**Effects of Aging on Muscular System**

strength and muscle mass peak in 20’s

by age 80 most have only half as much strength and endurance

eg. a large percentage of 70 yr olds cannot lift 10 lb weights

.major factor in falls, fractures, etc

as we age lean body mass is replaced with fat

eg. young well conditioned male, muscle accounts for 90% of cs
area of mid thigh; in 90 yr old woman only 30%

especially loose fast twitch fibers

muscle fiber have fewer myofibrils; sarcomeres less organized, less ATP, glycogen, myoglobin, etc

fatigue more quickly

reduced circulation means muscles heal more slowly

motor units have fewer muscle fibers per neuron

less ACh is produced

**Disorders of the Muscular System**

the muscular system suffers fewer disorders than most other organ systems

but it is particularly vulnerable to stress injuries

often exacerbated by overzealous exertion or improper warmup exercises

most athletic injuries can be prevented by proper conditioning

“no pain, no gain” is a dangerous creed

typical injuries are treated with **RICE:**

- **Rest** – prevents further injury
- **Ice** – helps reduce swelling
- **Compression** – with elastic, helps prevent fluid accumulation
- **Elevation** – promotes drainage
1. Convulsions and Spasms
   abnormal uncoordinated contractions of various muscle groups

2. Fibrillation (cardiac muscle)
   asynchronous contraction of individual cardiac muscle cells

3. Poisons and Toxins
   mainly affect Ach at NM jcts and in brain where it is used as a NT
   
   Botulism toxin  – blocks exocytosis & release of Ach
   ‡: paralysis
   =Botox: relieves crossed eyes and uncontrolled
       blinking, also relaxes muscles that cause
       facial wrinkles
   
   Tetanus toxin  – interferes with inhibition of antagonists
                  ‡: all muscles contract
   
   black widow toxin  – stimulates massive release of Ach
                  ‡: intense cramping & spasms
   
   nicotine   - mimics Ach
                  ‡: prolonges hyperactivity
   
   atropine, curare   - binds to and prevents Ach from binding to
                      receptors; ‡: paralysis

4. Disuse Atrophy:
   lack of stimulation or immobilization (splint, cast)
   muscle cell mass can decrease 5%/day down to 25% loss
   muscle tissue replaced by connective tissue (fibrosis)
   can stimulate muscles electrically to reduce atrophy

5. Fibrosis
   skeletal muscle fibers degenerate and are replaced by fibrous connective
   tissue
   associated with aging
   loss of strength

6. Hernia
   occurs because of weakness in body wall may cause rupture
   visceral organs protrude through opening
   wall is weak because of spaces between bundles of muscle fibers
   undue pressure on abdominal viscera may force a
   portion of parietal peritoneum and intestine through these weak
spots

eg. heavy lifting can create up to 1,500 lbs pressure/sq “ in abdominal cavity (~100x’s normal pressure)

most common at inguinal area, also diaphragm & naval

women rarely get inguinal hernias

7. **Muscular Dystrophy**
   (muscle destroying diseases)

some are fatal, others have little impact on life expectancy

Duchenes: sex linked recessive trait; usually inherited but can occur spontaneously

Symptoms: muscle stiffness, difficulty relaxing muscles, muscle weakness, difficulty walking, drooping eyelids, progressive muscle wasting progresses from extremities upward

most die by 20 yrs old

Physiological Cause: sarcolemma deteriorates

biotech trying to replace gene that makes missing protein

8. **Myasthenia Gravis** (Heavy weakness)

weakness of skeletal muscles,
   esp face and neck muscles:
      drooping eyelids
      difficulty talking and swallowing

autoimmune disease: immune system attacks ACh receptors

   shortage of ACh receptors prevents fibers from contracting

mostly women, 20-50 yrs old

damage leads to easy fatigue and weakness on exertion

often, eyes are affected with drooping eyelids and double vission

difficulty swallowing or speaking are common
9. **Steroid abuse**

normally testosterone promotes bone development and muscle mass

some wondered: ??could megadoses of steroids help body builders??

by 2000 nearly 1 in 10 young men have tried steroids
take high doses (to 200mg/d) during heavy resistance training

**positive data:**
- increases isometric strength
- rise in body weight

but not sure if these changes result in better PERFORMANCE

**negative data:**
- bloated faces
- shriveled testes
- infertility
- liver damage
- alters blood cholesterol levels
- 1/3\textsuperscript{rd} of users exhibit serious mental problems such as manic behaviors