THE EXTRAPYRAMIDAL SYSTEM

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THE EXTRAPYRAMIDAL SYSTEM
THE CEREBELLUM

Motor activity is intricately controlled by the interactions of three major regions of the brain: the cerebral cortex, the cerebellum, and the basal ganglia. These regions influence the lower motoneurons either directly through the **pyramidal system** or indirectly through the **extrapyramidal system**. The pyramidal system consists **of the corticonuclear and corticospinal pathways**.

THE EXTRAPYRAMIDAL SYSTEM

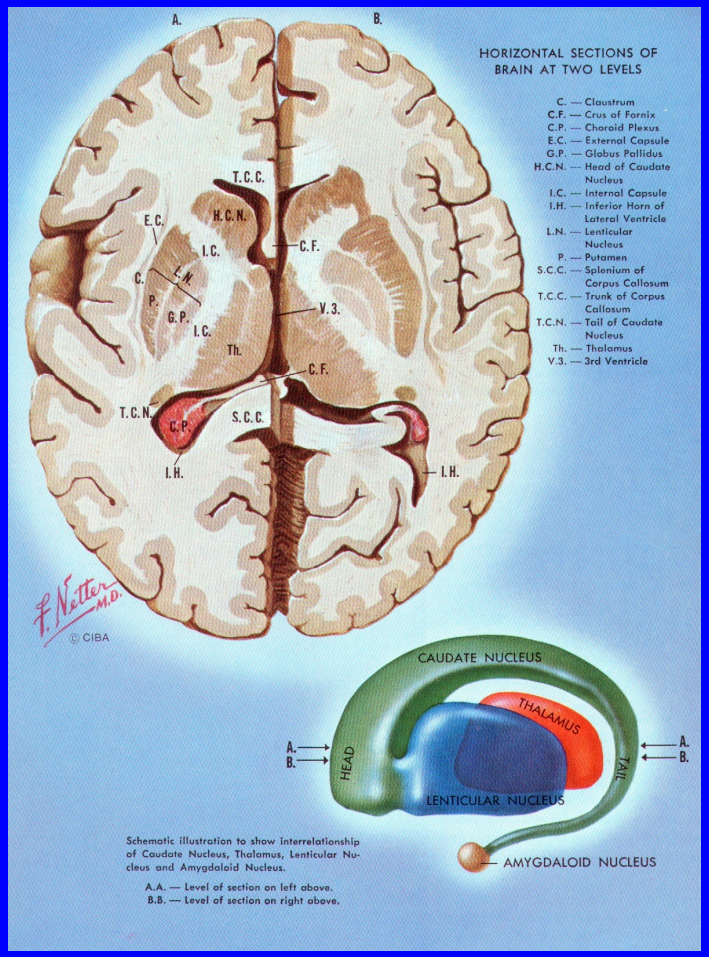
The extrapyramidal system is composed of all other projection pathways that influence motor control, including the basal gangllia and the projection pathways from the brain stem to the spinal cord (e.g., the rubrospinal, reticulospinal, vestibulospinal, and tectospinal tracts). The neuronal circuits of the extrapyramidal system are closely connected with those of the pyramidal system; thus, separating the connections into two systems are artificial.

