Basal Ganglia

Basal ganglia

- Consists of

1. Caudate nucleus
2. Putamen
3. Globus pallidus - Internal and external segments
4. Subthalamic nucleus
5. Substantia nigra - pars compacta
   pars reticulata

Basal ganglia

- Lenticular nucleus
  - Globus palidus and putamen
- Striatum
  - Caudate nucleus and putamen

- Parts of the thalamus are intimately related to the basal ganglia

Basal ganglia

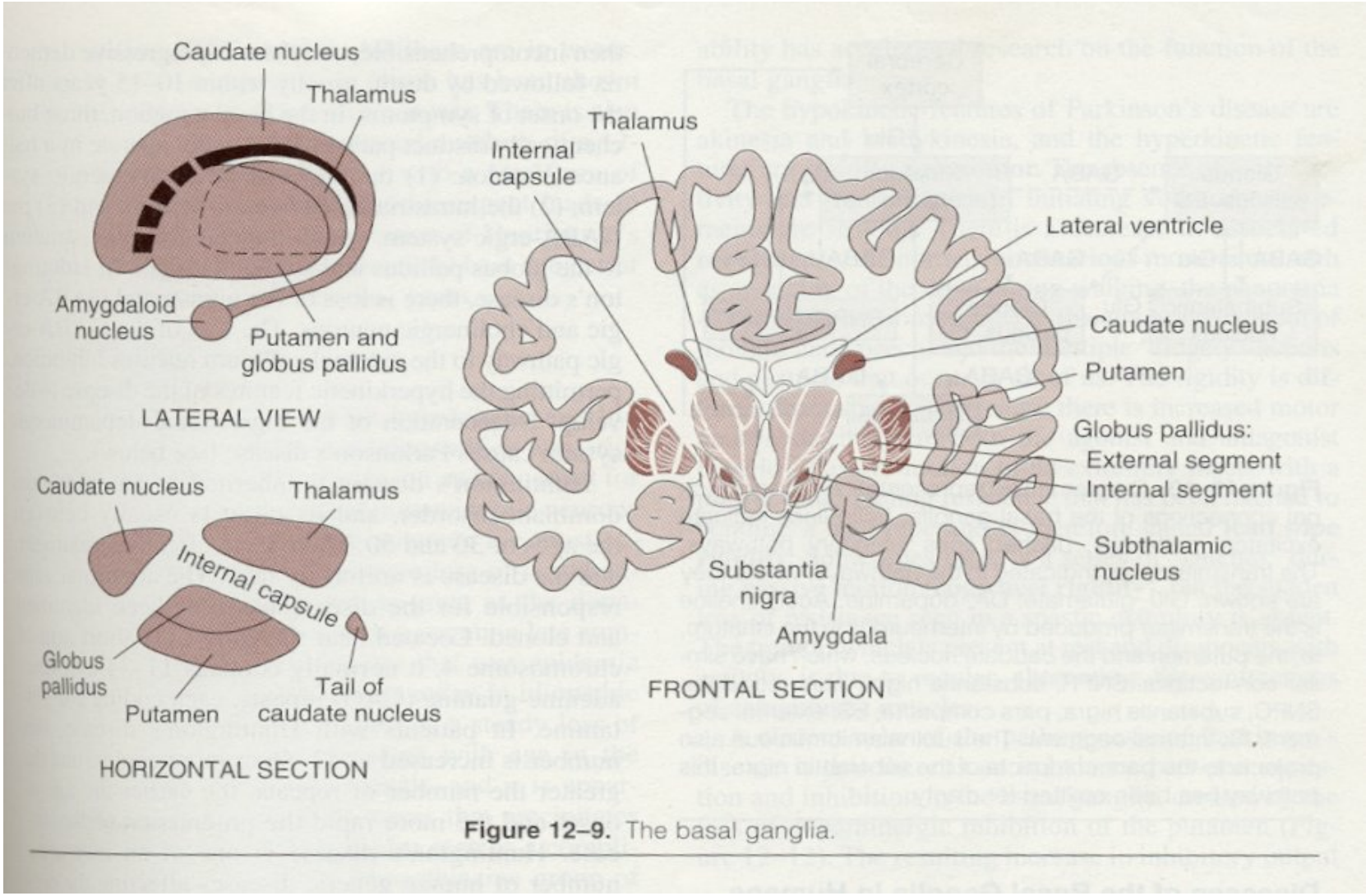


Figure 12–9. The basal ganglia.

