• Extrapyramidal Motor System

Descending extrapyramidal paths receive input from other parts of the motor system:
- From the cerebellum
- From the basal ganglia or “corpus striatum”

• Basal Ganglia or “Striatum”

- Caudate & putamen get input from cortex, thalamus & substantia nigra, a midbrain motor area
- They send commands to globus pallidus which sends them on to the motor portions of thalamus & brainstem
- Very interconnected system with lots of feedback loops

• Basal Ganglia or Striatum

Interconnected set of nuclei (gray matter) buried within the cerebral hemispheres that have primarily motor functions
- Best known components:
  - Caudate nuclei (“tail shaped nuclei”)
  - Putamen (“seashell”)
  - Globus pallidus (“pale globe”)
- Connect with other motor regions in cortex, thalamus, and brainstem
• Functions

- The basal ganglia are important for:
  - Initiating or starting motor programs – often multiple programs at once
  - Inhibiting undesired movements; terminating voluntary movements

• Parkinson’s Disease
  (paralysis agitans or shaking palsy)

- About 1% of those over 50 have PD (~1,000,000 total in US; 60,000 new cases/yr; 90% cases occur after age 60)
- Progressive deterioration of DA input to basal ganglia – the “nigrostriatal pathway” from substantia nigra in midbrain to the “striatum” in forebrain
- We lose about 4% of those DA neurons/decade, but those with PD have accelerated loss (70% or more gone)
- Results in difficulty initiating movements & tremor
• The nigrostriatal path sends DA messages from the substantia nigra to the basal ganglia.

• Classic PD Symptoms
  • Worsening bradykinesia (slowing of movement) & akinesia (loss of movement)
  • Rigidity (too much muscle tone); clumsiness, decreased postural stability so tends to fall
  • “Pill-rolling” tremor-at-rest
  • Reduction in movement is also seen in lack of facial expression & blinking; shuffling walk without assoc. arm movements; soft, halting, monotonous voice; slow blinks; small writing; feeling stuck or frozen

• Possible Causes
  • Environmental toxin of some sort (industrial heavy metals, pesticides, “free radicals” currently under study)
  • Genetics (especially in those who get atypical PD at an early age)
  • Brain trauma may increase your risk

• Additional Video Options
  • [http://www.5min.com/Video/Understanding-Parkinsons-Disease-29159696](http://www.5min.com/Video/Understanding-Parkinsons-Disease-29159696)
  • [http://www.youtube.com/watch?v=o8lsjfgAAg](http://www.youtube.com/watch?v=o8lsjfgAAg)
  • The following gets a bit too detailed but does talk about PD dementia

  • If video at above link does not immediately appear, click on video # 31 in their list

• [http://www.youtube.com/watch#playnext_from=TL&videos=8Lji02qQKA0&v=UTImkp1e9Uk](http://www.youtube.com/watch#playnext_from=TL&videos=8Lji02qQKA0&v=UTImkp1e9Uk)
  • One specific example of a toxin causing immediate PD
• **Treatments**
  - Increase DA production with l-dopa/carbidopa (Sinemet)
  - Problems: l-dopa induced dyskinesias and loss of effectiveness over time
  - Others: DA agonist (bromocriptine/Parlodel or pergolide/Permax, or newer, better Mirapex, Requip) or DA releasor (amantadine/Symmetrel)
  - Eldepryl/Deprenyl (selegiline) to decrease DA breakdown and slow loss of neurons
  - Anti-ACh drugs (Artane, Cogentin) can help restore chemical "balance" of basal ganglia

• **Balance Between DA and ACh**

• **When Drug Therapy Fails**
  - When drug effectiveness declines, exp. options include:
    - Pallidotomy; thalamotomy (Michael J. Fox)
    - Deep brain (thalamic) stimulation
    - Transplant of DA producing cells

• **PET Scan of DA Activity**

破through surgery for Parkinson's
Pallidotomy, an operation that has been restored after more than 40 years and refined, is showing promise for Parkinson's patients. The surgery releases severe shaking.

The operation:
1. Surgeons make an incision in the scalp and drill a quarter-sized hole in the skull.
2. The doctor places a probe into the globus pallidus, a part of the brain that controls muscle tone and positions the body for voluntary movements.
3. After testing to see that the probe is correctly placed, the surgeons turn on a generator that sends radio waves through the probe. The energy burns away a pea-sized area of the surrounding tissue.

Pallidotomy

http://www.youtube.com/watch?v=7bUXQGH058

http://www.youtube.com/watch?v=1DPw8NVi15I&feature=related
• Alternative Surgery – Thalamotomy
- Damages motor portion of thalamus
- Michael J. Fox had this surgery done

Deep Brain Stimulation for PD
- [http://www.youtube.com/watch?playnext=1&playnext_from=TL&videos=XAUE164OopQ&v=xejclwbwsk](http://www.youtube.com/watch?playnext=1&playnext_from=TL&videos=XAUE164OopQ&v=xejclwbwsk)
- [http://www.youtube.com/watch?playnext=1&playnext_from=TL&videos=XAUE164OopQ&v=IOHtUzW02cg](http://www.youtube.com/watch?playnext=1&playnext_from=TL&videos=XAUE164OopQ&v=IOHtUzW02cg)

• Parkinson’s Disease Update
- Although PD is thought of as a motor disorder, the decline in DA also produces cognitive and emotional changes in some
  - Major depression
  - “bradyphrenia” (cognitive slowing); decreased attention
  - “frontal lobe” symptoms (disinhibition of behavior, poor judgment and planning)
  - Full-blown dementia in ~40-50% (associated with neuropathological sign called Lewy bodies)
  - PD treatment, on the other hand, can produce hallucinations and other symptoms of psychosis