THE EXTRAPYRAMIDAL SYSTEM

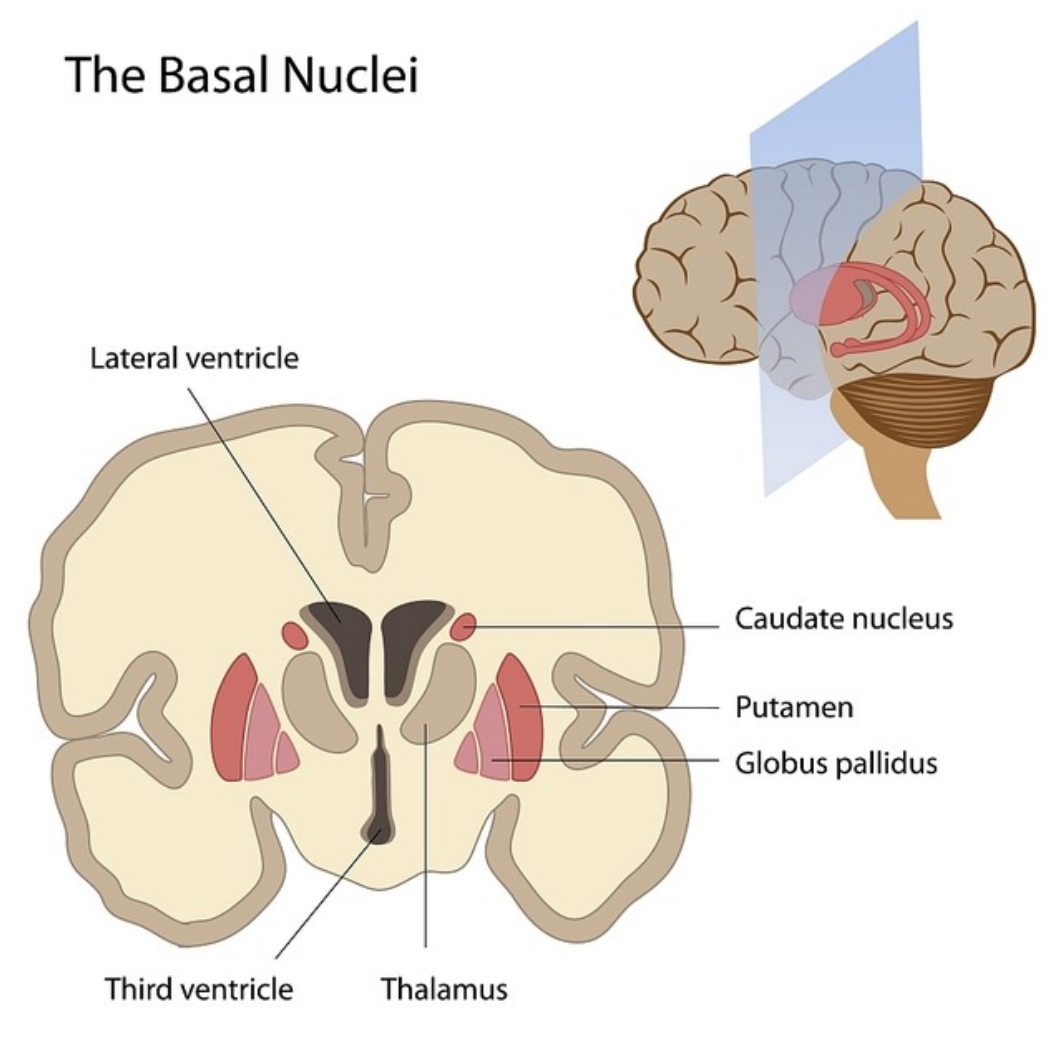
Nevertheless, the term “extrapyramidal system” is frequently used clinically to denote the components of the basal ganglia and related subcortical nuclei that influence motor activity, and disease of the extrapyramidal system results from neurologic symptoms different from those occurring with diseases of the pyramidal system.

STRUCTURES IN THE BASAL GANGLIA

The major components of the basal ganglia include the caudate nucleus, the putamen, and the globus pallidus.