Connections

- These nuclei have complex interconnections
- No direct connection with the spinal cord
- Afferents

1. Corticostriate projections
   - are the main afferent fibers
   - terminate in the striatum
   - have afferents from all parts of the cerebral cortex

Connections

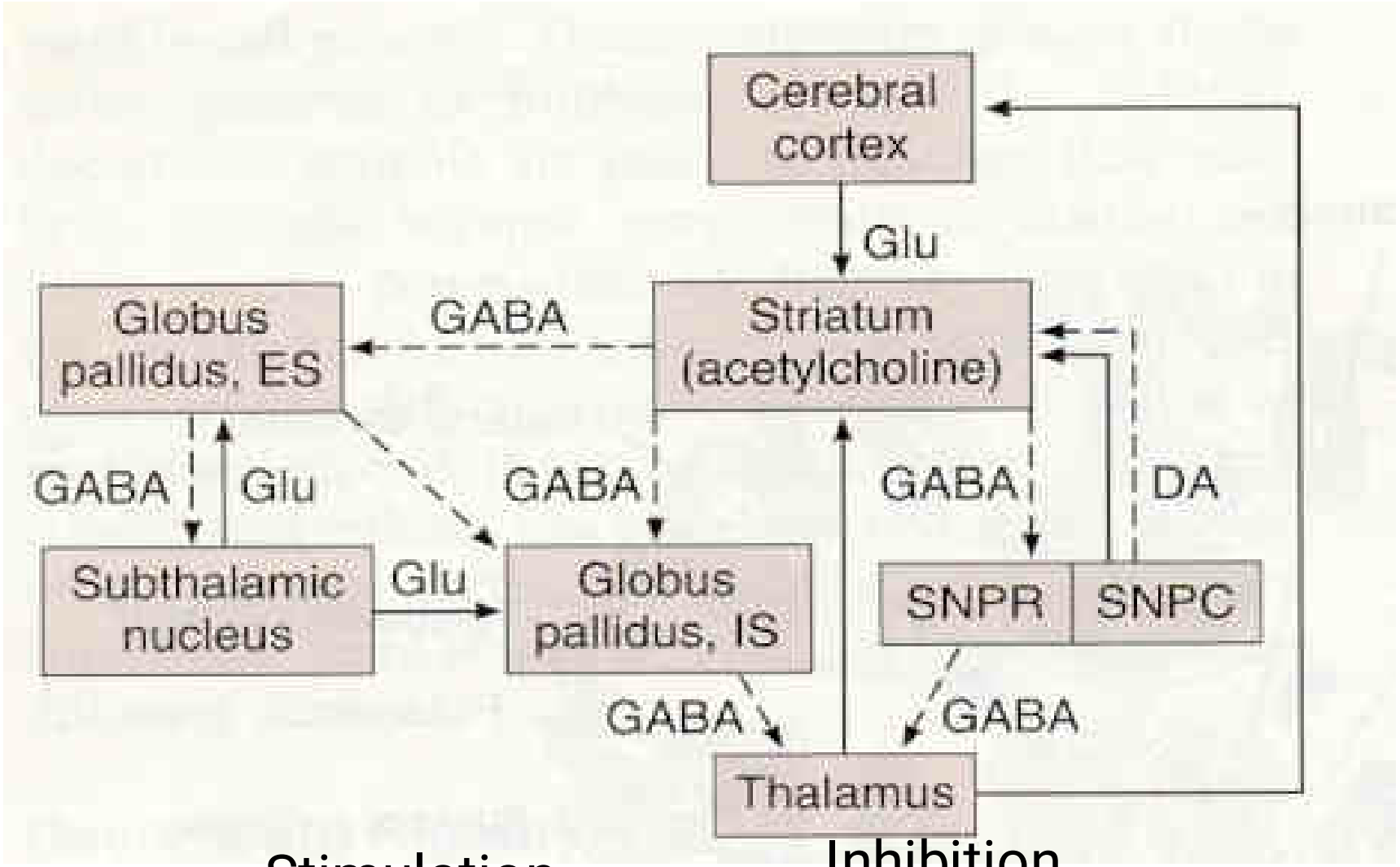
2. Dopaminergic nigrostriatal projections
   - from pars compacta of substantia nigra
3. GABA-ergic projections
   - from striatum to the pars reticulata of substantia nigra
4. Complex interconnections between each others

