12.5C: Optic (II) Nerve

The optic nerve (cranial nerve II) receives visual information from photoreceptors in the retina and transmits it to the brain.

LEARNING OBJECTIVES

Describe the optic nerve (cranial nerve II)

KEY TAKEAWAYS

Key Points

- The optic nerve is considered part of the central nervous system. The myelin on the optic nerve is produced by oligodendrocytes rather than Schwann cells and it is encased in the meningeal layers instead of the standard endoneurium, perineurium, and epineurium of the peripheral nervous system.
- The optic nerve travels through the optic canal, partially decussates in the optic chiasm, and terminates in the lateral geniculate nucleus where information is transmitted to the visual cortex.
- The axons responsible for reflexive eye movements terminate in the pretectal nucleus.

Key Terms

- **oligodendrocyte**: A type of neuroglia that provides support and insulation to axons in the central nervous system.
- **retina**: The thin layer of cells at the back of the eyeball where light is converted into neural signals sent to the brain.
• **optic nerve**: Either of a pair of nerves that carry visual information from the retina to the brain.

• **visual cortex**: The visual cortex of the brain is the part of the cerebral cortex responsible for processing visual information. It is located in the occipital lobe, in the back of the brain.

• **pretectal nucleus**: This mediates behavioral responses to acute changes in ambient light, such as the pupillary light reflex and the optokinetic reflex.

The optic nerve is also known as cranial nerve II. It transmits visual information from the retina to the brain.

Each human optic nerve contains between 770,000 and 1.7 million nerve fibers. The eye’s blind spot is a result of the absence of photoreceptors in the area of the retina where the optic nerve leaves the eye.

The optic nerve is the second of twelve paired cranial nerves. It is considered by physiologists to be part of the central nervous system, as it is derived from an outpouching of the diencephalon during embryonic development.

As a consequence, the fibers are covered with myelin produced by oligodendrocytes, rather than Schwann cells that are found in the peripheral nervous system. The optic nerve is ensheathed in all three meningeal layers (dura, arachnoid, and pia mater) rather than the epineurium, perineurium, and endoneurium found in the peripheral nerves.

The fiber tracks of the mammalian central nervous system are incapable of regeneration. As a consequence, optic nerve damage produces irreversible blindness.

The optic nerve leaves the orbit, which is also known as an eye socket, via the optic canal, running posteromedially toward the optic chiasm, where there is a partial decussation (crossing) of fibers from the nasal visual fields of both eyes.

Most of the axons of the optic nerve terminate in the lateral geniculate nucleus (where information is relayed to the visual cortex), while other axons terminate in the pretectal nucleus and are involved in reflexive eye movements.
The optic nerve transmits all visual information including brightness perception, color perception, and contrast. It also conducts the visual impulses that are responsible for two important neurological reflexes: the light reflex and the accommodation reflex.

The light reflex refers to the constriction of both pupils that occurs when light is shone into either eye; the accommodation reflex refers to the swelling of the lens of the eye that occurs when one looks at a near object, as in reading.