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The Human Cranial Nerves

Much of our perception of the outside world is mediated by our twelve cranial neurons. The sensory ganglia of the cranial nerves enable us to see, taste, hear, smell, and feel. They are constructed of elements derived from the neural crest and cranial placodes (see Barlow 2002). The motor ganglia of the cranial nerves are involved with eye, neck, and head movements, as well as feeding, speech, and facial expression (see Guthrie 2007).

The cranial nerves are:

I. **Olfactory nerve**: Originating in the telencephalon, it transmits smell from the nasal cavity. It is sensory.

II. **Optic nerve**: Originating in retinal ganglial cells, it transmits visual signals from the eye into the brain. It is sensory.

III. **Oculomotor nerve**: Originating in the anterior midbrain, it innervates those muscles controlling eye movements and pupil dilation (motor).

IV. **Trochlear nerve**: Originating in the dorsal midbrain, it innervates the superior oblique muscle that can rotate the eye laterally (motor).

V. **Trigeminal nerve**: Both motor and sensory, this nerve from the pons is the one the dentist numbs when removing teeth. It receives sensations from around the face, and it also controls the jaw muscles.

VI. **Abducens nerve**: Originating in the pons, it also controls eye movements by innervating the lateral rectus muscle (motor).

VII. **Facial nerve**: Originating in the pons, this nerve has both sensory and motor components. It controls facial expression, enables us to taste from the anterior and central regions of the tongue, and helps regulate salivary production.

VIII. **Vestibulocochlear nerve/Auditory nerve**: Originating in the vestibular and cochlear nuclei of the ear, this sensory nerve allows us to hear and keep our balance.

IX. **Glossopharyngeal nerve**: Originating in the medulla, this nerve has both sensory and motor components. It enables swallowing and speech, as well as receiving taste from the posterior region of the tongue.

X. **Vagus nerve**: Originating in the medulla, it controls most larynx and pharynx muscles for speech and swallowing. It also regulates heartbeat, sweating, and peristalsis. It has both motor and sensory components.

XI. **Accessory nerve/Spinal accessory nerve**: These motor neurons go to the trapezius muscle and certain neck muscles.

XII. **Hypoglossal nerve**: These motor neurons innervate the tongue muscles for speech, eating, and other oral functions.

The memorization of the twelve cranial neurons and their functions used to constitute a major portion of one's neuroanatomy and embryology courses. However, when developmental biology began concentrating on mechanisms (transcription factors, paracrine factors, adhesion molecules, etc.), this anatomical tradition was largely abandoned. As Anne Fausto-Sterling (2003) has written, "Similarly, I eliminated the tradition of asking students to memorize all 12 cranial nerves, assuming that those students who became neurosurgeons would have to return to a careful study of these

nerves, but that others could learn important principles of nerve anatomy from a more limited sampling."

However, they remain critically important to any investigation of vertebrate or medical neurobiology. In order to memorize them, many mnemonics have percolated through generations of medical school classes. These include:

On **O**ld **O**lympus' **T**owering **T**ops, **A** **F**inn **A**nd **G**erman **V**iewed **S**ome **H**ops

Odor **O**f **O**rangutans **T**errify **T**arzan **A**fter **F**orty **V**oracious **G**orillas **V**iciously **A**ttacked **H**im

Or, more recently:

Only **O**wls **O**bserve **T**hem **T**raveling **A**nd **F**inding **V**oldemort **G**uarding **V**ery **S**ecret **H**orcruxes

Literature Cited

Barlow, L. A. 2002. Cranial nerve development: placodal neurons ride the crest. *Curr. Biol.* 12: R171–173.

Guthrie, S. 2007. Patterning and axon guidance of cranial motor neurons. *Nature Rev. Neurosci*. 8: 859–871.

Fausto-Sterling, A. and S. F. Gilbert. 2003. Educating for social responsibility: changing the syllabus of developmental biology. *Int. J. Dev. Biol*. 47: 237–244.