Connections

- Efferents
- from internal segment of globus palidus via thalamic fasciculus to
  - ventral lateral
  - ventral anterior
  - centromedian

    nuclei of thalamus

Connections



Functions of basal ganglia

- Planing and programming of the movements
  - abstract thought is converted to voluntary action
  - sends information to motor neurons via
    - thalamus
    - motor cortex
    - corticospinal tract

Functions of basal ganglia

- Cognitive control of motor activity
  - particularly by caudate nucleus
  - determine the pattern and sequences of movements
- Determination of the timing and scaling the intensity of a movement

Diseases of the basal ganglia

Produce marked and characteristic abnormalities of the motor functions

Generally two types of motor disorders

- Hyperkinetic
- Hypokinetic

- Hyperkinetic disorders

  there is excessive abnormal movements

  include

  - chorea
  - athetosis
  - ballism

Diseases of basal ganglia

- Hypokinetic disorders
  - Include
    - akinesia
    - bradykinesia

Features of basal ganglia disease

Hyperkinetic disorders

1. Chorea
   - rapid involuntary dancing movements
2. Athetosis
   - continuous,slow writhing movements
3. Balisum
   - sudden,intense,violent jerky movements of the body
   - due to damage to subthalamic nuclei

Features of basal ganglia disease

- Hypokinetic disorders

1. Akinesia
   - difficulty of initiating movements
2. Bradykinesia
   - slowness of movements
3. Rigidity- lead pipe rigidity
   - Due to increased motor discharge to both agonist and antagonist muscles
4. Cogwheel rigidity
   - Rigidity interrupted by tremors

Parkinson's disease

- Has both hypo and hyperkinetic features
- Hyperkinetic features are
  - Resting Tremor
  - Muscle Rigidity
- Hypokinetic features are
  - Akinesia
  - bradykinesia
- With Postural instability
- Decreased associated movements
  - lack of swinging movements with walk
  - Lack of facial expressions and gestures

