The motor system
Outline
  Muscles
  Reflexes

Disorders of movement

Types of Muscles

  Digestive tract
  Arteries

Controlled by autonomic nervous system

  : Two types
    Cardiac muscle
    Skeletal muscle

Reflexes

  Involves only one synapse (two neurons)
  Involves more than one synapse

Monosynaptic reflexes
Sensory neuron from ________________________
_________________________ neuron from spinal cord to muscle

Polysynaptic reflexes

  When one muscle is voluntarily contracted, the other is automatically inhibited

Polysynaptic reflexes
Flexion reflex
  Jerking hand away from ________________________
  Pain receptors transmit info to ________________________ in spinal cord
  Interneurons excite the muscles and inhibit the ________________________
  Leads to the action

Reflexes change….
Born with

  Stepping
  Grasping

All are gone by ________________________
  Never actually gone, but rather inhibited
Pathway to the Brain
Two routes

_________________________ pathway
_________________________ movements
_________________________ pathway
_________________________ processes

Lateral pathway
Information comes from the motor cortex or the _______________________ to the spinal cord
Contralateral organization

Ventromedial pathway
Posture
Coordinating _______________________ movements with eye movements
Respiration, _________________________, sneezing

Cerebellum
Does not appear to _______________________ movements
Plays a role in _______________________ movements
_________________________ the muscles at the right times to produce a sequence of movements
Receives information from motor cortex via the _________________________
Sends _______________________ back to motor cortex via the thalamus

Basal Ganglia
Collection of cell bodies

_________________________
Putamen
_________________________
Like the cerebellum, receives information from the motor cortex and sends it back to the motor cortex via the thalamus
The information is _______________________ though

The Basal Ganglia
Damage can lead to _________________________
Theory
Less dopaminergic activity in Basal Ganglia
Less inhibition of thalamus
_________________________ of thalamus
Less activity in _________________________

Symptoms of Parkinson’s Disease
Difficulty moving
_________________________ in resting body parts
Frozen _________________________
Stoooped posture
Loss of balance, frequent falls
_________________________ disturbances
Premature death

**Causes of Parkinson’s Disease**
Degeneration of _________________________ (midbrain)
Less _________________________ activity in basal ganglia
Genetics in ________________ cases
Correlates with exposure to toxins:
  - Synthetic heroin
  - _________________________ Solvents

**Treatments of Parkinson’s Disease**
L-DOPA
  - Precursor to Dopamine
  - Leads to an increase in the amount of _________________________ activity throughout the body
  - Benefit: increases in dopamine levels in the _________________________ lead to a decrease in the PD symptoms
  - Cost: BAD side effects
    - Increases in dopamine levels throughout the body lead to issues with the liver and other organs
    - ONLY treats the _________________________, not the cause

**Motor cortex**
Primary motor cortex
_________________________ area (SMA)
Premotor area

**SMA**
Involved in the _________________________ of controlled movements
Receives information from the _________________________ and send info to primary motor cortex and the brainstem

**Premotor areas**
Involved in the _________________________ of movements
Orienting the body correctly to pick up a glass
The _________________________ needed comes from the cerebellum

**Feedback**
Motor systems are highly intertwined with feedback from the _________________________
  - Gives the ability to change a movement throughout the movement
**Disorders of the motor system**

**Toxins**

- Muscular dystrophy
- Polio

**Huntington’s Disease**

**Parkinson’s Disease**

**Toxins**

Cholinergic agonists (e.g. black widow spider toxin) ____________________________ the neuromuscular junction, producing convulsions followed by paralysis.

Cholinergic antagonists paralyze muscles:
- Curare
- Botulinum toxin

**Myasthenia gravis**

________________________disorder

Results in the breakdown of __________________________ (ACh) receptors on the muscle fiber

Symptoms include extreme weakness, fatigue, droopy eyelids, slurred speech, difficulty

________________________

Treatments include medications that suppress the immune system or inhibit acetylcholinesterase (AChE)

**Muscular dystrophy**

Heritable condition involving the muscle protein ____________________________.

Premature muscle growth is followed by degeneration.

__________________________ may provide effective treatments soon.

**Polio**

The polio virus destroys alpha motor neurons.

Without neural input, ____________________________.

Vaccination may eradicate polio world-wide in the next few years.

**Lou Gehrig’s Disease**

aka Amyotrophic Lateral Sclerosis

Motor neurons in the spinal cord and brainstem degenerate.

__________________________ of cases are due to genetic defects

The rest are sporadic: no known cause

Correlated environmental factors include ____________________________.

Treatments for symptoms are being developed
**Huntington’s Disease**  
A genetically programmed __________________________ of neurons  
Produces involuntary ________________________, depression, hallucination and delusions.

**Huntington’s Disease**  
Heritable condition  
   Parents with HD pass it on __________________________  
Antibiotics and fetal tissue transplants and maintaining activity may provide treatment in the future.