The Basal Nuclei



Components of the Basal Ganglia and Their Connections

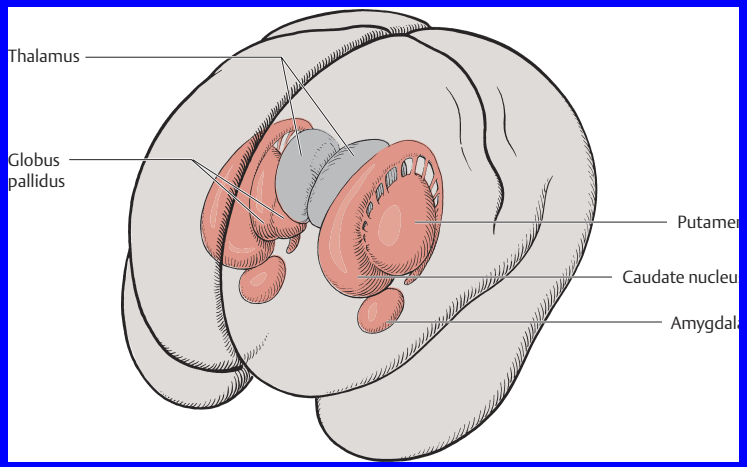
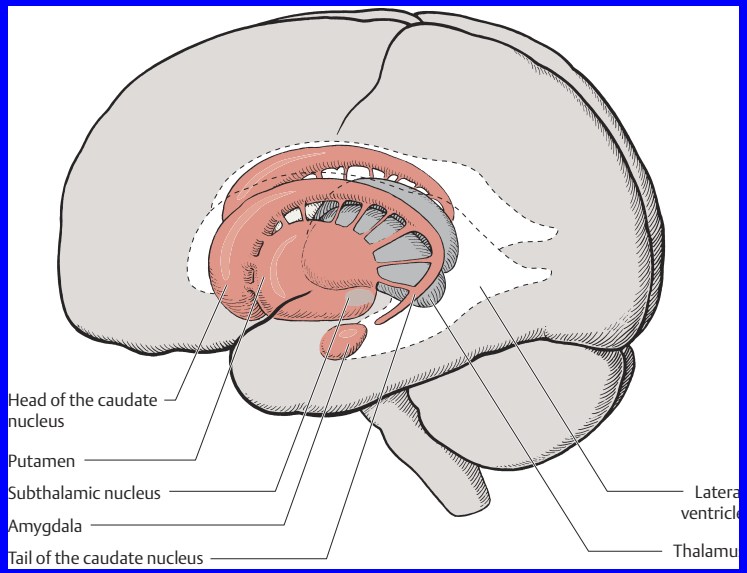


Fig. 8.1 Topographical relationships of the basal ganglia (in red)