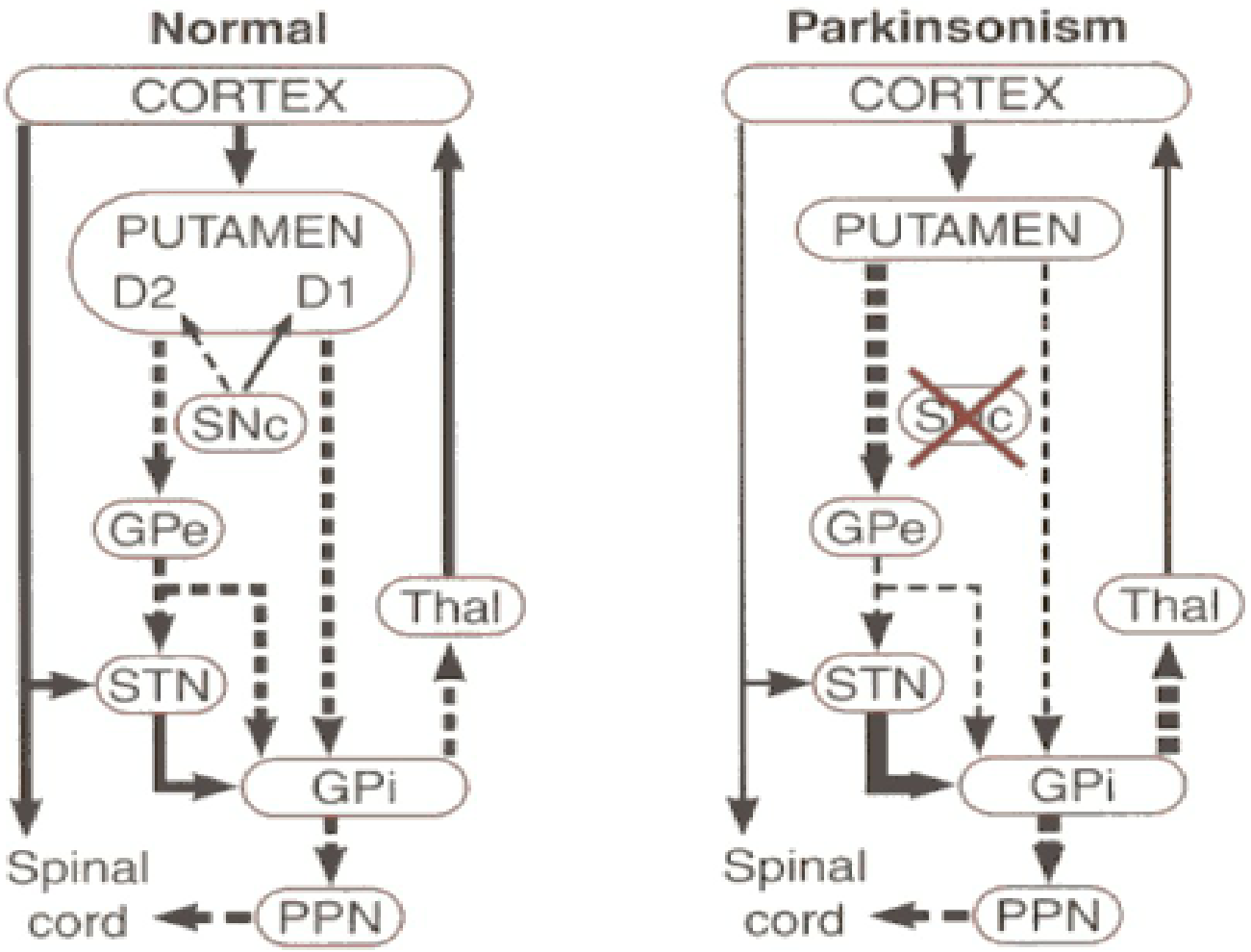
Remember TRAP

Causes(Aetiology)

- Idiopathic
- Old age
- Viral infections –influenza
- Drugs causes features of Parkinson's disease
  - D_2 receptor blockers

- Usually there is a balance between
  - Dopaminergic inhibition
  - Cholinergic excitation in the basal ganglia
- Effects are due to
- Loss of dopaminergic neurons in nigrostriatal system
- Creating loss of dopaminergic inhibition of putamen
- Resulting imbalance between excitation and inhibition
- towards increase in inhibitory out put to cerebral excitation and cortical drive
- Resulting akinesia and bradykinesia

Parkinson disease



Parkinson's disease

Treatment

- By increasing dopaminergic stimulation
- Dopamine does not cross blood brain barrier
- Therefore L-dopa is used
  - Cross the blood brain barrier
  - Converted to dopamine by dopa decarboxylase
- To minimize the side effects of dopamine at peripheral tissues a dopa decarboxylase inhibitor is also given
- This inhibitor does not cross the blood brain barrier

Parkinson's disease

Treatment

- Other dopamine agonists
  - Bromocriptine
- Anticholinergic drugs
- Mono amine oxidase-B inhibitors
  - Eg. Selagiline