

Lecture 33 – Brain Stem -- Hen

I Anatomy of the cranial nerves and cranial nerve nuclei

- A. The cranial nerves are functionally homologous to the spinal nerves
- B. The cranial nerves leave the skull in groups and therefore are likely to be injured together
- C. The cranial nerve nuclei follow the basic plan for sensory and motor structures in the spinal cord
 - (1) The sensory nuclei
 - (2) The motor nuclei
- D. The brain stem deviates from the organization of the spinal cord in two important ways

II Function of the cranial nerves and cranial nerve nuclei: reflexive behavior

- A. The cranial nerves supply the sensory and motor functions of the face and head and autonomic functions of the body
- B. Neuronal ensembles in the brain stem reticular formation coordinate reflexes and simple behaviors mediated by the cranial nerves

Table 44-2 Functional Classes of Cranial Nerves

Classification	Functions	Structures innervated	Cranial nerve
Sensory			
General somatic	Touch, pain, and temperature Proprioception	Skin, skeletal muscles of head and neck, mucous membrane of mouth, and teeth	V, VII, IX, X
Special somatic ¹	Hearing, balance	Cochlea, vestibular organ	VIII
General visceral	Mechanical Chemosensory	Pharynx, larynx, neck, gut	V, VII, IX, X
Special visceral	Olfaction, taste	Taste buds, olfactory epithelium	I, VII, IX, X
Motor			
General somatic	Skeletal muscle control (somites)	Extraocular and tongue muscles	III, IV, VI, XII
General visceral	Autonomic control	Tear glands, sweat glands, gut	III, VII, IX, X
Special visceral	Skeletal muscle control (branchiomeric)	Muscles of facial expression, jaw neck, larynx, and pharynx	V, VII, IX, X, XI

¹The optic nerve (II) is considered part of the somatic afferent class but is not included here because it does not contain the axons of primary sensory neurons, but rather those of third-order neurons in the visual pathway.

III Anatomy of the monoaminergic and cholinergic neuromodulatory pathways.

- 1) Cell groups in the brain stem with long projections can be defined by their neurotransmitters
- 2) Noradrenergic pathways
- 3) Adrenergic pathways
- 4) Dopaminergic pathways
- 5) Serotonergic pathways
- 6) Cholinergic pathways
- 7) Histaminergic pathways

IV Functions of the monoaminergic and cholinergic pathways

A. descending projections

- (1) pain
- (2) posture, gait, and muscle tone

B. ascending projections

- (1) motor control: the nigro-striatal dopaminergic system
- (2) motivation and reward: the mesolimbic dopaminergic system
- (3) impulsiveness and aggression: serotonin
- (4) anxiety and depression: serotonin and norepinephrine
- (5) sleep, arousal and consciousness
 - The EEG reflects two modes of firing of thalamic neurons
 - Damage to either branch of the ascending arousal system may impair consciousness (examination of the comatose patient)

Relevant reading: chapters 44 and 45 in “Principles”