Cranial Nerves

The human brain has 12 pairs of special nerves called the cranial nerves. These are specifically bundle of neurons and axons which transmit special information to and from the brain. They are generally very similar to spinal nerves in their make-up. However, they differ in the highly specific functions which they serve. The cranial nerves all exit from the bottom surface of the brain and brainstem and exit the skull through various holes (foramina) to reach their targets. Below are some more details on each cranial nerve.

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<th>Main Function</th>
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Figure 1: Base of the brain showing some of the cranial nerves.

Further Explanation

Olfactory Nerve – Cranial Nerve 1

The olfactory nerve is essentially responsible for the sense of smell. It courses along the base of the frontal lobes and perforates through the base of the skull and rests inside the roof of the nose.
Recently, these nerves have received additional interest because of their potential for involvement in the harvest of naturally existing stem cells.

**Optic Nerve - Cranial Nerve 2**
The optic nerve is responsible for vision. The sight/light/vision is reflected from the object through the lens of the eye and focused onto the retina (nerve cells in the back of the eye.) From here, the information is taken through the optic nerves and eventually into the back of the brain in a region called the occipital lobe.

The processing of the information before reaching the brain is very interesting. Before the vision information even reaches the brain, the signal from the eyes crosses in a part of the optic nerve called the optic chiasm. The result of this is such that the entire right visual field is seen by the left occipital lobe and vice versa. Thus, half of each eyes vision goes to the opposite brain.

Figure 2: The two circles below represent the vision seen by both eyes. Initially, both the right and the left optic nerve record and take back to the brain 2 colors – black and yellow. After the fibers cross in the optic chiasm, only the yellow picture from each eye is returned to the left occipital lobe and only the black picture is returned to the right occipital lobe.

![Left Eye](left-eye.png) ![Right Eye](right-eye.png)

**Oculomotor, Trochlear, and Abducens Nerve - Cranial Nerve 3, 4, and 6**
Together, the Oculomotor, Trochlear, and Abducens Nerve move the eye in many directions. The oculomotor nerve is the most diverse. It is responsible for moving each eye towards the nose, up, down, and external rotation. Additionally, it is responsible for shrinking the size of the pupil and allow less light to enter the eye. A problem with the oculomotor nerve might result in double vision when looking at near object and cause trouble when reading. The trochlear nerve is responsible for internal rotation of the eye. A problem with this nerve often is noticed by the patient as they have trouble walking down stairs. Finally, the abducens nerve is responsible for moving each eye temporally – or away from the nose. A problem with the sixth nerve results in double vision on looking at distant objects.

Figure 3 – Two eyes and a nose and arrows showing how the 3rd, 4th, and 6th cranial nerves move the eyes as described above.
Trigeminal Nerve - Cranial Nerve 5
The trigeminal nerve is one of the largest cranial nerves. It also has many functions. The entire sensation from the face, the forehead, the cheeks, and the jaw are returned to the brain from the three different divisions of this nerve.

Facial Nerve - Cranial Nerve 7
The facial nerve is responsible for moving most of the muscles of the face. It helps us to smile, raise an eyebrow, wrinkle the forehead, puff our cheeks, straighten our neck muscles in order to shave, and sometimes even to wiggle our ears. Interestingly enough, the taste from the front 2/3 of the tongue is transmitted to the brain from the facial nerve and parts of the facial nerve aids in allowing the salivary glands to secrete their fluid to assist in chewing and digestion.

Auditory Nerve - Cranial Nerve 8
Another name for the auditory nerve is the vestibulo-cochlear nerve. It is so called this because it serves 2 purposes. The hearing or sound information is transmitted back to the brain through the cochlear nerve and the balance information is transmitted through the vestibular portion of the nerve. There is a fairly well known tumor although misnamed called an Acoustic Neuroma which arises from this nerve. It is misnamed because this commonly benign tumor actually arises from the vestibular nerve and is not a nerve tumor as the name implies.

Glossopharyngeal and Vagus Nerve - Cranial Nerve 9,10
The functions of the glossopharyngeal and the vagus nerve are too many to list. In essence, these two nerves take to and from the brain information regarding swallowing, taste, voice, organ function, heart rate, abdominal function, etc. In fact, vagus means wandering in Latin. The vagus nerve actually starts from the brain and is continuous all the way through and even reaches the intestines. Since there are so many functions of this nerve, the signal from the body also have to be returned to many parts of the brain through the same nerve as well. Interestingly, it was discovered that this nerve could serve as a conduit through which to treat epilepsy – or
seizures. A neurosurgeon can surgically wrap and electrode around this nerve and connect it to a pacemaker device which can then be used to treat epilepsy in some patients.

**Accessory Nerve - Cranial Nerve 11**
The accessory nerve is responsible for turning the head, nodding yes and no, and shrugging the shoulders. Specifically, it controls the muscles called the sternocleidomastoid and the trapezius. Since this nerve controls head turning and is a cranial nerve – as opposed to a spinal nerve, the motion of turning the head is typically preserved in patients who injure their spinal cords.

**Hypoglossal Nerve - Cranial Nerve 12**
The hypoglossal nerve is responsible for the complex movements of the tongue. There is some help from the vagus nerve but three of the four main tongue muscles are controlled from the hypoglossal nerve.

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