Muscles and Exercise

Muscle Tone

- Non-visible contraction of some fibers even when the muscle is relaxed
  - muscle remains firm, healthy, and ready for action
  - if nerve supply to a muscle is destroyed, muscle can not longer be stimulated
  - muscle loses its tone – paralyzed
  - then muscle becomes flaccid, and begins to atrophy (decrease in size)

Muscle Fatigue

- Muscle is unable to contract even though it is still being stimulated
  - lack of ATP
  - depletion of oxygen and glucose – **Oxygen Debt**
    - breathe heavily after exercise because body is trying to replenish ATP and Creatine reserves
  - high levels of lactic acid – creates soreness

- Increased acidity and lack of ATP causes the muscle to contract less and less effectively

Type of Muscle Contraction

- Isotonic – same tone or tension as the muscle moves through a range of motion
  - Concentric – contracting and shortening
  - Eccentric – contracting and lengthening
- Isometric – same length and muscle does not shorten

DOMS – Delayed Onset Muscle Soreness

- Microscopic tearing of the muscle fibers
- Soreness sets in 12 to 24 hours after activity and can last up to 5-7 days
- Swelling can occur which increases the pressure on surrounding tissues

Muscle Cramps

- Involuntary, sustained muscle contraction
  - If muscles are placed under stress and Na+ levels are not adequate it can make the muscle more irritable
  - Prolonged use of the muscle can cause cramps (writers cramp)
  - This will cause the slightest stress or twitch to cause a contraction that does not stop
  - Deficit of K, Ca, and Mg does not necessarily cause cramps
  - Unconditioned athletes, people with diabetes and vascular problems, dehydration, and alcohol use can be more predisposed to cramps

Effect of Exercise on Muscle

- Use it or Lose it – muscles that are inactive will get weaker and smaller
- Regular exercise increases muscle size, strength, and endurance
- Two types of exercise:
  - aerobic/endurance
  - resistance

Aerobic or endurance exercise

- Examples: jogging, biking, walking
  - Utilizes slow twitch fibers that are resistant to fatigue
  - Results: stronger, more flexible muscles with greater resistance to fatigue
  - Blood supply increases, mitochondria number increases, stores more oxygen
  - Helps body metabolism, improves digestion and coordination, heart hypertrophies, and lungs work better
  - Does NOT increase size of muscle

Resistance exercise

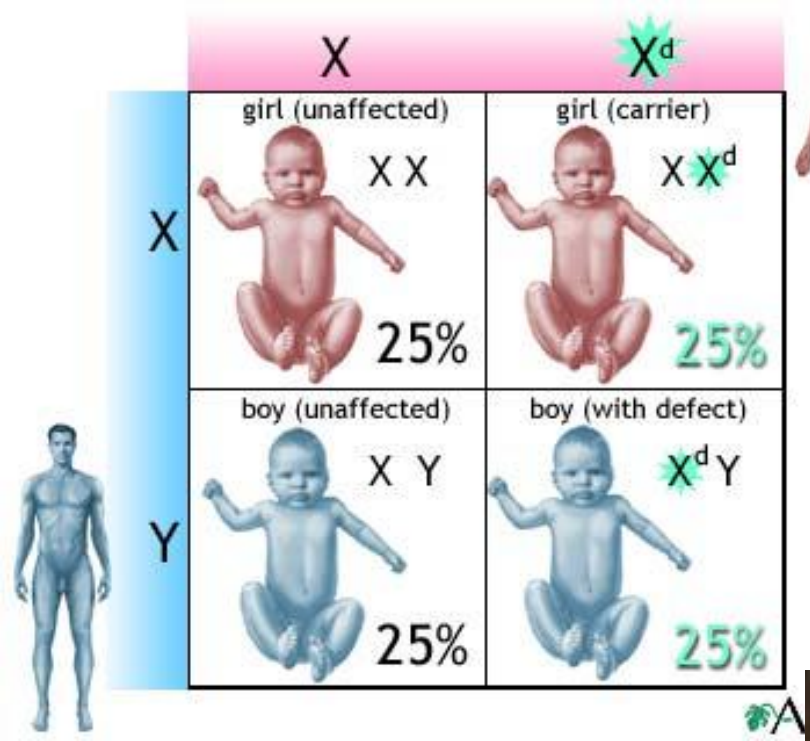
- Example: weight lifting
  - Utilizes fast twitch fibers that are fatigable
  - Isometrics require very little time or money (push against a wall)
  - Increases number of myofilaments not number of muscle cells
  - Increases amount of connective tissue supporting the muscle
  - Takes 6 weeks to see any real increase in muscle size

- Muscle tone and endurance = low weight and high repetitions

- Muscle strength and hypertrophy = high weight and low repetitions

Muscle Disorders

- Paralysis – when nerve supply to a muscle is destroyed and muscle is no longer stimulated
- Torticollis – (wryneck) when sternocleidomastoid or platysma gets injured during birth
- Muscular dystrophy – inherited muscle destroying diseases where fat gets deposited and muscle fibers degenerate and atrophy
- Myasthenia gravis – characterized by droopy eyelids, difficulty in swallowing and talking, and generalized muscle weakness
  - There is a shortage of ACh and death usually involves respiratory failure


X
X^d
girl (unaffected)
X X
25%
girl (carrier)
X X^d
25%
boy (unaffected)
X Y
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boy (with defect)
X^d Y
25%
X
Y

Muscle Development

- In embryo = muscles laid down in segments and then nerves attach
- Development of the muscular system occurs early in pregnancy
- 16th week = mother can feel the baby's movements
- After birth = movements are reflex type movements because nervous system is not mature yet

Muscle Development

- Gross to fine motor control
  - Babies learn how to raise their head before they can sit up which is before they can walk
  - Babies learn how to wave bye-bye before grasping a pen
- Midadolescence = reached peak of neural control
- Old Age = muscle tissue decreases which can cause a drop in weight and decrease in strength