Components of the Basal Ganglia and Their Connections

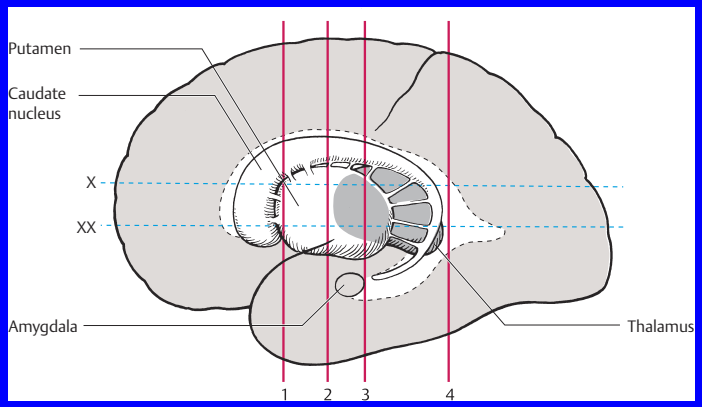
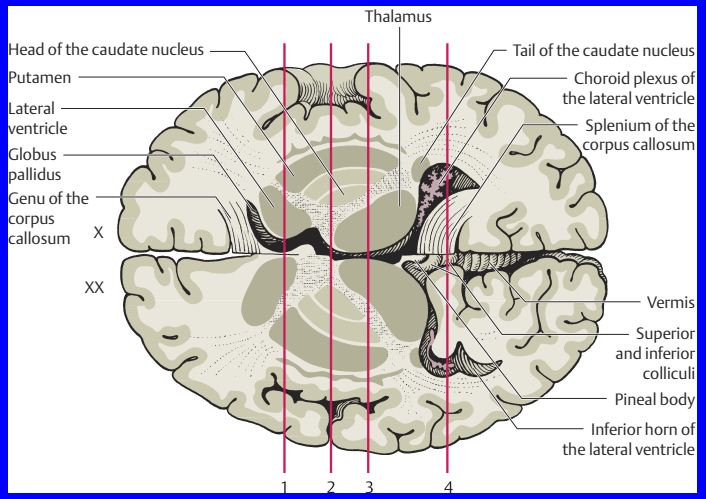
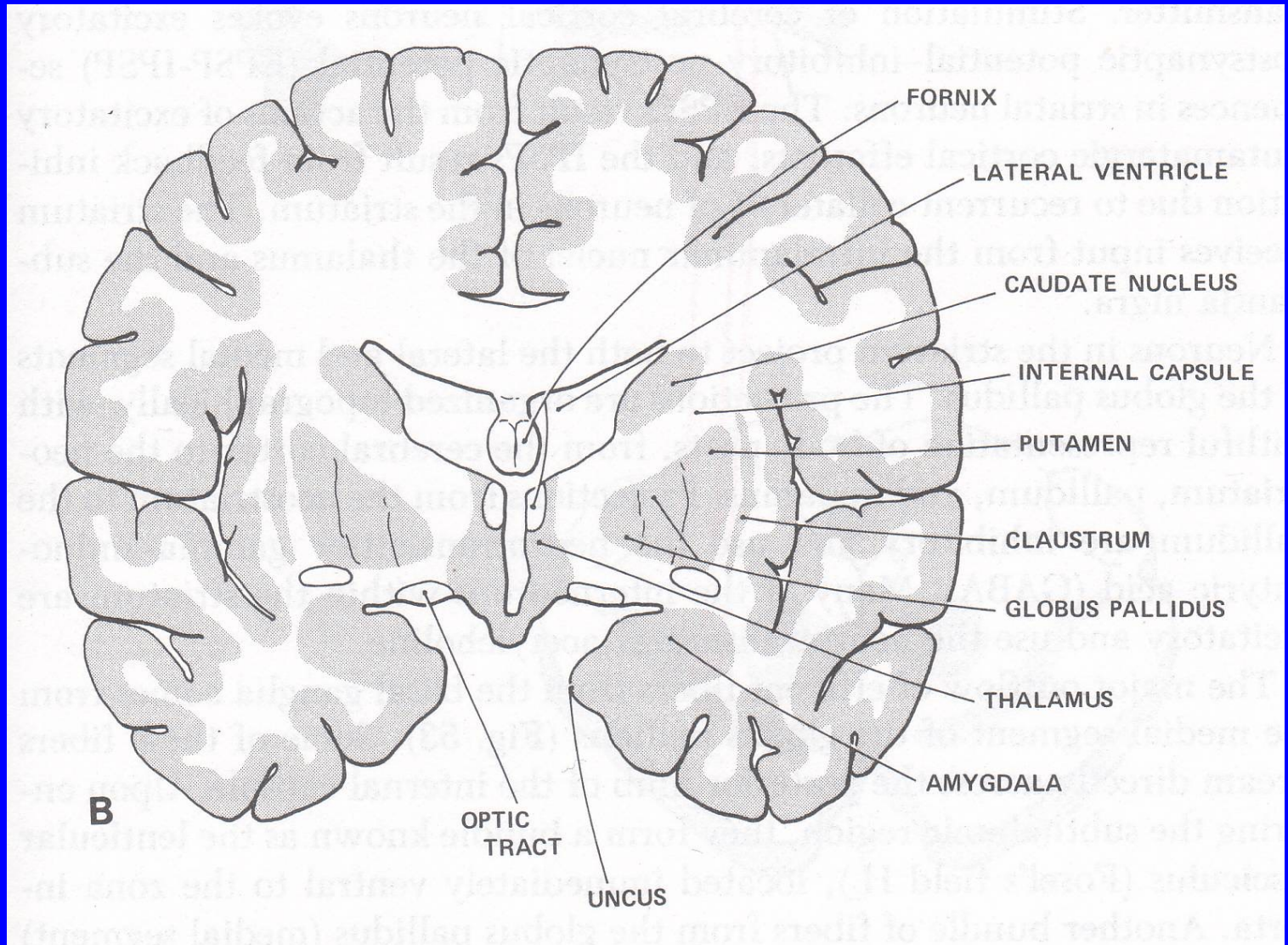


Fig. 8.3 **Lateral view of the basal ganglia.** X, XX: horizontal planes of section for Fig. 8.4; 1–4: coronal planes of section for Figs. 8.5–8.8.



