoulder shrugs
- Hamstrings: leg curls



# Designing a Weight Training Program

- Small Muscles and lifts
- Biceps: arm curls
- Rectus abdominis: ab curls & sit-ups
- Triceps: Tricep extensions
- External oblique: side ab curls
- Gastronemius: heel risers



# Staying Motivated

- Make time to train regularly
- Make training fun □ find a workout space or facility you like, and a program that's challenging but enjoyable
- Develop a realistic routine: don't make it so hard you'll get discouraged
- Work out with friend or training partner
- Benefits of strength training: better appearance, higher self-esteem, improved metabolism, and a feeling of accomplishment



# Summary

- Strength training can reduce back pain, decrease injuries, enhance bone health, and maintain age-related working capacity
- Strength is dependent on muscle size and fiber recruitment
- There are three major types of human skeletal muscles: slow-twitch, fast-twitch and intermediate
- The amount of slow, fast, and intermediate muscles vary among individuals. There is a relationship between fiber type and success in some athletics.
- Fiber recruitment is the process of involving more muscle fibers to produce increased force



# Summary, continued

- Progressive resistance exercise (PRE) is the overload principle applied to resistance training
- Individualized programs can be specific for strength or endurance gains through mode, number of repetitions and sets
- Isotonic (dynamic) exercises involve movement . Isometric (static) exercises involves no movement. Isokinetic exercises are performed at a constant velocity, often using machines
- \*Design a strength training program with at least 10 different lifts which work specific muscles. Know muscles scientific names, place in proper order with proper Sets and Reps.

