Neuroscience 1

Pause for thought:

Probably 100 million neurones fire during skilled movements.
Divisions of the Nervous System

- Central nervous system
  - Brain
  - Spinal cord

- Peripheral nervous system
  - Sensory
  - Motor
    - Somatic
      - Autonomic
        - Sympathetic
        - Parasympathetic
Parkinson’s Disease & Basal Ganglia
Posture, Stance and Gait

Posture: position of body. Standing, sitting, kneeling & lying (supine or prone)

Stance (Station):

Gait - locomotion

Movement Disorder can be recognised by disruption of any combination of posture, stance or gait.
Classification of Movement Disorders

Hypokinetic – slow/poor movements
- Bradykinesia, Freezing
- Rigidity, Postural instability

Hyperkinetic – fast/excessive movements
- Rhythmic – tremors
- Non-rhythmic – purposeless, irregular movements

Not mutually exclusive eg Parkinson’s Disease has both hypo- and hyperkinetic movements
Parkinson’s Disease

Parkinson’s Disease (PD) is a progressive neurological condition affecting movements such as walking, talking, and writing. It is named after Dr. James Parkinson (1755-1824), the London doctor who first identified PD as a specific condition.

Etiology (Cause) – UNKNOWN.

The symptoms of PD have three primary features:

**Resting Tremor** - which usually begins in one hand. This is the first symptom for 70% of people with PD

**Slowness of movement (bradykinesia)** - people with Parkinson's may find that they have difficulty initiating movements or that performing movements takes longer.

**Stiffness or rigidity of muscles** - problems with activities such as standing up from a chair or rolling over in bed may be experienced.

Various non-motor symptoms may also be experienced, for example: sleep disturbances constipation urinary urgency depression
Parkinson’s Disease

PD is found all over the world. Exact global figures are not always available, though it is estimated that four million people worldwide have the condition.

Generally, in the UK:

one in 500 people, around 120,000 individuals, have PD
about 10,000 people in the UK are diagnosed each year
statistically, men are slightly more likely to develop PD than women

(Essential Tremor – estimated that 1.4 million people in UK are affected).

The risk of developing PD increases with age, and symptoms often appear after the age of 50. Some people may not be diagnosed until they are in their 70s or 80s.

However, in some cases PD is diagnosed before the age of 40, and this is known as young-onset PD.

If PD is diagnosed before the age of 18, it is known as juvenile Parkinson's, although this is extremely rare.
Parkinson’s Disease

http://www.youtube.com/user/yassermetwally#p/a/u/1/PrLnxS1bf4g
The Basal Ganglia is a Part of the Motor System

The Basal Ganglia occupies a Sub-cortical Location
Motor Cortex, Basal Ganglia and Thalamus form a Motor Loop
The Four Nuclei of the Basal Ganglia

- **Striatum**
  - comprising: caudate nucleus and putamen

- **Globus pallidus** (or pallidum)
  - comprising: external (or lateral) and internal (or medial) segments.

- **Subthalamic nucleus (STN)**

- **Substantia nigra**
  - comprising: pars reticulata and pars compacta

**Functional Aspects:**

- Striatum – Input stage of the Basal Ganglia.
- GPi/SNr – Output stage of Basal Ganglia.
- SNc – Regulates neural behaviour between Striatum and GPi/SNr.
Striatum contains spiney neurons.
D1 - neurons which are excited by Dopamine.
D2 – neurons which are inhibited by Dopamine.

SNc – contains Dopamine neurons.

PD is a problem with the SNc.
Substantia nigra
Neuromelanin

Normal

PD

No Neuromelanin

Normal

PD
There are Other Motor Disorders of the Basal Ganglia

- Parkinsonism mimics Parkinson’s Disease

- Drug-induced Parkinsonism
  (e.g. D2 antagonists to treat psychosis)
- Vascular Parkinsonism
- Repetitive Head Trauma (Boxers)
- Postencephalitic Parkinsonism
  “Awakenings”
There are Many Therapies for PD

L-dopa enhances Dopaminergic Synthesis in the Striatum

Levodopa crosses the BBB

Carbidopa does NOT cross the BBB
There are Many Therapies for PD

There are Surgical Treatments for Parkinson’s Disease

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Chronic High Frequency Deep Brain Stimulation for Tremor

Stereotaxically placed electrode into the subthalamic nucleus

Subcutaneous leads

Remote controlled battery operated stimulator
Deep Brain Stimulation ON/OFF/ON
Fetal Transplantation
Physical Exercise


VIDEO LINK - http://video.google.co.uk/videoplay?docid=-6491096078141797558&ei=U1OuSdy2AZGgqgLzyojdDg&q=parkinson%27s+disease&hl=en