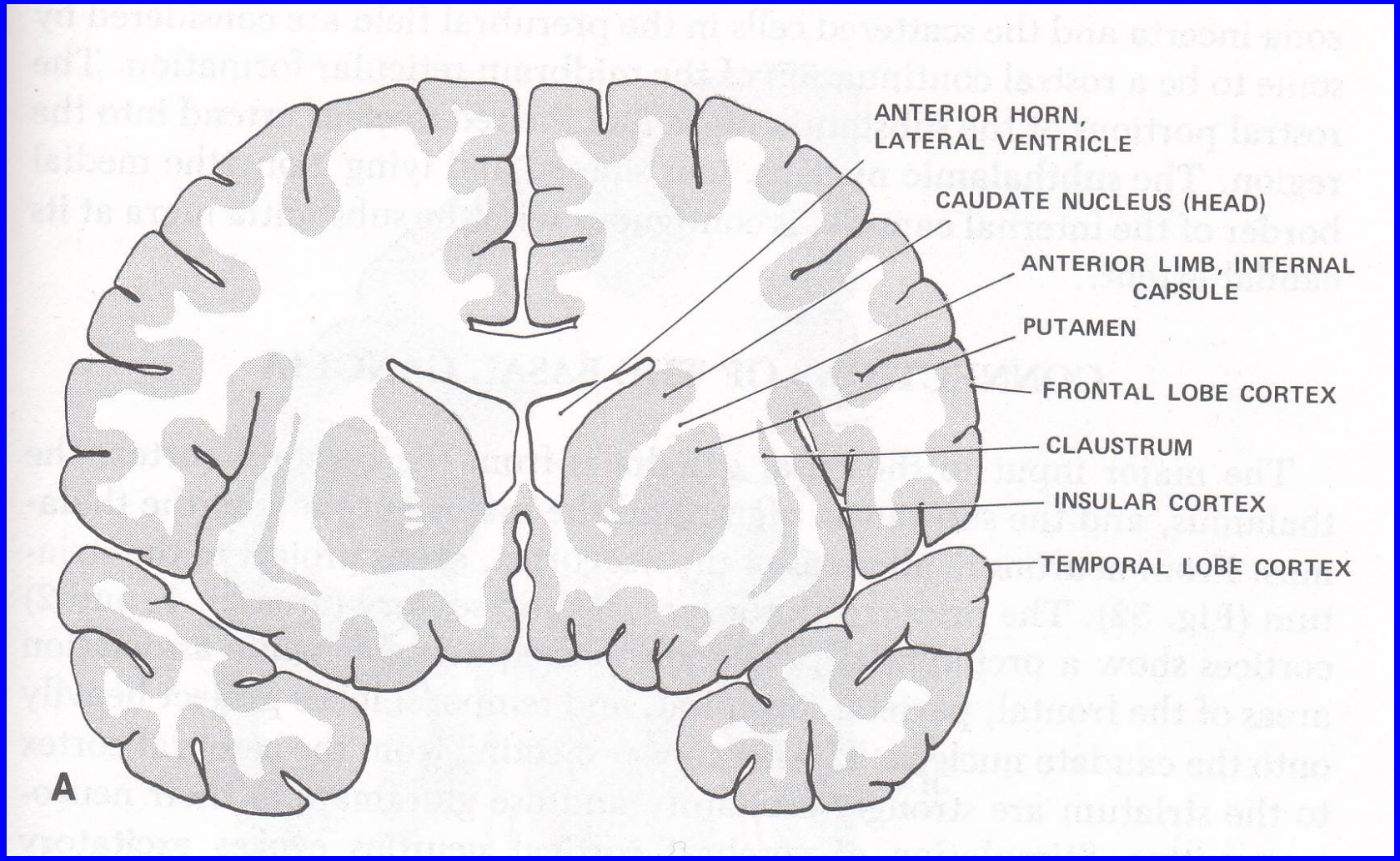
STRUCTURES IN THE BASAL GANGLIA

The caudate nucleus occupies a position in the floor of the lateral ventricle, dorsolateral to the thalamus.



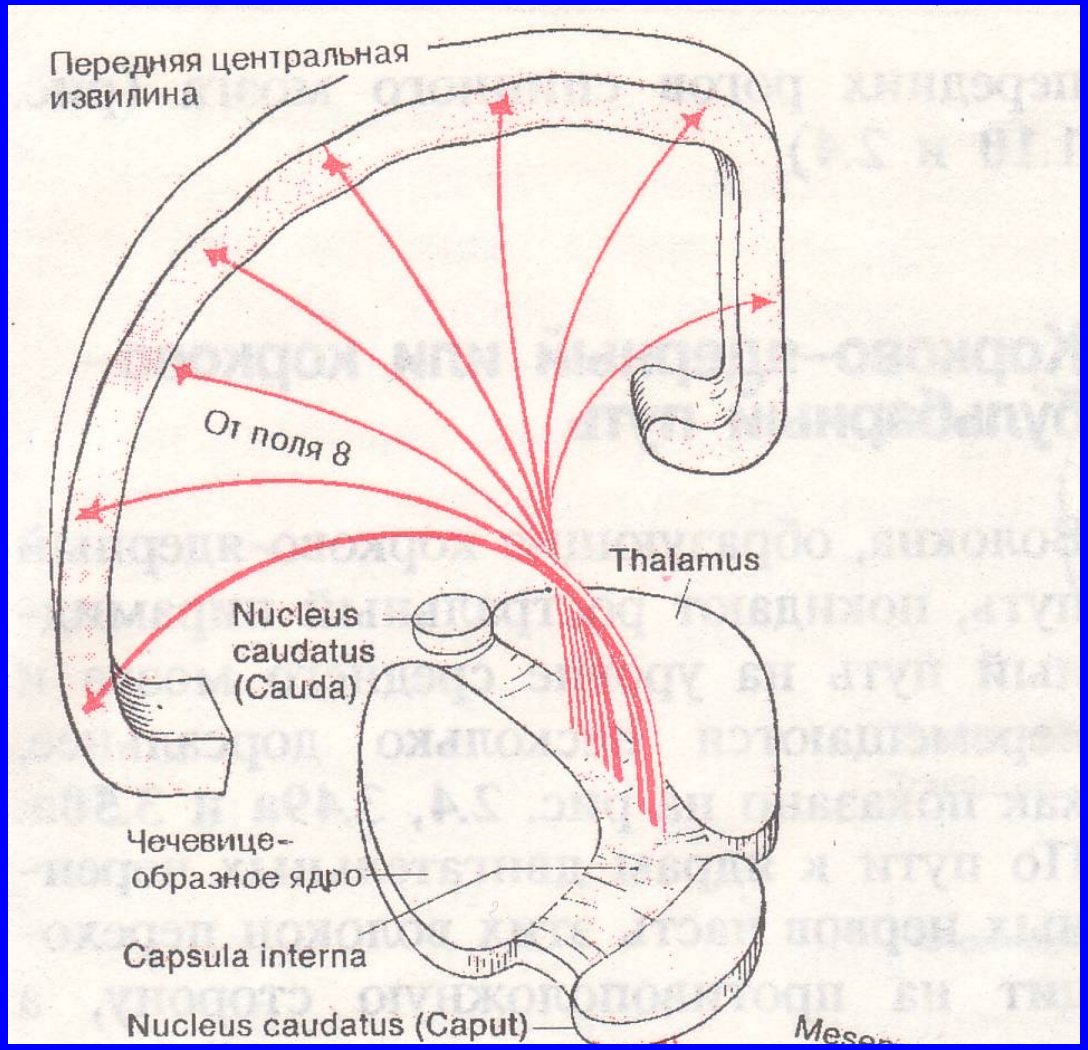
STRUCTURES IN THE BASAL GANGLIA

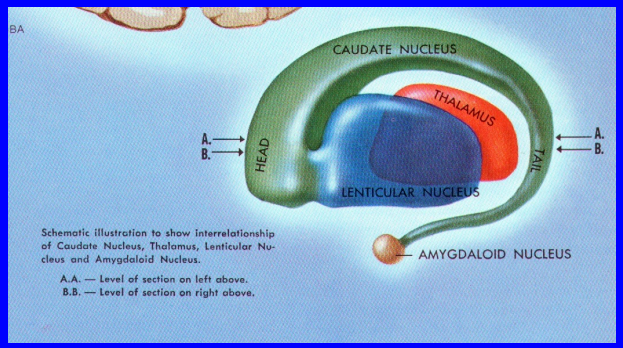
The bulge at the cephalic end of the caudate nucleus is known as the head.



STRUCTURES IN THE BASAL GANGLIA

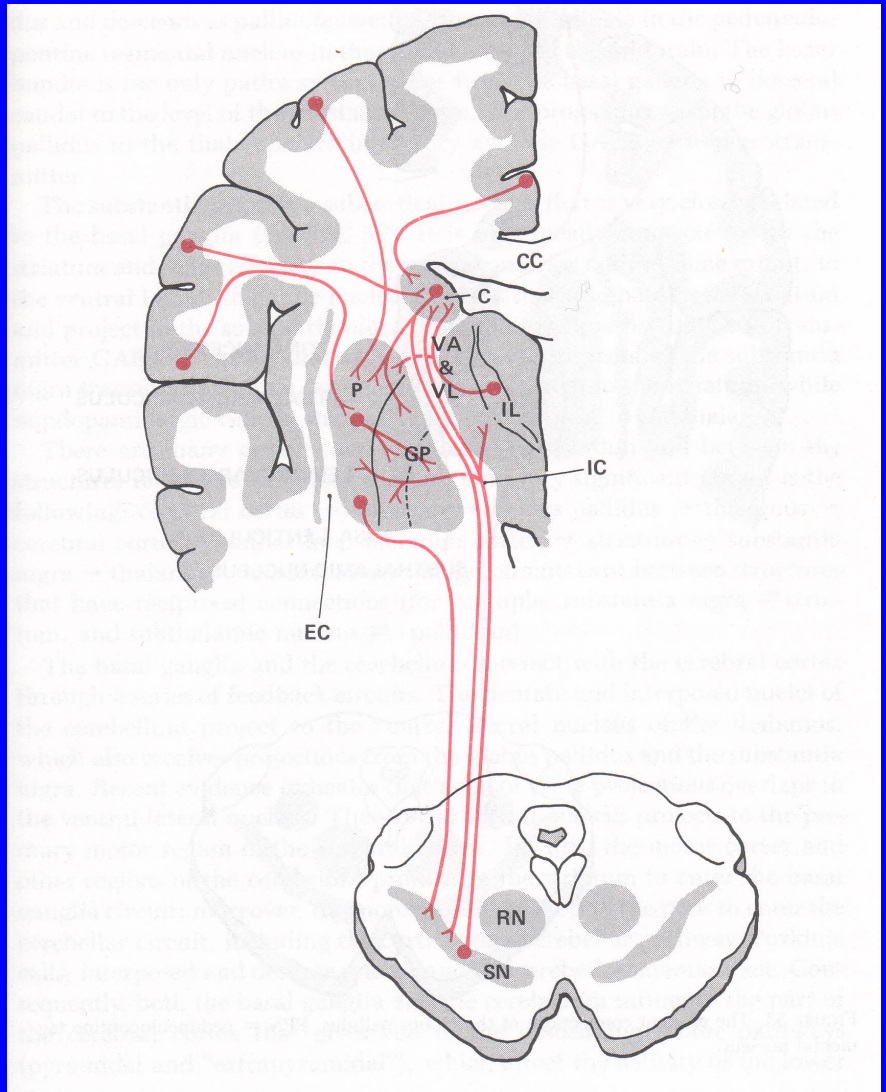
The putamen and globus pallidus together form the lenticular, or lentiform,nucleus.





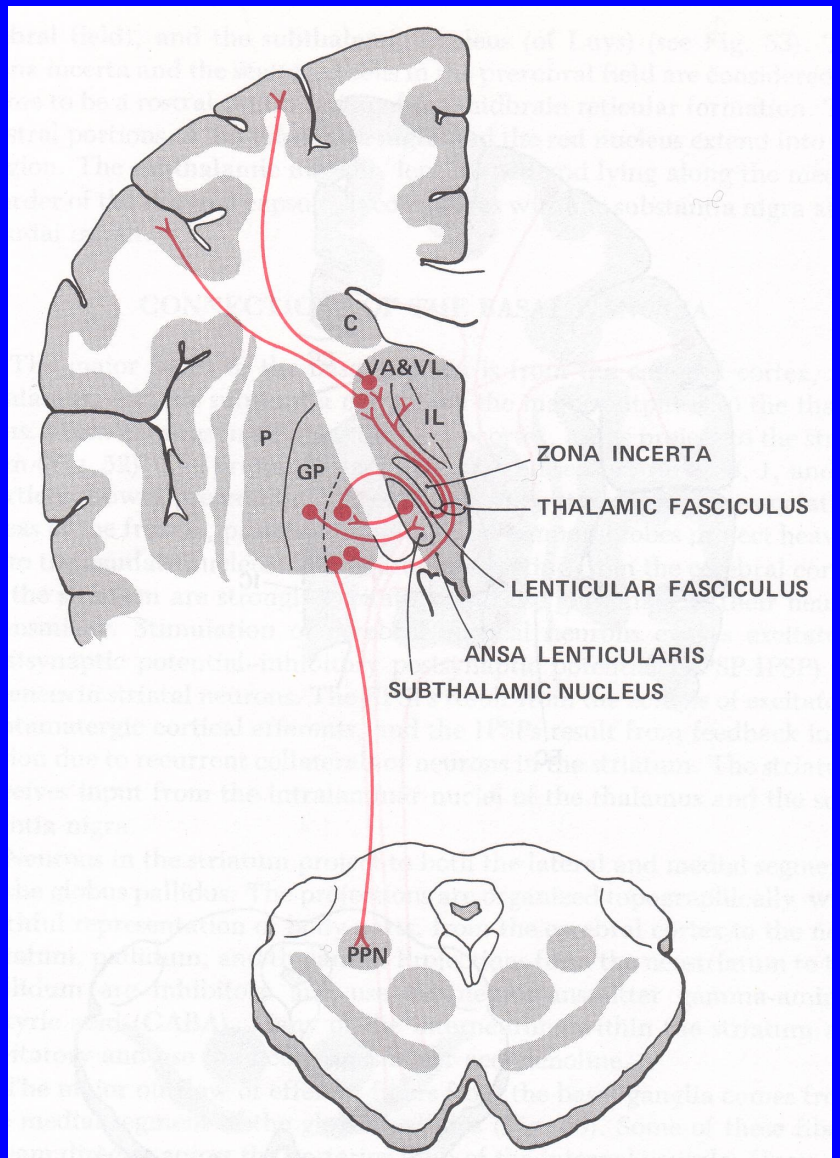
CONNECTIONS OF THE BASAL GANGLIA

The major input to the basal ganglia is from the cerebral cortex, the thalamus, and the substantia nigra, and the major output is to the thalamus. From neurons in all areas of the neocortex, axons project to the striatum.



CONNECTIONS OF THE BASAL GANGLIA

The major outflow of efferent fibers from the basal ganglia comes from the medial segment of the globus pallidus.



FUNCTIONAL CONSIDERATIONS

Lesions of the basal ganglia in humans cause:
- Disorders of the initiation of movement (akinesia);
- Difficulty continuing or stopping an ongoing movement;
-Abnormalities of muscle tone (rigidity)
-The development of involuntary movements (tremor).

Thus, the basal ganglia are thought to participate in movement control, particularly in the initiation of movement, but also in the support of ongoing movement. The movements influenced by the basal ganglia include those related to posture, automatic movements (such as swinging the arms while walking), and skilled volitional movements.

BASAL GANGLIA DISEASE
CHOREA

Chorea is a movement disorder that results from disease of the basal ganglia. Choreiform movements consists of a rapid, irregular flow of motions, including "piano-playing" flexion-extension movements of the fingers, elevation and depression of the shoulders and hips, crossing and uncrossing of the legs, and grimacing movements of the face.

BASAL GANGLIA DISEASE
CHOREA

Sydenham's chorea occurs in children as a complication of rheumatic fever, but the disease is self-limited and recovery is complete.

Huntington' s disease is a disorder inherited as an autosomal dominant trait and characterized by progressive dementia and choreiform movements, usually beginning in adult life. Recently, the approximate site of the genetic locus responsible for this disease was found.

BASAL GANGLIA DISEASE
ATHETOSIS

Athetosis is a movement disorder characterized by slow, writing movements of a wormlike character involving the extremities, trunk, and neck. Athetosis occurs in assosiation with dystonia, which is the abnormal persistence of limb and trunk postures. Athetosis is frequently seen in patients with cerebral palsy and results from brain damage that occurred at birth from hypoxia and ischemia.

BASAL GANGLIA DISEASE
HEMIBALLISMUS

HEMIBALLISMUS is a movement disorder characterized by the sudden onset of continuous, wild, flinging motion of the arm and leg on one side of the body. This result most often from a vascular lesion of the contralateral subthalamic nucleus.

BASAL GANGLIA DISEASE
AKATHISIA DYSKINESIA

Akathisia — motor restlessness where the patient constantly shifts, crossing and uncrossing his legs and walking on the spot.

Dyskinesia — a term used to describe movements associated with neuroleptic drugs; particularly used to describe movements of mouth and face (oro-facial dyskinesia).

BASAL GANGLIA DISEASE
DYSTONIA TIC TREMOR

Dystonia — co-contraction of agonist and antagonist which may lead to an intermittent or persistent maintenance of abnormal posture. Position maintained is usually at an extreme of extension or flexion.

Tic — a stereotyped and irresistible repetitive action, normally a repeated purposeful action.

Tremor—rhythmical alternating movement.

QUESTIONS?